

1938

# Knowledge of results as a factor in motivation.

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KNOWLEDGE OF RESULTS  
AS A FACTOR IN MOTIVATION

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KNOWLEDGE OF RESULTS  
AS A FACTOR IN MOTIVATION

By

Angelo F. DeAngelus

Thesis Submitted for Degree of Master of Science

Massachusetts State College

Amherst, Massachusetts

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## INTRODUCTION

### Purpose.

This thesis concerns knowledge of results as a factor in motivation. The direct purpose of the study is to witness the comparative effects of closely related methods of utilizing an incentive upon performance in a simple motor task, namely gripping the hand dynamometer for strength of grip under the following conditions:

1. When knowledge of results is in the form of verbal suggestions and deliberate deception of progress is resorted to by way of quantifying results in varying degrees above and below a certain achieved grip.
2. When no knowledge of progress is made known.
3. When visual knowledge of results is employed.

### More Specific Implications.

The nature of the problem divides it readily into more specific implications such as:

1. To attempt to determine the effect of awareness of progress in stimulating interest and formulating attitude upon strength of grip.
2. To attempt an evaluation of the method of varying the degree of deceptive suggestions.
3. To secure quantitative statements as to the comparative ability of an individual's strength of grip while under waking and hypnotic suggestions.
4. To find the effect on the work curve of the discontinuation of deceptive knowledge of results, and then later, the reestablishment of awareness of progress by utilizing visual knowledge of results.
5. To indicate such reflections upon individual differences as might arise from such a study.

### Introduction to a Modified Method.

The use of deceptive knowledge of results delimited to the form that is utilized in this experiment is believed to be an



initial attempt in this specific field. True, as will be shown later, certain researches have been conducted which contain some elements of similarity. For example, visual deception occurring with a combination of other incentives has been employed. Then too, there are those experiments where irrespective of competency or achievement persons were encouraged or discouraged. Again, the use of various types of suggestions, both positive and negative, in the waking and hypnotic states has been made explicit in some studies.

In one part of this study an attempt is made to quantify the incentive by deliberately voicing various degrees of deception in kilograms above and below a certain achieved grip. Carrying the consideration of method a little further, three important reasons for using the technique of suggesting results to the subject rather than to allow him to see visually the amount gripped each trial may be advanced. First, it is thought that auditory suggestions may make possible a closer adherence for experimental study of capacities in the waking and hypnotic states to similar procedures for parallel experiments. Second, it avoids the encumbrances that would be encountered in the construction and re-standardization of a modified hand dynamometer necessitating a shunting-release system of some kind to be operated by the experimenter so that knowledge of strength of grip could be purported in a certain deceptive manner to be visualized thus by the subject without suspicion. Third, it is also believed that proper types of suggestions may produce a similar type of awareness as that produced through vision.

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SUMMARY OF RESEARCH RELATIVE TO PROBLEM

Importance of Study in Motivation.

The significance of a study in motivation may be drawn from a statement by Diserens as excerpted by Skinner (32), claiming that "the slightest observation of human conduct suggests that a psychology of motivation is more useful in daily intercourse, more closely related to questions which all of us are constantly asking, and consequently more interesting to the majority of mankind than any other form of psychology". In deliberation, appreciation of apparent motivational factors may come to the fore, but, regardless of whether we are conscious or not of any motive determining an action, a definite motivation is invariable present. As Young (47) says, "All behavior is motivated".

A review of the researches in motivation by no means depicts an exhausted study with consistent, conclusive results. One is justified in saying that we have no complete knowledge of the more complex determiners of human behavior. Assuming that unity will be approached gradually and then only through a consideration of all relevant facts, it becomes the hope of this study to merely shed some light upon one minute aspect of the huge problem of motivation.

Utility of External Incentives.

The employment of external incentives has not always been considered as possessing undisputed value. It has been argued that such incentives are inferior in stimulating effort in comparison to that method where an appeal is made to the interest of



the subject himself by showing him the close relationship to some dependent and desired activity. To continue on this trend one might bring reference to the so-called Doctrine of Freedom with its advocated principle discouraging the uses of incentives because they tend to encourage one to do something he would not do otherwise (C). Unfortunately many of the tasks confronting us do not make a direct appeal. When an external aid is used it may be hoped, in such situations where a direct appeal is thought more commendable, that the interest, which is first attached to the artificial stimulant will be transferred to the process itself. If viewed in this light external incentives need not be, necessarily, considered as interfering with direct interest (11).

Other common criticisms threatening the use of incentives center around the contentions that artificial stimulation may lead to questionable tactics with resulting injury to one's health, and that the quality or caliber of highly motivated work is often sacrificed for speed or quantity. It is easy to see how anyone, blinded by the desire to achieve some such objective, who is continually working under maximum and taxing conditions may become the victim of ill-health. Young (48) claims that there is reliable evidence to show that motivated work may maintain a qualitative as well as a quantitative level if proper precautions are taken. On this issue, he says "that a decrease in accuracy or quality of the work is by no means the inevitable result of added motivation. Through instruction to the subject, with emphasis upon accuracy or qualitative excellence, the motivational increment can be made one of accuracy and quality, i.e., a qualitative increment".

One may question the ethics involved in the utilization of a motivational method, which in extreme form may be seen to be abusive, but the manifold practicality and importance of incentives cannot be overlooked in realms vitally concerned with human activity. In shaping our individual and social life, incentives may be seen to arouse desires and establish purposes. In industry special incentives function to an appreciable extent in spurring the worker to a higher level of output. In school work, where students are allowed to see worthy objectives, an increased interest and probable effort may, to a certain extent, manifest themselves in the result. Years ago Chapman and Feder (11) made the claim that the consensus of opinion seemed to be that a close relationship exists between interest and effort in all types of mental work. More recently, Strong's (37) extensive interest measurement program has proceeded upon the assumption that one will be more effective in his vocational career if engaged in work that he likes.

#### Theories and Methods in the Study of Human Motivation.

Historical literature on motivation depicts a gradual inclination toward appreciation of the complexity of human behavior and realization of the shortcomings of attempted explanations by any one theory. Troland (38) admirably reviews classical and modern doctrines embodying ideas concerning the diversity of opinion regarding knowledge of motivational factors that have been handed down to us. He makes expository the identification of motives with spirits, souls, primal matter of the universe, the striving for happiness or pleasure, reason and knowledge of



the nature of virtue, impulse toward self-preservation and self-assertion, mechanisms, inherent sociability of man's nature, association of ideas, subconscious and unconscious forces of various kinds, and many more. More recent doctrines concerning motives have established their basis in the psychological discussion of instincts, the detailed analysis of neuromuscular action, psychoanalysis, behaviorism, and introspection involving laws governing association, attention, feeling and volition.

Young (46) says that the study of motivation from one standpoint is concerned with energetics or those conditions which evoke specific bodily movements regulating the general level of activity. From another viewpoint the study is an investigation of factors which regulate and control the course of activity, such as those designated as purposive behavior. From still another point of view, the problem relates to the development of motivational factors; and so it is a genetic study of the change and interplay of interests, desires, habit organizations and other similar determiners.

Refraining from a detailed account of existing theories of motivation pointing out each specific limitation, suffice it to present a conclusion by Thomson and excerpted by Skinner (33) that the existing theories of motivation are inadequate chiefly because of their limitations. It is futile, it is claimed, to attempt a comprehensive and systematic treatment on the basis of any one theory. Effort aimed at finding a single motive in any situation is alluring but it is doomed to end in disappointment, for life is too complicated and behavior too complex to allow such simple and direct analysis. A synthetic presentation of

human dynamics will function more ably in helping us to appreciate the complexity of motivational factors, attempting merely to determine the dominating motive or motives in any given case so that something of the principles of motivation in general may be known.

Methods of studying motives in man, as one may gather from the above, are closely linked with the theories of motivation. In early philosophical approaches, where too often ethical rather than psychological interest were dominant, introspection, unsystematic observation of others, and mere speculation based on theological dogmas or personal desires and attitudes were the main methods used. With the emergence of the nineteenth century philosophical speculation assumed a more scientific aspect. Psychologists became more concerned with the explanation of motivation for all forms of behavior in all kinds of organisms. The recognition and utilization of more objective methods together with the classical method of introspection has influenced modern psychology in transforming and expanding concepts of motives.

Experimental studies of human motivation developed from animal studies and at first similar methods were used. The range of motives available for purposes of experiment in man is greatly extended in theory, but for legal, social and practical reasons with due respect for the elaborate system of habits that human performance is so often dependent upon, methods necessitated a considerable modification of approach in many instances.

Diserens and Vaughn (16) have classified a number of methods employed in the objective study of motivation in man as followed in the majority of experiments. These they list as the simple reaction, the learning, the discrimination, the optimum achieve-



ment, and the group response methods. The simple reaction method is illustrated by Johanson's study of the effect of positive and negative incentives on reaction time. The learning method may be illustrated, for example, by such a study purporting to examine the effects of active and passive attitude on the learning of visual material. Judd's experiment on the effects of incentives on accuracy is a good illustration of the discrimination method. The maximum achievement method or qualitative and quantitative study and measurement of standard performances under the influence of incentives is illustrated by Crawley's study of the effect of incentive on amount of work and fatigue, and by Chapman and Feder in their investigation of the influence of various incentives on school work. The group response method is illustrated by most studies in social motivation.

### Laws of Motivation.

A progressive field of investigation is generally characterized by the appearance of new laws and generalizations. In 1931 Diserens and Vaughn (17) published a report including statements in the nature of laws on the psychology of motivation. Thus:

- "1. The number of motives available for experimentation increases with the complexity and degree of development of the organism.
2. The energy of a motive varies directly with its primitiveness. Thus punishment and the desire for food or sexual expression are more energetic than social motives.
3. The degree of unity of motivating forces in any situation varies inversely with the intelligence of motivated organism.
4. The effectiveness of a given motive in any situation varies directly with the number of cooperating motives or facilitating factors, and inversely with the number of competing motives or inhibiting factors".

Until more conclusive results were obtained from the experimental program in vogue, it was considered a better policy to withhold other tentative laws which might have been hazarded. Incidentally, to illustrate the fallibility of man-made laws, one might refer to Young's (43) recently advocated modification of the last law cited in relation to the effect of a combination of motivating factors upon performance. He says that it is not a given motive whose effectiveness varies, but rather the total configuration. Then too, the principle is valid only within limits; for if the degree of motivation be increased beyond a certain critical point, the result is typically a disruption of behavior.

#### Previous Investigations.

##### Inquiry into Knowledge of Results as an Incentive.

Knowledge of results as an incentive in motivation has been subjected to considerable experimental analysis with the majority of researchers reporting that the employment of the incentive is followed by an increase of the function studied. Some of the experiments are of the laboratory type, while others are more pedagogical in approach adhering to ordinary classroom conditions. A prominent factor, however, along with the accumulation in number of the studies, has been the critical analysis that the methods used and conclusions reported in studying the effects of this incentive, in many instances, have had to withstand in order to retain their reliability.

In 1905 Judd (24) reported a study, which grew out of a preliminary investigation concerning the effects of practice on the Muller-Lyer illusion (25), wherein the effect of knowledge



of results on estimating the size of angles was studied indirectly by the discrimination method. His conclusion would justify the contention that habits implicated in such a performance, whose development take place without constant evidence of success or failure of a given movement, bring little if any change with practice. In his experiment the subject was shown a line sloping upward or downward at varying degrees. The subject was to continue the line, doing so without seeing what he was doing. The table in front of the subject was divided in the center by a screen and the subject's task was to place a dot behind the screen at a point which would fall within the exact continuation of the line. It was found that under such conditions practice brought little if any change. Without a motive for improvement, the records for the first and last days differed from each other about as much as did the first and second.

In 1906 another one of the earliest studies concerning the effect of incentives was reported by Wright (42) on work and fatigue. Four subjects were required to work to exhaustion with the Cattell spring ergograph, but under three different conditions. In the first condition no knowledge of how well or how much the subjects were doing was allowed; they were merely told to work as hard and as long as they could. In the second condition the incentive was furnished by placing blocks under the carriage of the ergograph, and the subjects were requested to see how many times they could reach the block. In the third the subjects worked with complete knowledge of the records, as depicted on a smoked drum upon which there had previously been a line drawn, and were requested to do their best to reach the line as many times as they

could. Under both conditions of incentives, the subjects did more work, and were able to keep at it for a longer time than when they had no goal or incentive set for them. Wright also demonstrated that when the goal was too far removed, the tendency was not to go as far as possible, but to be more or less discouraged and to do even less than one might perform under more ordinary conditions. Then too, it was found that fatigue accompanying work involving relatively few muscles was not so great when working under the direct stimulus of a definite aim notwithstanding the fact that the subject at the same time produced an increase in his amount of work--out of harmony as it may appear with the law of conservation of energy.

In 1917 Arps (1) reported a preliminary study, the main purpose of which was to secure a quantitative statement concerning the influence of awareness as a factor in work as conducted by means of the Bergstrom ergograph. It was concluded that the average absolute efficiency value of all the work series done with knowledge of results exceeded by ten percent that of the series done without knowledge of progress. In a later report, Arps (2), with additional work on the Bergstrom ergograph, found that the average unit value of the known series of all sets of experiments showed a higher rate of work by eighteen percent over the corresponding value of the unknown series. Three subjects worked on the ergograph with various loads to exhaustion. During some of the work periods the subjects could see tracings they were making on a smoked drum. During other work periods they had no knowledge of their results. In both of Arp's reports, space was given to the influence of imagery that was



considered to be reproductive of the perceptual experiences; for example, of a preceding series using knowledge of results as the group rotation method was used.

Chapman and Feder (10) in 1917 reported a study on the effect of external incentives upon achievement in elementary school subjects, endeavoring to get qualitative and quantitative measurements of performance under such an influence. The general approach was to give extended practice in three tests to two equated mixed groups of boys and girls from grade 5A. The three functions tested for were addition, cancellation, and substitution. One group worked under the normal conditions of the classroom, while the other was motivated by external incentives. In this experiment, knowledge of results consisted, for the most part, of supplying the incentive, although credits given in the form of stars and available prizes that were also employed must be given just consideration. An outstanding significance of this experiment was the fact that it was in the tests which required more lengthy periods of work that such a marked difference of gain or improvement in the motivated group as compared with the non-motivated group occurred. The implication here becomes obvious if it is considered that the ordinary school work demands continuous effort over long periods of time with but little interest stimulated by novelty.

In 1922 there was published a study by Johanson (23), who utilized the simple reaction method in finding the influence of knowledge of results and punishment upon reaction time. The apparatus that was provided for measuring the time between stimulus and response was screened from the subject's view. There

were three experimental conditions. Under one condition, the subject received no information about the speed of his reactions. In another, work was done with knowledge of results--that is, he was informed of his previous reaction time before making a succeeding trial. In the third, an electric shock was given for slow reactions. Although knowledge of results did not yield reaction times as short as those from the punishment series, they did show superiority over the normal series with no knowledge of results.

One of the most significant studies in the field of incentives was contributed by Book and Norvell(8) in 1922. Here a series of experiments were conducted under controlled conditions with knowledge of results as the only supposed variables. The subjects consisted of a mixed group of 124 college upperclassmen. The functions tested included making the letter "a", a cross-out word test, an association test, and multiplication of two place numbers by two place numbers. Two groups were equated on the basis of preliminary testing. Then those in the stimulus group were given information as to their progress, while the subjects in the control group were kept in ignorance of their score. After two weeks the control and stimulus groups were reversed. Thus each group had two weeks with knowledge of results and one week without, or two weeks without and one week with knowledge of results. From this study two conclusions, among others, stand out. All sections receiving knowledge of results increased their output in each series more than those who did not. Also, evidence was shown that a stimulus group making rapid continuous progress ceased to do so when the incentive was removed; and the exact



reverse was true of the control group, for given an incentive improvement suddely began rapid and continuous.

In 1923 Spencer (34) reported a repetition, as nearly as possible, of Judd's experiment on the effect of knowledge of results on estimating the size of angles in an attempt to ascertain the extent of reliability and significance of Judd's data when a more plausible method of statistical treatment was used. Spencer's main concern, however, was not to question the greater improvement of the informed learner that Judd found, but to bring out the facts as to whether or not the subject working in ignorance of success or failure improved at all. It was found here that, in this function of estimating the size of angles, subjects were also able to improve while performing under no knowledge of success or failure. Why this improvement occurred was not determined, although an assumption was put forth to the effect that it was due merely to the improvement of adjustment to the general conditions of the procedure; and that a continuation of the experiment would show a plateau of no improvement once the situation was thoroughly familiar.

Crawley (14) in 1928 published the results of an investigation showing that all of four subjects participating produced greater amounts of muscular work when permitted to watch their own performances than they did when required to work without knowledge of their output. The apparatus used for both arm and leg experiments was a modified form of the simple chest-weight apparatus found in practically every gymnasium. The ergographic principle was developed so that measurement could be made upon larger isolated groups of muscles when varying loads were moved

after rest periods of various lengths. In addition to the conclusion cited above, another outstanding fact was reported in this study which contradicted somewhat the finding by Wright already mentioned. The extra work produced by incentive in this experiment called for greater time in recovery because larger muscle groups were involved.

In 1927 a publication by Ross (29) showed the influence of knowledge of results on the making of tally marks. The process involved was a simple act of muscular skill, namely, making groups of four vertical lines and crossing them out with a fifth. Fifty-nine college students, appearing in four groups, were divided into three sections each of equal size and of substantially equal achievement as shown by the results on an initial practice period. The purpose of the experiment, for the most part, was to compare the achievement of the three sections in each of the four groups; one section working with full knowledge of progress; another section with partial knowledge; and the third with no knowledge of progress at all. It was concluded that the addition of a single other motivational factor, namely knowledge of results, was sufficient to give the students with such information a distinct superiority over the others; and that the degree of superiority was roughly proportional to the amount of information possessed.

The experiment was carried further, however, to follow along in a similar manner Book and Norvell's work. At the end of ten practice periods conditions were reversed, but the results reported after the reversal of conditions were found to be distinctly different. There was no sharp decline found as Book and Norvell



had reported after the motive was dropped. In fact, Ross never found any evidence of letting down in any of his curves. On the contrary, he was convinced that the motivating effect of a knowledge of progress was relatively continuous, and measurably self-sustaining, persisting undiminished through the remaining practice periods in spite of the fact that no further knowledge of progress was allowed. Ross (31) probably spotted the flaw when he suspected Book's admonition to his subjects, after the withdrawal of knowledge of progress, "to banish all thought and desire for improvement as such from their minds" (3), which may have served as a positive suggestion to slacken their efforts that was more potent than the negative effects of withholding further knowledge of progress.

A report of a study was published by Deputy (15) in 1929 on the influence of knowledge of success on grades made by college freshmen in philosophy. The general method followed included the rotation of three groups so that two sections had written exercises during the first half semester and the third during the last half semester. In one of the stimulus groups during the first half-semester, a ten minute written exercise was taken each time the class met; while in the other stimulus group a twenty minute interval was set aside once a week for written work. The control group during that time was allowed the first ten minutes of each meeting for reviewing orally the preceding lesson by discussing the points contained in the written work of the other two stimulus groups. Care was taken to see that the two stimulus groups were receiving their cue share of knowledge of progress. At mid-semester it was found that the section which had written

work each time it met and was constantly aware of progress made did significantly better than the one which had written work once a week, or the one which had only recitation work. But the section which had written work once a week did not do significantly better than the one without any written work.

During the last half of the semester the previous control group became the experimental section, while the former stimulus groups became the control groups. Evidence drawn from this data indicated that knowledge of their daily success did not stimulate the stimulus group during the second part of the semester to greater achievement as compared to the other two acting control sections on the final examination, a thing which it seemed to do for the previous stimulus sections on the mid-semester examination. The improvement in the experimental section of the last half-semester working with frequent awareness of progress was not found to be sudden, rapid, and continuous like Book and Horvelli had reported. Precaution should be taken, it was stated, in deriving our principles of learning from functions so unlike those of the classroom situations.

In 1929 a report by Hamilton (12) appeared wherein knowledge of results was included among the incentives studied in his investigation of the effect of incentives on accuracy of discrimination measured on the Galton bar. In one part, a modification of the Galton bar was used upon which lengths were to be discriminated. The task to be performed consisted of making a certain length on the bar comparable in a certain way to a standard one under various conditions. At one time a Knowledge Group was used where the experimenter said simply "long", "short", or



"right", whichever happened to be the case after each trial. Thus the group always knew the direction of its error. Although in this experiment the results from the utilization of various combinations of incentives were seen to be superior to the Knowledge Group, it was found that visual discrimination of lengths was made more accurate with knowledge of results.

Young (50) reviews an interesting study reported in 1932 by Chase (13) that deals primarily with the effect of a combination of motivational factors upon strength of grip. The experiment is deemed important here, however, in view of the fact that it depicts in a way the use of deceptive knowledge of results both visual and suggestive upon performance. By an ingenious motivation-dynamometer to control "success" or "failure", a way was provided for measuring a child's actual performance quite apart from his apparent strength of grip. In brief, one instrument that was used consisted of a lever system to be gripped and a vertical board supporting two glass tubes; the front one visible to the subject and the rear one visible only to the experimenter. The hydraulic system implicated could be manipulated to eliminate the suspicion of trickery and yet show a column of water in the rear tube, visible only to the operator, giving a true measure of muscular strength, while at the same time regulate the water level in the tube visible to the subject indicating apparent success or failure. Praise and reproof were given by a series of standardized statements either complimenting or belittling a performance.

In this experiment there were 211 subjects ranging in age from two to eight years. Upon an initial test under neutral conditions avoiding all incentives to be used, four equivalent

groups were formed. Conditions were arranged so that certain groups would receive various types of incentives during the progress of the study. It was found that additional incentives of reward, punishment, praise and reproof yielded motivational increments over and above those referable to success and failure. As Young comments, however, this experiment is not without its shortcomings.

Also in 1922, there appeared a published report by Brown (7), who made a study of knowledge of results as an incentive in school room practice. In his criticism and restatement of the problem, he says that all the experimental work in the field of incentives is open to some criticism. After reviewing several experiments, he offers various points of attack upon which all without exception may have one or more directed to them. For example, many studies have been performed with advanced students under unnatural conditions. Such conditions with unusual tests have a tendency to cause the subject to be aware of the procedure and purpose. If an incentive was once given to a control group and this group knew the purpose of the experiment, it would be impossible for them to deliberately forget their previous score upon retesting. Attempts to eliminate other incentives have tended to increase rather than to decrease their effectiveness. Some studies may be criticized for lack of uniformity in the procedure of the experiments. Others find their shortcomings in the failure to equate control and stimulus groups. Again, practice effects can scarcely be eliminated in such novel tests that are often employed.

With respect for the foregoing criticisms, Brown proceeded



to utilize a method against which these criticisms could not be lodged. Working two parallel experiments, one with children in grade 7A, the other with subjects from grade 5A, drills on arithmetic, which had been learned in preceding grades, were studied. For each grade two groups were equated and designated as the stimulus or control group for either the first or second ten days of a total twenty for each experiment. This method of alternating the conditions in each experiment by making the first group the stimulus group, allowing it to see results presented graphically for the first half of the experiment, and then making it the control group for the second half, eliminated all group variables in the results--it was thought. The data collected showed that it was reasonable to expect some increase in score if the results of previous work was known.

In 1933 Ross (30) reported another research. In contrast with his earlier laboratory experiment, however, he found this time that in the college classroom knowledge of progress had a negligible effect upon achievement. The data accumulated from this study consisted of records of 72 college students enrolled in a "Tests and Measurements" course, whose basic text was Ruch's "The Objective or New-type Examination". Four substantially equivalent groups were formed from this class from the scores of a comprehensive objective test, whose reliability was .90, based upon Part I of the text. Each student in a control group was "paired" with a similar student in each of the experimental groups. During the remainder of the school term objective tests whose median reliability was .66 were given once a week to all students. One group worked in ignorance of the scores made on

the tests; a second group was given vague information in the nature of good, fair, or bad; a third group was given partial information in that the students were told their point score on each test; and the fourth group was given all the information possible as to their progress and mistakes made. This procedure continued for seven tests, at the end of which time conditions were reversed. During the remaining four tests the group with full knowledge and the one with no knowledge changed places, and similarly, the groups with vague and partial knowledge were reversed.

The data from this entire class experiment revealed the surprising fact that nowhere was there a statistically significant difference among the four groups. As partial explanation for this, Ross offered two commendable possibilities. Although one group may be referred to as having no knowledge of progress, it is manifestly impossible to eliminate the subjective impression of the student regarding his progress. Also, the inherent difference between the laboratory situation and the classroom conditions is certain to make the former a somewhat artificial situation. In other words, knowledge and suspense in the laboratory are not the same as knowledge and suspense in real life.

It was interesting to note in this report how Ross questioned the reliability of the experiment of the year previous by Brown, who had taken such care to avoid maladaptive techniques in his procedure. Brown, as we recall, found some evidence that knowledge of progress tended to increase the scores on arithmetic tests. The main criticism centered around the fact that Brown did not equate his experimental and control groups in either grade on the basis of attainment in arithmetic. In Brown's experiment,



the groups in 7A were selected on the basis of teacher rating and scores on the Terman Group Test of Mental Ability, and the differences between the groups were quite large. In 5A the selection was based upon a combination of teacher's and principal's estimates.

One of the most recent studies was reported by Manzer (27) and published in 1935. A threefold purpose prompted this work; namely, to find out what changes occurred in the curve of muscular work when the worker was given knowledge of results after having worked in ignorance of the amount of his output; to find the effect on the work curve of the discontinuation of knowledge of output; and to detect the differences if any between men and women with respect to the effect of knowledge of output on work. The subjects were 68 men and 60 women, all college students. The subjects of each sex were equated and divided into an experimental and a control group. The task studied consisted of maximum work on the Smedley hand dynamometer, which was clamped vertically to an iron stand on the top of a table. Both the apparatus and the records were completely hidden from all subjects in experimental and control groups throughout the experiment.

The procedure followed was relatively simple and quite commendable. In the control groups each subject made fifty maximal contractions at intervals of fifteen seconds without knowledge of how much work was being done. With the experimental groups the whole work series was divided into three parts. Contractions one through ten were made without knowledge of results. During contractions eleven through thirty the subjects were told their strength of grip each trial. Beginning with the thirty-first



contraction and continuing through fifty, the subjects again worked in ignorance of their scores. The information gathered from the results of this study seemed to justify some outstanding conclusions. Knowledge of output was followed by a prompt upward turn in the curve of muscular work, and this effect was more sudden among the women than among the men subjects. When knowledge of results was suddenly discontinued, there was no abrupt fall in the work curve. The incentive developed by knowledge of results appeared to have an after effect and this after effect was more persistent among the men than among the women subjects.

Inquiry into Suggestion as a Motivation Factor.

Suggestion, as it is used in this investigation, is so closely akin to the main incentive studied that to neglect to consider some noteworthy studies bordering on this incentive would be to provide an improper setting to the problem. It is difficult, however, to set a limit to researches concerning suggestion in either the waking or hypnotic state. Yet a few of the landmark experiments, and the ones more closely allied to the present investigation, will serve to show that under certain conditions suggestion becomes a motivating factor. As it has been conveniently summed up, "The word can arouse a wish, a purposive set, a fear, or an attitude predisposing towards or against something." (52)

In 1905 a report by Brand (5) showed that the visual estimation of length was affected by suggesting error. The purpose of Brand's study was to find out how far, and in what direction, the visual estimation of a linear magnitude could be influenced



by suggestion of certain possible errors in estimation when the subject knew that the suggestions were purely arbitrary. The general method used was similar to a procedure whereby a subject was shown, for a brief time, two small objects at a predetermined horizontal distance apart and then allowing him to place similar objects so as to include between them an interval judged to be equal to that between the standard objects. Suggestions were introduced by showing to the subjects, along with the standard interval, certain printed mottoes containing the random suggestions of possible errors in the reproduction of the interval. Suggestions were of this nature: "don't make too long", "make short", "make long enough", "make long", etc. Although it doesn't seem possible to make deductions from the results of this experiment, there was some evidence that the brief suggestions, "make short" and "make long" tended more than the others to make the reproduced distance greater in magnitude; and the two suggestions "don't make too long" and "don't make too short" tended to a lesser degree to have the same effect.

The effects of suggestion upon the reproduction of triangles and vertical point distances was studied by Bell (3) and reported in 1908. Two types of suggestions were used in his experiment--auditory and visual. The auditory type was in the nature of the words "high", "low", "make high enough", etc. that were given to the subject just before the presentation of the object to be reacted upon. For the visual suggestion a diamond-shaped figure of irregular dimension was used which could be turned to suggest "high" or "low" depending upon whether it was turned to a horizontal or vertical position. The instructions were to reproduce



the triangles of different shapes and heights as they were presented. A similar performance was required in another part of the experiment when various vertical point distances were presented to be reproduced. Bell concluded that, in general, the suggestions did affect the reproduction of triangles; that the auditory was more effective than the visual; and that in the auditory set the "low" suggestion was more effective than the "high". The main weakness of the experiment, it has been advanced, is that too few observations were made of each subject with each type of suggestion.

A study by Strong (36) published in 1910 showed the effect of different types of suggestions upon dynamometer records. Both positive and negative types of visual, auditory, and auto-suggestive forms of suggestions were used. A positive suggestion, when given verbally by the experimenter, was: "Now you can make it stronger than usual." The negative suggestion was: "Now you can't make it as strong as usual." The visual suggestions were presented on cards and were symbolic of the auditory. For the auto-suggestions, the subject chose between the positive and negative types and spoke aloud: "Now I can make it stronger than usual", or "Now I can't make it as strong as usual."

The general plan of the experiment was to give the subject one of several suggestions in a haphazard but standard order, and then have him respond each time with his maximum grip on the Collin elliptical form of dynamometer. The subject was seated in a chair possessing two flat arms, upon which he could rest his hand, and from which he could extend his palm uppermost when gripping the apparatus. Upon a table a screen separated the subject



from the operator. Once every twenty seconds the subject was handed the dynamometer to be gripped until a series of trials with each hand was completed. A compilation of data from three subjects over a long period of time justified some instructive conclusions. Suggestions, on the whole, were found to heighten the maxima. Auto-suggestions, however, were most effective. There was not much choice between the visual and auditory types.

Strong's report included other interesting statements. He rationalized that the so-called maximum effort in his experiment was not the real maximum exertion each time; rather, it was an effort to attain a certain standard. The left hand may be considered to be at a disadvantage in maintaining its maximum, or definite standard, because of its lesser use and inferior discrimination ability. In commenting upon the findings of another investigator working with two of his same subjects, but upon reproduction of distance instead of maximal exertion, Strong said that apparently the various types of suggestions disturbed the accuracy of such reproduction. The other investigator had found that the most accurate reproduction of distance occurred with the presentation of "neutral" suggestions. In other words, it seems probable that when accurate work is to be done, all suggestions prevent the best work. When mere amount of muscular effort is called for, any arousal of attention to the work acts as a stimulant and helps a person to do better than he would have done otherwise.

Langfeld's (26) report published in 1913 shows a concern about voluntary movement under positive and negative instruction. The instrument used was a tracing board. With an electric stylus,

the subject was asked to trace under such instructions as "Go down the middle groove", or "Do not touch the sides". Introspection reports and quantitative findings brought attention to the fact that different forms of imagery and different types of performance accompanied such statements.

There are other studies wherein various types of suggestions have been made explicit. For example, those listed as affording praise and reproof, or encouragement and discouragement. To go into an enumeration of such, however, would lead this review astray. The last few researches considered have shown a definite attempt to isolate a certain suggestion and compare its effect with another or others. Needless to say, this factor is a variable in every human experiment. There are always suggestions which the subject receives from the experimenter, both intentional and unintentional.

In the early literature on hypnosis there had been the tendency to attribute remarkable or supernormal powers to persons in a hypnotic trance. The view still persists that hypnotized individuals may display certain powers which transcend those possible with normal voluntary effort. Hull (20) says: "While it cannot be denied that claims of the transcendence of physiological normality smack strongly of the miraculous, it is to be observed that as a rule they are not put forward as magic, but soberly, the cause being attributed to some hypothetical but as yet unrecognized physiological principle." Consequently it is both unscientific and unsafe to reject all such statements as untrue, preposterous as they may appear to common sense. Hull adds that "the decision in each case must rest, in the last



analysis, upon the evidence of carefully controlled experiment."

The evidence from previous experiments, however, is at variance. This fact comes to light even in the citation of a few of the outstanding experiments more relevant to the present study.

In 1920, Nicholson (28) reported a study on the influence of hypnotic suggestion upon the power to facilitate resistance to the fatigue resulting from muscular action under load. He concluded from his investigation as a whole that suggestions given in the hypnotic condition were far more effective than when given in the non-trance state. William's (41) report in 1929 included a repetition of a portion of Nicholson's study under better controlled conditions. Results were not found to conform very definitely to those found by Nicholson.

Hadfield's (18) investigation of hypnotic suggestion and the strength of grip is important in this review, since a casual report is made on the influence of such suggestions upon the upper limit of momentary muscular contraction where no fatigue or pain element was involved. This experiment is typical of the older and uncontrolled variety. Three men were asked to act as subjects in a test for the effect of mental suggestion upon their strength. The three were said to have averaged 101 pounds with the dynamometer in the normal state. With the suggestion to be "very strong" in the hypnotic trance, they averaged 142 pounds per grip. When again in the hypnotic state it was suggested that they be "weak", their grips averaged only 29 pounds. Hull (21), in evaluating this report, says that if the subjects knew the purpose of the experiment, the results would lose all scientific value so far as any question about the hypnotic transcendence of

physiological normality is concerned.

Young's (43) (44) investigations, published in 1925 and 1926, have been designated as making up the first well-controlled, large-scale experimental study in the history of hypnotism. The general purpose of his entire investigation was to put a large number of subjects through waking and hypnotic performances of the same simple tests, under as identical conditions as possible, in order to determine the relative capacity of the same persons in the two states. More than fifteen different functions were experimented with. One of these had to do with hypnotic suggestion and strength of grip.

In the dynamometer test there were fourteen subjects taking part. The experiment consisted of obtaining five grip scores for each hand at each session. In hypnosis the subjects' eyes were closed, while in waking they were kept open; otherwise the conditions were the same for each state. The instructions, to grip the apparatus as tightly as possible, were repeated before each of the ten trials at each of the sessions in both states. In all there was a total of 616 scores. In both states the subjects worked without knowledge of results. This experiment, which measured only the ordinary capacity, not the capacity of resisting fatigue, showed a lack of significant difference in capacity between the two states. In other words, there was no difference found between the two states in respect to the power of momentary grip of the dynamometer.

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EXPERIMENTAL INVESTIGATION

Apparatus and How Used.

The apparatus used in this study was the Smedly hand dynamometer, a commercial type (35). It consisted of an inner adjustable grip handle pulling against a spring, and a dial graduated into divisions of 1/10 through to 100 kilograms. On the dial were two pointers, one a swivel-release type which could be forced by the other to a position to indicate the grip each trial, thus necessitating a resetting to zero before each succeeding grip made. The outside stirrup or handle is graduated and provided with a clutch or clip to prevent the inner stirrup from twisting during use. By means of graduations on the outside stirrup, a record of grip adjustments may be kept, necessitated by the differences in size of hand of various subjects.

During practice trials coming before the experiment proper began, all subjects were instructed in the use of the apparatus. This was done to eliminate the novelty element and to acquaint them with the "feel" of the instrument. A grip adjustment was made for each subject so that the handle would fit the palm comfortably in such a way that the second phalanges of the fingers were pressed against the top part of the inner handle. Precaution was taken to make sure that whenever a particular subject used the apparatus, his grip adjustment was set properly. In performance the subject was always requested to stand and hold the apparatus down to his side free from any bodily reinforcement, such as pressing it against his limb. Before each grip, the subject was given a preparatory signal "get ready", whereupon he adjusted his hand comfortably to the apparatus. Upon a signal

"grip", the subject was asked to make an initial effort to exert his maximum strength all at once, putting equal pressure on all the fingers involved, and trying to bring the same muscles into play each time. It was deemed best for the subjects if they did not "hold" the handles and grip gradually for it was found that in so doing, considerable energy, which might be more profitably spent in an initial maximum exertion, might be lost. The subjects worked individually in the presence of only the operator.

#### General Approach.

The data for this entire study was accumulated during the months of February, March, and April of the year 1938 at the Massachusetts State College Psychological Laboratory. The study was divided into three sub-experiments, which were classified as Experiments A, B, and C respectively.

Experiment A was further subdivided into three series, to be designated as Series I, II, and III; the first dealing with suggested deceptive knowledge of results; the second with no knowledge; and the third with visual knowledge. It took four days to complete each series. Altogether, the three series extended over a period of approximately three weeks, and followed in the order as indicated. Each subject took two records a day, one in the morning and another in the afternoon, at a time when he was most conveniently free from his regular school schedule. The subjects always reported at approximately the same times each day. A record consisted of a succession of six grips at intervals of thirty seconds with both the right and left hands. The hand used first in gripping was alternated from day to day.



In Experiment B, a procedure parallel to that of Series I above was repeated. This time, however, a comparison was also made, under as similar conditions as possible, of records taken in both the waking and hypnotic states. In other words, the effect of suggested deceptive knowledge of results as used in the waking state was now examined as to its influence on the subject while in a hypnotic trance. The subject was one who had participated in the previous experiment, and who was found to be quite susceptible to hypnotic suggestion. He reported twice a day for four different days at the same times that he had done previously. The only modification, then, was the prolongation of Series I in Experiment A to include the same type of suggestions while the subject was in the hypnotic state--waking and hypnotic states alternating, depending on which came first the preceding day, with a convenient interval between the two to eliminate or compensate for fatigue effect.

The last main division, Experiment C, was an incorporation of conditions studied in the other two main divisions. This experiment was subdivided into four parts designated as Part I, II, III, and IV respectively. In the first, suggested deceptive knowledge of results was used in the waking state. In the second, the same deceptive suggestions were given in the hypnotic state. In the third, subjects worked with no knowledge of progress in the waking state. Finally, visual knowledge in the waking state was employed. This procedure followed in the succession indicated, with a ten minute interval between the Parts. A record of any part consisted of a succession of six grips by each hand at thirty second intervals, beginning with the right hand. Three

subjects performed in this experiment. All the records were taken in one night.

### Subjects.

There were eight different participants in this study; five young women and five young men. As has already been indicated in the above, however, only certain ones were included in the various main experiments. Because of the nature and outline of the procedure, it was impossible to find many who would act as subjects throughout for both the waking and hypnotic states. The only convenient time for some of the subjects to report for records was during a ten minute interval between class periods. Such an interval was not long enough for taking records in the hypnotic state. Then too, subjects who were willing to be hypnotized were not twenty-one years of age and couldn't get their parents' consent. All subjects were college students beyond the freshman year pursuing their regular studies and school habits.

In Experiment A there were six acting subjects--three young women and three young men. One of the men, who gave his consent and who was found to make a good subject for hypnosis, was the only participant in Experiment B. This same individual together with two young women, who as yet had not participated but who had given their consent to be hypnotized, comprised the three subjects in Experiment C. The subjects, together with more detailed information concerning them, are listed in the following:

#### Experiment A.

Subject I: Young man. Age 20. Height 5'8". Weight 156



lbs. Grip adjustment 5.5. College sophomore. Scholarship average 85. Very aggressive in sports--adept in baseball, football, hockey, boxing, wrestling, track, weight lifting. Worked summers with construction group as bus driver, etc. Reported for records at 11 A.M. and 4 P.M.

Subject II: Young woman. Age 20. Height 5'5½". Weight 130 lbs. Grip adjustment 5.3. College sophomore. Scholarship average 75. Aggressive in athletics--tennis, basketball, swimming, badminton, field hockey. Reported for records at 11:15 A.M. and 3 P.M.

Subject III: Young man. Age 19. Height 6'. Weight 145 lbs. Grip adjustment 5.6. College sophomore. Scholarship average 75. Active in swimming, track and basketball. Reported for records at 10:30 A.M. and 3:15 P.M.

Subject IV: Young woman. Age 20. Height 5'5½". Weight 125 lbs. Grip adjustment 4.5. College senior. Scholarship average 78. Not very athletic-minded, but likes tennis, swimming, walking. Reported for records at 9:30 A.M. and 4:15 P.M.

Subject V: Young woman. Age 20. Height 5'4½". Weight 165 lbs. Grip adjustment 5.3. College senior. Scholarship average 88. Not very aggressive in athletics--likes badminton at present. Reported for records at 11:30 A.M. and 3:30 P.M.

Subject VI: Young man. Age 22. Height 5'8". Weight 155 lbs. Grip adjustment 5.6. College junior. Scholarship average 80. Not very active in sports at present--has played golf, basketball, baseball, football. Reported for records at 10:50 A.M. and 2:30 P.M.

#### Experiment B.

Subject I, above, reported for records at same hours.

#### Experiment C.

Subject I: Started taking records at 6:00 P.M.

Subject VII: Young woman. Age 19. Height 5'7". Weight 165 lbs. Grip adjustment 5.8. College sophomore. Scholarship average 75. Athletics--swimming, badminton, tennis. Started taking records at 7:30 P.M.

Subject VIII: Young woman. Age 21. Height 5'6½". Weight 120 lbs. Grip adjustment 5.4. College junior. Scholarship average 75. Athletics--swimming, soccer, rowing. Started taking records at 9:00 P.M.



Procedure.

Experiment A.

Series I--Suggested Deceptive Knowledge of Results.

After a grip adjustment was made for a particular subject, he was told to make twelve grips; six with one hand and six with the other, as designated, with a thirty second interval between trials for resting the hand in use. The reason for choosing this interval will be explained later. In general, the procedure consisted of giving a suggestion concerning the amount of work done in a statement including the degree of deception desired.

Before the first trial for a record, the operator stated that the subject was to work with knowledge of results as they were suggested to him after each grip was made. Upon hearing his score, the subject was to try to better his grip in succeeding trials. After the first grip was made, the apparatus was handed back to the operator so that the subject could not see his record. The operator recorded the score and then told the subject the exact grip achieved--for example, "Your grip that time was 50 kilograms." The apparatus was handed back to the subject. Just before thirty seconds had elapsed since the preceding grip, the preparatory signal "Get ready" was given. This was followed at the proper time by the signal "Grip". After the second grip, the exact score was recorded, but the suggestion for the following trial was, "That time your grip was 45 kilograms", which, of course, was five kilograms less than the first grip irrespective of the second one. The suggestion for the fourth trial was, "Your grip that time was 40 kilograms", which made the degree of deception ten kilograms below the initial grip.



For the fifth attempt, the suggestion portrayed a deception of five kilograms above the first; and for the sixth, ten kilograms above the first, irrespective of any of the others made. This order of deception just described was called Order I.

In Series I there were four Orders used, one on each of the four days that a subject reported. Such conditions for a day were for records made by the right and left hands, in the morning and afternoon. The Orders used can best be demonstrated, perhaps, in outlined form showing the nature of suggestions and degree of deception resorted to for each trial.

Orders	T R I A L S					
	1	2	D e c e p t i o n s			
			3	4	5	6
I	Preliminary Suggestions: grip maximum, try to exceed record on each succeeding trial.	Exact knowledge of grip given	5 kgs. less	10 kgs. less	5 kgs. more	10 kgs. more
II			10 less	5 more	10 more	5 less
III			5 more	10 more	5 less	10 less
IV			10 more	5 less	10 less	5 more

From the above it can be observed that the deceptive suggestions did not come until after the second trial. The degree of deception was always figured by the operator from the record on an initial trial rather than from an immediately preceding one because it was thought that such a procedure would make it harder for the subject to know exactly when or how much he was being deceived, even if suspicion of the extreme fictitious scores was experienced. The subjects never knew that computations were made from their initial grip with that hand, for they were never allowed to see their records in this Series. The rotation of Order

from day to day lessened the possibility of habituation to general conditions, which might have occurred if the same Order had been used over and over. Then, too, this rotation method was used in order to get more quantitative data for evaluating the method of quantifying suggested results. If a certain type or degree of suggestion could be found to produce the same effect whenever used and in various positions in the work series from day to day, one might be more justified in forming conclusions for the evaluation of this method.

Series II--No Knowledge of Results.

After the subjects had completed the above series, they were called to appear for four more days at the same time in the mornings and afternoons as they had been doing. The same general procedure was continued, except that this time work was done under no knowledge of results. That is, a subject was never told anything about the extent of his grips. He was handed the dynamometer and merely told to grip his maximum each time while trying to exceed his record each trial. In short, the only suggestions given here were those directional in nature. They were the same as those given to the subjects in the preceding series just before the taking of records each time occurred.

Series III--Visual Knowledge of Results.

The same general procedure that was outlined in the foregoing was followed in this Series. This time, however, the subjects were permitted to see their own records after each grip. In fact, they were instructed in the reading of the dynamometer



dial and in making approximations when the swival-release pointer fell between the 1/10 kilogram intervals on the dial. The subjects say and reported their scores; the operator merely gave the signals when to grip, and recorded the scores as reported.

### Experiment B.

This experiment was designed primarily to investigate the comparative strength of grip of a subject while under waking and under hypnotic suggestions. The suggestions were of the deceptive nature and the method followed was the same as that of Series I of Experiment A. The subject for this experiment was one of those who took part in the first experiment. He reported in the mornings and afternoons of four different days as he had been doing. On the first day, Order I of the deceptive suggestions was employed. On this day suggestions were given in the hypnotic state first, and twelve grips were made, six with one hand and then six with the other, at thirty second intervals. When these records were taken, a ten minute rest was introduced, after which the subject went through the same procedure in the waking state. In the remaining three days, the other three Orders of quantified suggested deceptive results were used. The states, however, as already indicated, were so regulated that if the hypnotic state came first one day, the waking state preceded on the following day.

Since the only different technique introduced in this experiment was that involving hypnotism, space will be given to illustrate the procedure that was followed.

The subject was asked to seat himself comfortably in a well-upholstered chair which had been provided. The operator induced



the trance by twirling a shining object, tied on the end of a string, in front of the subject's eyes, at the same time suggesting in a low monotone:

"Relax everything. Imagine you are going into a deep, deep sleep. Banish all other ideas and thoughts from your mind. Just concentrate upon my suggestions. Concentrate upon my suggestions and carry them out implicitly. Pay attention to no other sounds, just concentrate upon what I have to say. Completely relax. Imagine you are falling into a deep sleep. Now I want you to fixate upon this object. Look into this object. Fixate upon a bright spot in the object. Stare into it without blinking. Your eyes are tired and drowsy now. You are going into a deep, deep sleep. Your eyelids are heavy and want to close. Your eyes are beginning to smart. Your eyelids are closing--closing--they are closed. They---are---closed. You are completely relaxed and sleeping quietly and peacefully. You're hearing my voice. You're hearing only my voice and carrying out my suggestions. You will not wake up until you are told to, and then, you will wake up quietly and feel quite refreshed as the result of my suggestions. You're hearing my voice, concentrating upon my suggestions and acting them out accordingly."

The subject was then permitted to go into a deeper state and the eye catalepsy and hand clasp tests were tried, thus:

"I'm going to count to five. When I get to five you will be in a deeper slumber. 'One' suggests deep sleep. You're hearing only my voice--concentrating upon my suggestions. 'Two' suggests deeper sleep. 'Three' suggests still deeper sleep. When I get to five, you'll be in a deep slumber. 'Four' suggests still deeper sleep. 'Five'--you're in a deep slumber. You're sleeping quietly and peacefully. You're in a quiet and peaceful sleep--hearing only my voice and carrying out my suggestions. Your eyes are closed tight. Your eyelids are closing tighter together. They are stuck together. You can't open your eyes--the more you try the tighter they stick together. The tighter they stick together. Relax. Relax completely. You're breathing heavily but comfortably. Now clasp your hands together, fingers interlocking. Your fingers are tightly interlocked. Your palms close together have a tendency to grow into each other. Your hands are in a tight grip now. You can't open your hands. The more you try the tighter they get--the tighter they get. Relax. Relax your hands. Relax completely. Free your fingers and let your hands rest comfortably upon your lap. You're hearing my voice. You're hearing only my voice and carrying out my suggestions."



Suggestions in preparation for the grip experiment included those given to the subject in the waking state under deceptive knowledge of results. Outside from the additional voicifications, which were thought more conducive to a deeper trance, the procedure followed was the same. In the next, the subject was brought to open his eyes and stand in front of the chair with all suggestions firmly fixed. Often, for better fixation, some of the following was repeated more than once:

"We are going to prepare, now, for a grip experiment. You're hearing my voice and fixating my suggestions. We are going to make preparations for measuring your strength of grip. You're hearing only my voice--fixating my suggestions. You will be able to open your eyes when you are told. You will stand in front of the chair and at the proper signals you will grip the apparatus, that is handed to you, with maximum effort, trying to beat your record each time. There will be a series of twelve grips, six with each hand beginning with the right. At the end of the twelfth grip you will be given the signal 'That is all', whereby you will go to the chair in which you are sitting, close your eyes, and go back into a deep slumber. There will be a preparatory signal, 'Get ready!', before each trial that will suggest getting a good hold on the apparatus. At the signal, 'Grip', you will immediately grip your maximum, exerting equal pressure on all the fingers of your hand. There will be an interval of thirty seconds between each grip, wherein you may rest your hand and flex your fingers as best you can. You will not work in ignorance of your results. After each trial you will turn the dial of the apparatus so I can read it. I will record the score and tell you how well you have done each time. I will let you know how well you have done each time. Upon hearing your score you will relate it to a previously known score and try to exceed your record each trial. All suggestions firmly fixed now. You're hearing my voice, --only my voice. Without waking you may open your eyes. You feel quite at home in the room with your eyes open. You can open your eyes. Nothing else matters to you much except carrying out my suggestions. You will get up carefully from the chair and stand in front of it. All suggestions for the grip experiment are firmly fixed."

At this point the suggested deceptive knowledge of results was used in the Orders already referred to; a different Order for each of the four days the subject reported. After the subject



worked under a set of such suggestions, he went back to the chair, closed his eyes, and was retested for the eye catalepsy and hand clasp reactions. If it was thought that the subject was not following out suggestions close enough, a simple post hypnotic suggestion was given to see if that would be carried out. For example, such a test might call for the subject to remain in the chair upon waking until the operator unclasped his hands. It will be noticed in the above suggestions that a statement was made to the effect that the subject was to take note of the score reported to him each time and try to exceed his record each trial. Experience showed here that such a suggestion was necessary. If it was left out, the subject was apt to pass up the reported scores without meaningful interpretation. The termination of the trance was brought about as follows:

"I'm going to count to five. When I get to five you'll be completely awake. You'll awake easily. You'll have no ill-effects as the result of your experience. You will wake up quietly and feel rested as the result of my suggestions. 'One' suggests getting awake. 'Two' suggests waking up. 'Three'--your eyes are loosening. 'Four'--your eyes are open. 'Five'--you're completely awake and feeling fine."

This entire procedure usually lasted about fifteen minutes. At times, extraneous noises and other such influences were common, for records were taken when other activities were going on in the same building. Such influences, of course, proved detrimental to the induction and continuation of the trance. However, in the event that the subject was found to be not very deeply hypnotized on a certain day, his record for that day was destroyed.

### EXPERIMENT C

The main purpose of this experiment was to study the changes



in the work curve, if any, on work done with the dynamometer when the various motivational methods embodied in the two previous experiments were used. Each of the three subjects participating worked individually in the presence of only the operator. The work period for each lasted a little more than an hour. The fatiguing effect was kept at a minimum by introducing a ten minute rest period after each Part. As the procedure in each Part to be considered has a direct bearing upon one already demonstrated, reference will be given to that one after which it was patterned. The motivational conditions appeared in this order:

Part I: Suggested Deceptive Knowledge of Results.

The procedure here was the same as that in Experiment A, Series I, using Order I of deceptive suggestions.

Part II: Suggested Deceptive Knowledge of Results in the Hypnotic State.

The conditions here were modeled after those for the hypnotic state in Experiment B using Order I of deceptive suggestions.

Part III: No Knowledge of Results.

Here the procedure followed took the form outlined for Series II of Experiment A.

Part IV: Visual Knowledge of Results.

The technique used in this last was the same as that in Series III of Experiment A.

For lack of time and inability to get the subjects to come at hours not conflicting with their regular school pursuits, Experiment C was concluded in one night. It was included in this

report for its possible prognostic value for future study.

Throughout the study an attempt was made to keep fatigue effects at a minimum. The thirty second rest period between grips, and the limitation of the number of grips to six for either hand each time a subject reported for a record, helped to contribute to this cause. The thirty second interval was chosen because a preliminary investigation indicated that it might be an adequate period of time, with a limited number of successive trials, for recuperation of the muscles used in gripping. At the outset, the subjects practiced with 15, 20, and 30 second rest periods between grips. From the records made and from the feeling of fatigue reported by the subjects, the latter interval was found to be more adequate. The interval was limited to 30 seconds because it was thought that if the subject had to wait too long between grip contractions, weariness might set in. Whenever there were two alternating states to be experimented with, a ten minute rest period was allowed between the two. During this interval, a subject usually rested in a sitting posture, passing the time in mild conversation.

A sample of the record sheets that were used is included in the appendix. These sheets functioned primarily to keep the data accumulated in orderly fashion and to make sure that the subjects were reporting a proper number of times at approximately the same times each day. Records that were not taken on a scheduled time usually came within an hour of that time. In a few cases, subjects were not able to report both in the morning and afternoon of the same day; in such cases, grips were made in the morning of one day and in the afternoon of another, in order to



complete the performance for a day record. On the record sheets, space was also provided for notations concerning the type of activity resorted to the night before, and also that prior to gripping. An attempt was made to get subjective estimates on how strong a subject felt at performance time. These estimates were made numerically (10 signified very strong and 1 very weak). These evaluations, however, were not very valuable, for it was seldom found that they would correspond with the amount of work done.

If such factors as time of day, type of activity the night before, work previous to making grip contractions, and nearness to the last meal had any influence on strength of grip, it is believed that such conditions in the present study were well controlled. Through such control of conditions chance errors that might arise, like temporary indisposition toward the work, also were thought to be considered. Under each motivational condition, each subject was permitted to take the dynamometer tests repeatedly on several days at about the same hours each day. In view of the fact that all the subjects were students attending college classes it can be said that, in general, the type of activities followed by each subject from day to day were quite the ordinary.

At the end of each experiment, introspective reports were called for. They were not reported at the end of each series in the first experiment, for it was feared that conversation concerning the procedure at that time would cause the subject to become more aware of the purpose of the study. The subjects were, however, asked to keep in mind all along their attitude

toward their work under the various sets of conditions. All reports were kept; many were found to be similar.

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RESULTS AND INTERPRETATION

Treatment and Generalizations:

All of the original data accumulated for the subjects in each experiment is included in the appendix.

In Experiment A each of six subjects made a total of 288 grip contractions, 1/3 of which were made in each of the three series. In other words, 96 measurements were taken in each series. The averages representing these records are found in Table I. The final averages for the six subjects as a group present the evidence that the best performance on the hand dynamometer was done during the third work series when visual knowledge of results was used. Although there isn't much difference between the work done in Series I with suggested deceptive knowledge of results and that in Series II with no knowledge of results, the final averages for the former show a very slight superiority over the latter. These same final results for the group are pictured graphically by Figure I.

Table II presents the mean variations of the quantities in Table I. The variations are from-day-to-day averages in each work series. The final mean variations present some evidence that the group of subjects as a whole was more variable in its performance in Series I with deceptive knowledge, and least variable in Series III with visual knowledge of results.

Figure 2 represents the final averages of each subject for each specific grip number (1-6) in each of the three series. This figure permits one to view the results from another angle. These averages were obtained from the total amount of work done at a particular grip number in each four-day work period of a series.

Each series in Figure 2 is separated by a horizontal line. The abscissa represents the grip numbers (1-6) for each series. The ordinate stands for the final averages for each grip number in each series. The average plotted for grip #1 in Series I represents, then, the final averages of all the initial grips taken during the four-day work period of that series. The initial grips in this case have reference to the first contractions made with the right and left hands in the mornings and afternoons of the four days. The average plotted for grip #2 represents all the second contractions made in the series. It will be recalled that in Series I the grip numbers (3-6) were rotated each day. Consequently, the deception of 5 kilograms for the third contraction the first day was given on the second day for the sixth contraction, on the third day for the fifth, and on the last day for the fourth contraction. Thus in Figure 2 the average plotted for grip #3 in Series I stands for all those contractions for which a 5 kilogram deception was provided.

Besides presenting an illustration of the amount of work done in Experiment A, Figure 2 shows that each subject has his own work curve, the shape of which may vary under different motivational conditions. The "leveled-off" effect or the "peaked" performances shown by the curves in Series I present some evidence that the deceptive suggestions as a whole were influential in helping either to heighten or to maintain a standard of performance.

In Experiment B the one subject taking part made a total of 192 grip contractions in four days. Half of these were made in the hypnotic state. Table III contains the averages and mean



variations made by this subject while working with deceptive knowledge of results in both the waking and hypnotic states. The final results do not present any real significant difference between the performances in either state.

The results for Experiment C are found in Table IV. Each of the three subjects made a total of 48 grip contractions. Twelve of these measurements were taken in each of the four parts. In view of the fact that too few records were taken in this experiment, no generalizations can be made with justification. However, the procedure outlined for this experiment is comparable somewhat to the one originally intended for this study and provides a sample of the approach to the problem that would have been followed had opportunity permitted.

#### Analysis and Discussion.

There remains a closer scrutiny of the results to bring out the individual variations and to account for the smoothing effect of all the final averages from which generalizations were made. With this analysis there will be included also the information possessed about each subject which might have a direct bearing on influencing the results.

In Experiment A, Subject I was the only one not to show a superior performance with visual knowledge of results. Table I and Figure 2 both show that he varied very slightly, however, in his work from Series to Series. Two notations made at the beginning of his work with visual knowledge of results may have had a bearing upon his subsequent records. He reported that he had ceased the frequent heavy "workouts", which he had been taking

T A B L E I

RESULTS: EXPERIMENT A

Averages for Each of Six Subjects in Work Periods Under Receptive Knowledge, No Knowledge, and Visual Knowledge of Results.

	Morning		Afternoon		Final Average for Four Days' Work
	Right	Left	Right	Left	
<u>Subject I</u>					
Series I	55.08	49.99	56.13	50.46	52.92
II	55.51	51.57	54.25	51.80	53.31
III	54.26	50.50	54.26	51.51	52.66
<u>Subject II</u>					
Series I	38.78	25.37	39.42	27.17	31.84
II	38.80	26.91	39.01	28.24	32.28
III	40.33	29.46	41.47	29.21	35.14
<u>Subject III</u>					
Series I	52.22	47.42	49.22	46.19	48.79
II	54.25	49.17	54.88	49.62	51.98
III	58.46	51.89	56.86	50.88	54.52
<u>Subject IV</u>					
Series I	23.24	22.70	29.27	22.53	26.46
II	28.20	23.54	30.20	25.45	26.91
III	28.17	24.51	31.12	26.02	27.46
<u>Subject V</u>					
Series I	28.04	24.02	28.70	24.60	26.35
II	28.22	26.12	24.70	29.58	30.92
III	29.20	25.72	40.27	26.64	27.98
<u>Subject VI</u>					
Series I	47.15	39.99	52.75	46.89	46.70
II	47.80	41.51	50.91	43.76	46.00
III	52.72	48.29	58.19	52.11	52.85
<u>All Six Subjects</u>					
Series I	42.45	26.85	44.25	38.14	40.68
II	42.97	26.47	44.02	28.08	40.40
III	45.26	40.08	47.03	41.08	43.44



T A B L E I I

RESULTS: EXPERIMENT A

Mean Variations for Each of Six Subjects in Work Periods Under Deceptive Knowledge, No Knowledge, and Visual Knowledge of results.

	Morning		Afternoon		Mean Variations for Four-day Periods
	Right	Left	Right	Left	
<u>Subject I</u>					
Series I	2.00	4.38	0.57	1.44	2.35
II	1.23	1.35	0.99	2.21	1.60
III	0.472	1.02	1.13	0.67	0.82
<u>Subject II</u>					
Series I	0.61	1.44	0.99	1.21	1.06
II	0.84	2.78	0.98	1.37	1.64
III	0.75	0.89	0.70	0.61	0.74
<u>Subject III</u>					
Series I	2.78	1.77	3.26	2.51	1.02
II	1.20	0.99	0.89	1.01	1.02
III	2.12	1.74	0.92	2.05	1.71
<u>Subject IV</u>					
Series I	0.51	0.87	1.81	0.87	1.02
II	1.98	1.25	1.49	0.49	1.30
III	1.85	0.26	0.31	0.72	0.96
<u>Subject V</u>					
Series I	1.07	2.28	1.85	1.21	1.60
II	0.91	1.42	0.82	0.79	0.99
III	0.91	1.92	1.05	0.98	1.22
<u>Subject VI</u>					
Series I	3.10	2.27	2.76	2.90	2.76
II	3.82	2.14	3.39	4.25	3.40
III	1.97	0.49	1.78	0.77	1.25
<u>All Six Subjects</u>					
Series I	1.85	2.16	1.89	1.69	1.90
II	1.67	1.76	1.43	1.79	1.66
III	1.24	1.07	1.08	0.97	1.12

T A B L E I I I

RESULTS: EXPERIMENT B

Averages and Mean Variations for One Subject in a Four-day Work Period with Deceptive Knowledge of Results in the Waking and Hypnotic States.

	Morning		Afternoon		Average Four-days Work.
	Right	Left	Right	Left	
<u>Waking</u>					
Av.	52.09	47.66	50.31	47.68	49.43
M.V.	2.01	1.17	2.80	0.73	1.68
<u>Hypnotic</u>					
Av.	51.00	48.01	50.00	47.38	49.10
M.V.	1.19	1.17	2.22	1.23	1.45

T A B L E I V

RESULTS: EXPERIMENT C

Averages for Three Subjects Made in a One-night Work Period with Deceptive Knowledge in the Waking State, Deceptive Knowledge in the Hypnotic State, No Knowledge, and Visual Knowledge of Results.

	Subject I			Subject VI			Subject VIII		
	Right	Left	Both	Right	Left	Both	Right	Left	Both
Part I	53.68	48.93	51.30	32.00	24.50	28.25	33.40	30.15	31.78
Part II	54.80	49.08	51.94	31.47	23.90	27.69	30.80	28.80	29.80
Part III	53.17	45.50	49.34	31.65	25.30	28.48	29.20	27.75	28.48
Part IV	54.50	49.50	52.00	33.55	24.20	28.88	30.97	30.55	30.76



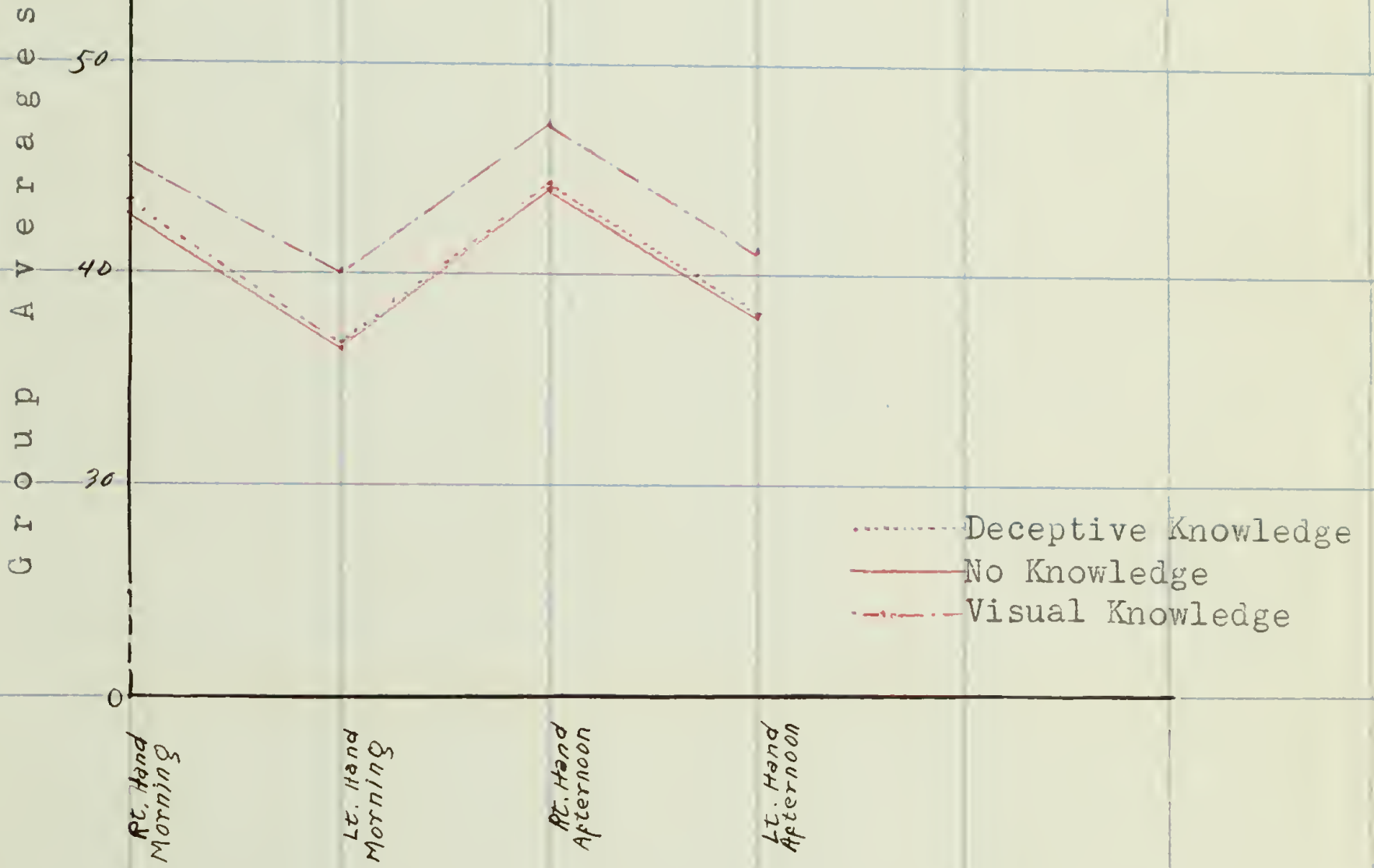


Fig. 1. Comparison of Strength of Grip in Four-day Work Periods With Deceptive, No Knowledge, and Visual Knowledge of Results.

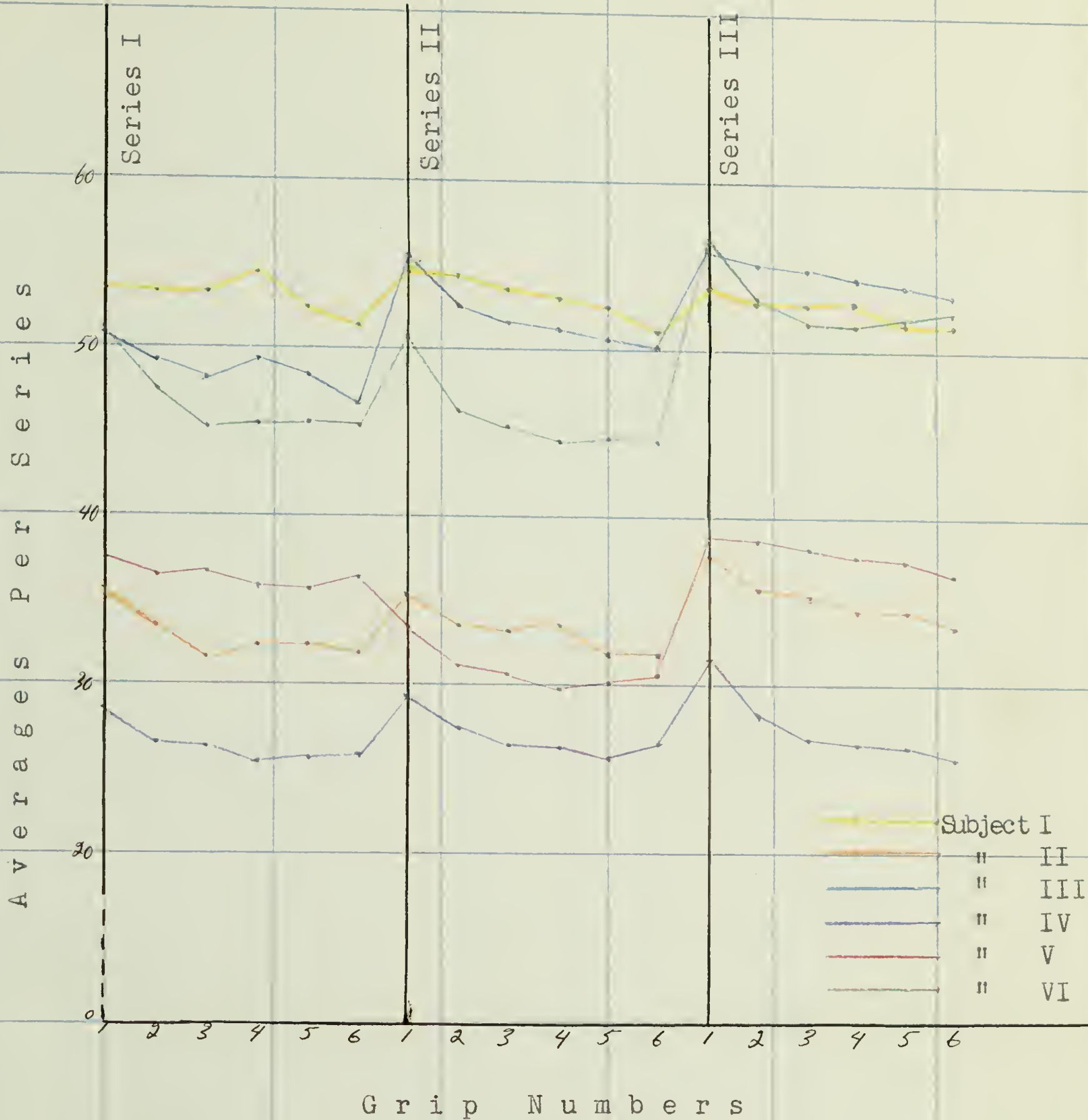


Fig. 2. Comparison of Averages Made in Four-day Work Periods for Each Specific Grip Number With Deceptive, No Knowledge, and Visual Knowledge of Results.



at the gymnasium for some time previous; also, that he had not fully recovered from a boxing injury to his hand. It is probable that the preliminary suggestions to grip his maximum and try to exceed his record each time was enough of an incentive for this "athletic type" in prompting him to maintain the high standard that he did when he was in physical fitness. Figure 2 also indicates that the extreme low deceptions in Series I caused a rise in his work curve. His records were taken at 11:00 A.M. and 4:00 P.M. each day, but his final averages do not show any persistent variation for time of day with either hand in all three work series. Table II indicates that he was more variable in his performance from day to day with deceptive knowledge of results. Subject I was quite regular in his daily habits. His activities prior to the taking of records were usually of this nature: attending class, walking, studying, or laboratory work. From his introspection report the following information was obtained concerning each series:

**Deceptive Knowledge of Results:** A low reported grip prompted a better preparatory set. A high reported grip gave him satisfaction and didn't make him feel like trying as hard. It was thought more probable to make a low score than a very high one especially if he had the idea that his hand might have slipped. At first the reported extreme scores were thought to be the results of a wrong reading of the dynamometer dial.

**No Knowledge of Results:** He tried to do a little better each time, or tried to maintain a grip, at least, as good as the one previous. This series was not as interesting as Series I.

**Visual Knowledge of Results:** He tried hard to beat a previous grip. If a maximum grip occurred in the initial contraction, it was found hard to be surpassed in succeeding contractions regardless of the attitude taken. This series was the most interesting, but most fatiguing.

Subject II did her best work with visual knowledge of re-



sults. This young woman was more of the athletic type. She reported for records at 11:15 A.M. and 3:00 P.M., and Table I shows that she generally did better work in the afternoons. From Table II it can be seen that she was most variable from day-to-day performances in Series I. Figure 2 indicates that the deceptive suggestions in general functioned to cause her to maintain a certain level of achievement. She was quite regular in her daily habits. Her activities prior to the taking of records each day consisted usually of studying, typing, attending class, or scoring tests and the like. From her introspection reports the following information was obtained:

**Deceptive Knowledge of Results:** Although an idea of deception occurred with the report of the extreme scores, an effort was always made to do better.

**No Knowledge of Results:** An attempt was made to maintain a standard of achievement subjectively estimated.

**Visual Knowledge of Results:** This was the most interesting. Often discouragement resulted from seeing the continual dropping-off of records each successive contraction, but an attempt was made to exert her maximum each time.

The best performance for Subject III was made with visual knowledge of results. Also, all his final averages for the no knowledge series were greater than those of the deceptive work period. This young man showed a gradual and marked improvement in his strength of grip records in the three week practice period. Table II shows that he was more variable in his performances from day to day in Series I. Although his reports were scheduled for 10:30 A.M. and 3:15 P.M., it was seldom that he was very regular in coming to take them. In Figure 2, a "peaked" performance is characteristic of his curve where the suggested deceptions of 10 kilograms less were employed. His daily habits were quite



varied and full of different activities. Prior to the taking of records, however, he usually had been attending class, walking, studying, or doing clerical work. His introspection report contained the following information:

**Deceptive Knowledge of Results:** He has no idea of deception of results. He always tried to put more into his grip. If a low score was reported, it was often thought that the hand had slipped. The high scores furnished him an objective to try to surpass.

**No Knowledge of Results:** He merely tried to maintain a standard of achievement subjectively estimated.

**Visual Knowledge of Results:** An attempt was made to make a better grip each time. When the gradual decline was seen to occur, it was thought only natural after having put so much effort in the preceding contractions. This series was the most interesting.

Subject IV did not show much significant improvement throughout the course of Experiment A. Her final averages, however, do indicate a slight superiority with the visual results series. Her strength of grip was lower than that of any of the other subjects. She reported for records at 9:30 A.M. and 4:15 P.M., and her afternoon records in two series, at least, were better than those of the mornings. Her activities prior to the taking of records usually consisted of studying, attending class, or doing clerical work. Figure 2 indicates that a certain level of performance was attained in Series I and II. Her introspection report of indifference to extreme scores may have some bearing upon the similarity of her work curve in Series I and II:

**Deceptive Knowledge of Results:** She had an idea that she was being deceived at times, for the reported scores did not vary proportionally to the amount of effort she knew was being put into previous grips. She became indifferent to the extreme deceptions and just tried to grip her best each time.

**No Knowledge of Results:** An attempt was made to do her best



work each time. The subjective estimate of how well she might have done in a previous grip furnished the cue for how much to exert to maintain the standard.

**Visual Knowledge of Results:** This was most interesting. The general attitude taken was to try to do the best possible even though a continual dropping-off of scores was seen.

Subject V made her best performance with visual knowledge, and one nearly as good with deceptive knowledge of results. She was the only one to do remarkably poorer work with no knowledge of results. Evidently, her records were very influential in bringing down the final averages for all subjects in the no-knowledge series. From a description of the Subject and from her records, it can be concluded that she is the type who needs proper motivation to bring out her best in physical work. In her case, awareness of progress, whether in the form as in Series I or III, provided proper motivational stimuli. She reported for records at 11:30 A.M. and 3:30 P.M., and in Series II and III she did slightly better work in the afternoons. Figure 2 pictures the "leveling off" effect of the deceptive suggestions in general. She was rather regular in her daily activities. During the periods previous to the taking of records, she spent her time usually in studying, attending class, walking, typing, or doing other types of clerical work. From her introspection report the following information was obtained:

**Deceptive Knowledge of Results:** With the extreme reported deceptions, an idea of deception occurred, but her attitude was the same; that is, she tried to do her best each time.

**No Knowledge of Results:** No special effort was made to do unusual work. She was content in keeping to a certain subjective estimate of output not involving a taxing effort.

**Visual Knowledge of Results:** This was the most interesting. In general the attitude was to try to surpass each preceding



grip. She interpreted the gradual dropping-off of scores in successive trials as just the natural effect of fatigue and muscle tenseness accompanying hard work.

Subject VI showed a very superior performance with visual knowledge of results. The amount that he improved in the three weeks' practice period with the dynamometer was one of the largest obtained in this experiment. Table I shows that the difference in the performances in Series I and II was not significantly great. Figure 2 illustrates the "leveling" effect of the deceptive suggestions in general. Table II presents the evidence that he was quite variable from day to day performances in both Series I and II. His records were scheduled for 11:00 A.M. and 2:30 P.M., and his averages for the afternoon records were considerably better than those of the mornings. This individual frequently reported an insufficient number of hours sleep. His activities prior to the taking of records included generally attending class, walking, or doing clerical work. This Subject was formerly quite active in athletics, and undoubtedly the practice on the dynamometer and the proper motivational condition were necessary to get him to put out his best effort. His introspection report contained information, which, for the most part, was not much different from that of the others:

**Deceptive Knowledge of Results:** The extreme reported scores caused him to be conscious of deception, but regardless, he tried to improve his grip each time. The highest score reported was a mark set up to be surpassed.

**No Knowledge of Results:** An attempt was made to maintain a certain standard of work subjectively estimated.

**Visual Knowledge of Results:** This series was the most interesting. It afforded a good opportunity to watch the method of gripping to see if improvement occurred with a certain type of adjustment. From the accomplishment during

self competition, the well being of the individual was enhanced.

A closer analysis of results for Experiment B does not offer any more dependable information other than what has already been generalized. The final averages indicate a slight but insignificant difference between the performance in the two states, but this difference is not even consistent for both morning and afternoon records.

Considerable comment should be made concerning Experiment B. In the first place, not enough subjects were used. The subject who did take part was familiar with the general nature of deceptive suggestions. It can be said, however, that he never knew how much he was being deceived when he experienced deception. Yet, it is questionable whether the suggested deceptions could have had the same effect on this individual after he had been recently through a long practice period with the dynamometer. His averages in Experiment B are considerably lower than those made in Series I of Experiment A. As a partial explanation for this, attention is again called to the fact that the hypnotic and waking states were alternated with a ten minute interval provided between the two. His records showed that during this period the interval was not sufficient to eliminate all the muscle tenseness and fatigue resulting from the physical exertion of a preceding state. This so-called "after effect" was neutralized, however, as the two states were alternated in their precedence from day to day, with the same rest interval between the two. Another possible reason for the lower record in this experiment may be attributed to the fact that the current base-



ball practice had left his hands somewhat swollen.

The tests used to show that the subject was hypnotized and carrying out suggestions were those such as the eye closing, complete physical relaxation, catalepsy of the eyes, the hand grasp catalepsy, and ability to open the eyes without affecting the trance. The only objective way to test whether the intellectual function involved in interpreting the deceptive suggestions had any appreciable effect in stimulating attitude and producing conviction to do better work in the hypnotic state was to compare the results. As the results offered no enlightenment, an introspection report must be mentioned as having some plausible bearing. This report stated that the function involved (that is, the interpreting of a reported score as being higher or lower than an already known grip) may be hampered and result in indifference to suggestions unless very strong directional suggestions concerning what is to be done are given.

Although the results of Experiment C are unreliable, they show somewhat that the three subjects varied in strength of grip performances under the different motivational conditions. Subject I made his best records with visual knowledge of results and with deceptive suggestions in the hypnotic state. Incidentally, an attempt was made this time in the hypnotic state to give repeated directional suggestions for the purpose of obtaining better fixation of the task to be performed. An introspection report by Subject I told of the extreme low reported score standing out as being more intensified; also, that as a succession of trials progressed, he would voluntarily and with firm conviction relate a reported score to two or three previous ones and then try hard

to exceed his records. All this seems to indicate that if the proper attitude is to be taken with the deceptive suggestions in the hypnotic state, exact directions concerning what is to be done should be given. Subject I made his poorest performance in the no knowledge series. Subjects VII and VIII, however, varied so much in their records with their right and left hands under the different motivational conditions that it is hard to say anything definite about their results.

In order to make clearer the significance of the findings of this study, some general comparisons will be made with the results of related studies.

In a summary statement concerning the influence of a definite knowledge of previous results, Young (51) says: "Such knowledge is effective in part because it gives rise to self competition with the attempt to excel one's previous record, and to rivalry with others; in part because it presents a definite standard derived from past work to be maintained or surpassed; in part because it puts emphasis upon the quantity and quality of work and therefore constantly predisposes the subject towards a consideration of the nature of his performance; in part because merely seeing the results of one's labor is in itself satisfying, and creates a more favorable attitude than the work which is done in ignorance of results."

The effect of knowledge of results on estimating the size of angles has been studied by Judd (24) (25), and by Spencer (34); on the making of tally marks by Ross (29); on simple performances such as making the letter "a" by Book and Norvell (8); on achievement in elementary school subjects by Chapman and Feder (10), and



by Brown (7); on grades made by college freshmen in philosophy by Deputy (15); on reaction time by Johanson (23); on accuracy of discrimination by Hamilton (19); on muscular work by Arps (1) (2), by Crawley (14), by Wright (42) and by Manzer (27). All of these investigations agree in finding that knowledge of results is followed by an increase in the functions studied. In contrast with his earlier laboratory study on the making of tally marks, Ross (30) found that knowledge of progress in the college classroom had a negligible effect upon grades made in an education course.

Contradicting results have been found in the above experiments where a reversal of conditions occurred. By reversal of conditions it is meant that during the course of an experiment conditions were changed so that a group was given the opportunity to work for a certain length of time with and without knowledge of results.

Book and Norvell (8) reported a rapid rise in the work curve when knowledge of results was introduced and a sharp decline when the incentive was removed. Brown (7) found that it was reasonable to expect some increase in performance whenever knowledge of results was introduced. On the other hand, Ross (23) did not find a sharp decline in performance, as Book and Norvell did, after the motive was dropped. Ross (30) also found no significant difference upon the introduction of knowledge of results. Deputy (15) did not find improvement to be rapid and continuous upon the introduction of the incentive. Manzer (27) concluded that knowledge of output was followed by a prompt upward turn in the work curve of muscular work, but there was no abrupt fall in the work curve upon the sudden discontinuation of the incentive.

The findings of the present investigation seem to suggest that if one has not been gripping his maximum, it is reasonable to expect a certain amount of improvement in strength of grip with the introduction of true knowledge of results. It is hard to make any definite statement concerning the influencing factors involved in the present study when work was done with no knowledge of results. Because of the small number of subjects participating and the variation of performance shown among them, it is necessary to speak in terms of individual accomplishments.

Only Subject V did outstandingly poor with no knowledge of results. Subjects I, II, and III showed a slight gain with no knowledge of results as compared with their records in the deceptive series. Subjects IV and V did not show any consistent improvement under either of these two conditions. Such findings suggest several possible influencing factors. It is possible that a subject might have been a personality type who, if physically fit, would do his best in a physical performance regardless of the motivating condition. Then too, there is the subject who seems to need a definite objective standard of some kind to supply a proper motive. It may be probable that practice during the period with deceptive knowledge of results served to habituate one to the general conditions of the experiment. Perhaps the preparatory suggestions to exert one's maximum and to try to exceed his record in succeeding trials furnished a motive for improvement. The introspective reports suggest that imagery or the subjective estimate of how well one was doing might have supplied a motive for betterment.

In Strong's (36) report upon the effect of suggestion on



strength of grip the claim was made that any arousal of attention to the work may act as a stimulant. Even Book and Morvill (8), who reported an abrupt fall in the work curve when knowledge of results was discontinued, can not deny the possibility that the suggestion to the subjects to "banish all thought and desire from their minds (9) (31)" might have played an important part in influencing subsequent performance. In the early investigation by Ross (29) the contention was held that the motivating effect of a knowledge of progress was relatively continuous and self-sustaining through a practice period with no knowledge of results. In his later report, Ross (30) came to the conclusion that it was manifestly impossible to eliminate the subjective impression of a subject regarding his progress when working with no knowledge of results. Manzer (27) found that the incentive developed by knowledge of results seemed to have an after effect upon performance with the dynamometer that persisted after the incentive had been dropped.

It will be recalled that Young (43) found no difference, in the momentary strength of grip on the dynamometer, between the waking and hypnotic states. Young, however, drew his conclusions from the results of a number of subjects who had been classified according to their respective degree of hypnotic suggestibility. In his study the subjects worked with no knowledge of results. While performing in the hypnotic state, they kept their eyes closed. In the present investigation deceptive knowledge of results was used and performance in the hypnotic state proceeded while the subject's eyes were open. One of the conclusions that Young (45) came to after reviewing the results of his entire

experimental program was: "The basic difference, then, between the normal and the hypnotic states seems to be a difference, not in strictly mental or even physical abilities, but in the attitudes which can be assumed with verisimilitude. These hypnotic attitudes are emotional, impulsive, and voluntary rather than intellectual."

It is difficult to make a definite statement concerning the effect of the deceptive knowledge of results that was used in this study on a subject in the hypnotic state. Because of the small number of subjects, it is thought best to limit a discussion to those factors that presented themselves during the course of the experiment rather than to attempt any possible explanation of the phenomena involved during hypnosis.

On one occasion Subject VII was seen to yawn several times during the course of making grip contractions. Preceding tests, however, indicated that she was following suggestions fairly closely. Yet it is questionable whether she could have been very deeply hypnotized and that the deceptive knowledge of results had much significance to her, especially if she were conscious of deception. It is probable that the condition of the subject and the opportunity provided for relaxation in the chair before making records were detrimental in predisposing her to perform a physical task with vigor.

Evidence derived unintentionally from an occasion with Subject I suggests that it might be possible to expect a better attitude toward the work if the subject is more deeply hypnotized. During the course of grip contractions an unexpected visitor, who made his presence obvious to the operator, came into the room and



stood in a position quite near to the subject. Later the subject said he did not hear or see the visitor come in. The subject also said that he thought he had been hypnotized more deeply than he had ever been and that the reported grip scores had considerable significance to him. Upon hearing each score he would relate it to one or more preceding scores. The lowest reported scores tended to anger him and to provide him with the determination to do better, he claimed.

Hull (32) lists a classification made by Davis and Husband who attempted to measure susceptibility to hypnosis. The negative auditory hallucination that Subject I showed would be included as one of the more significant symptoms of the somnabulistic, or deepest, trance according to the classification. In Young's (43) study on strength of grip it was found that all the deeply hypnotized subjects gave results clearly in favor of hypnosis. Young claims, however, that if the small difference he found between the capacity in waking and in hypnosis needs explanation, the answer may be in the fact that his experiment was conducted bordering slightly on a fatigue experiment, and that in hypnosis the subjective factor of fatigue was in abeyance. It seems, nevertheless, that the best procedure to follow when working an experiment involving hypnotism is to have a large number of subjects classified according to their respective degree of susceptibility to hypnosis. Before performing under hypnotic suggestions, each subject should be tested for those characteristic symptoms, or signs, indicating that a certain degree of susceptibility has been reached.

Whipple (33) says that records obtained upon the dynamometer,

as nearly all investigators have pointed out, are liable to be affected by subjective factors. Individuals who are supposedly exerting their maximum effort can often move the pointer a few kilograms farther over the scale if some stimulating appeal is made to them. It might be appropriate to call attention again to a statement made in Strong's (36) report claiming that the so-called maximum effort in his experiment was not a real maximum exertion each time, but rather an effort to attain a sort of definite standard. Evidence found in the present investigation suggests that a standard of achievement may vary according to the type of personality of the subject and the motivational condition employed.

Whipple (41) has summarized the results of some investigations upon strength of grip which, for the most part, have been published in obscure journals. Binet and Vaschide found that the average grip could be increased about three kilograms if the dynamometer test is taken under stimulating conditions such as competition, personal encouragement, and public announcement of records. Schuyten found that ennui, or loss of interest in successive tests, is sufficient to obscure the fatigue effect of a school session. Strength of grip has been studied in relation to other factors besides incentives. Its dependence upon sex, race, season, social status, intelligence, handedness and the like have been considered. Likewise, characteristic poses, grimaces, facial contortions and such factors accompanying grip contractions have been studied. Because of so many uncontrolled variables and such great individual differences in the various researches in the field of motivation, it appears impossible to make definite com-



parisons of results found in this study with the other researches in this field.

Evaluation of the Method of Using Deceptive Knowledge of Results.

From the results of this study motivated behavior is seen to be quite variable and plastic under different conditions with various subjects. In order to evaluate the effect of deceptive knowledge of results as it was used in this study, a comparison need only be made with the results obtained under the other conditions. Only one out of six subjects failed to do his best work with visual knowledge of results. The visual awareness of progress without an inkling of deception was more conducive to formulating an attitude of interest toward the work. Only one subject did remarkably poorer work with no knowledge of results. This fact seems to indicate that the preliminary suggestions to grip a maximum and try to exceed a record each time, together with the subjective estimate and mental imagery of how well one was doing, provided a ready stimulation in the no knowledge series. The only subject to do considerably better work with deceptive knowledge was the same one who did so poorly with no knowledge of results. In her case it seems that any type of objective awareness of progress functioned more adequately in stimulating a favorable attitude and furnishing a standard of work to be achieved than that produced through her own judgment and initiative. It is hard to differentiate between the amount of improvement that can be attributed to practice alone or to a particular motivational condition, for no group acted as a neutral or control throughout the entire practice period. Whether much



of a difference would have been made had the deceptive knowledge of results series come last in the practice period is not known. It is questionable whether deception coming after the subjects had already been through a series with visual knowledge of results would ever have the same effect.

In evaluating the method of quantifying the deceptive suggestions in degrees above and below a certain achieved grip score, it must be said that no way was found that would justify a predictable relationship between the degree of deception and the resulting quantitative achievement. In experimenting with the incentive quantitatively this way, one is coping with the large subjective element which varies from time to time and from subject to subject, depending upon the condition of the subject as well as upon the nature of the situation. No assurance is offered to indicate that because the suggestions implied a certain degree of deception the subjective effect was in any sense proportional, or that the resulting effort varied equally. The only evidence presented to show that deceptive knowledge of results in general had some influence is that illustrated in Figure 2 and that presented in Table II. A comparison of the work curves for the three series in Figure 2, as has already been mentioned, shows a "peaked" performance for the low deception of 10 kilograms for two subjects and a general "leveling off" effect of the rotated deceptions for the other four subjects. In Table II the variability is seen to be, on the average, greater in the work period when deceptive knowledge of results was used.

Bills (4) says that motivation can cause larger deviations than fatigue or most physiological agents, but that it is almost



impossible to experiment with motivation quantitatively because of the large subjective element which varies from time to time and from subject to subject. We have no assurance, he adds, that because two objective incentives are equated the subjective effect is in any sense equal. In relation to the question concerning the extent to which an increased interest stimulates an increased effort, the claim was made in Chapman and Feder's (12) report that it is impossible to estimate scientifically the amount of incentive employed in the same way the product produced can be measured. We cannot say that  $x$  additional units of incentive produced an increase  $y$  in product. However, it can be said that a group under such and such external conditions improves at this or that rate.

If attitude casts a reflection upon a goal, it can be reasoned that a person given deceptive knowledge of results concerning work he was interested in might try harder than a person given the same information in work he was not interested in. However, whether a person is interested in performing a certain task or not, it is questionable if an attitude toward the work could ever be established under consciousness of deception to compare with the attitude arising from viewing true knowledge of results. In the present investigation the majority of the subjects reported that they became conscious of deception at some time or other. For future research, it might be advantageous to try to employ a fool-proof method of portraying quantified deceptive knowledge of results concerning strength of grip at younger age levels where experience of deception is less apt to result.

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SUMMARY AND CONCLUSIONS

The problem investigated was that of the influence of knowledge of results upon strength of grip. A special attempt was made to study the effect of suggested deceptive knowledge of results varying in degrees above and below a certain achieved grip.

The entire study was divided into Experiments A, B, and C. Experiment A was further divided into Series I, II, and III, where deceptive knowledge, no knowledge, and visual knowledge of results, respectively, were used. Experiment B was an attempt to investigate the comparative ability of a subject with deceptive knowledge of results in the waking and hypnotic states. Experiment C was divided into four parts and included the motivational conditions involved in the two preceding experiments.

The apparatus used was the Smedley hand dynamometer. Whenever records were taken they occurred in a succession of six contractions for each hand with an interval of thirty seconds between each contraction. In Experiment A, six subjects performed on the dynamometer with the right and left hands, in the mornings and afternoons, for a period lasting about three weeks. An equal length of time was spent with deceptive knowledge, no knowledge, and visual knowledge of results. In Experiment B one subject reported in the mornings and afternoons of four days. Records were made in the waking and hypnotic states with deceptive knowledge of results as an incentive. Three subjects in Experiment C reported one night and each performed with deceptive knowledge in both the waking and hypnotic states, with no knowledge, and with visual knowledge of results.



From this study the following conclusions seem to be justified:

1. Practice on the dynamometer and an appropriate motivational condition are often needed to bring forth one's maximum strength of grip.
2. Visual knowledge of results was found to be superior to deceptive knowledge and to no knowledge in increasing interest and formulating an attitude more conducive to the best performance.
3. In general, quantified deceptive knowledge of results showed some influence upon the work curve. The effect of the degree of deception varied, however, with individuals. Degrees of deception may cause a more variable performance. They may produce a "leveling off" effect in the work curve or a "peaked" point showing which degree of deception produced the greatest effect.
4. No consistent results were found to indicate a superior type of work done under deceptive knowledge and no knowledge of results.
5. No reliable information was obtained regarding the comparative ability of an individual's strength of grip in the waking and hypnotic states when deceptive knowledge of results was used.

The work in this study has given rise to other problems which are listed below as possibilities for future consideration:

1. The construction of a hand dynamometer with a shunting-release system that will provide a means of deceiving the subject but still allowing him to see his apparent grip record. The

problem could be then, visual deceptive knowledge of results vs. visual knowledge of results.

2. The effect of deceptive knowledge of results with younger age groups.

3. The effect of deceptive knowledge of results in resisting fatigue.

4. The relation of some personality traits to the amount of improvement shown under different motivational conditions.

5. A better method should be found to analyze and evaluate the relative effects of varying the degree of deception above and below a certain achieved grip.

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A P P E N D I X

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DATA EXPERIMENT A

Series I

Subject I

Time	Hand	Records	T r i a l s (Rotated) (Kgs.)						Average per Trial
			1	2	3	4	5	6	
Morning	Right	1	41.0	55.0	52.0	53.0	54.0	58.0	52.16
		2	57.0	57.0	60.5	64.5	60.0	57.5	59.41
		3	54.8	52.5	52.5	48.5	53.9	49.8	52.00
		4	55.5	58.5	57.0	58.0	55.0	56.5	56.75
		Av.	52.07	55.75	55.50	56.00	55.72	55.45	55.08
Afternoon	Right	1	59.0	55.8	58.2	54.0	52.5	56.0	55.91
		2	58.6	56.0	54.5	58.0	52.0	54.6	55.61
		3	55.0	56.5	56.0	57.5	54.0	55.4	55.73
		4	59.0	57.0	60.0	58.0	56.0	53.5	57.25
		Av.	57.90	56.32	57.17	56.87	53.62	54.87	56.13
Morning	Left	1	49.0	50.5	51.0	50.0	49.0	48.0	49.58
		2	56.0	56.5	53.0	56.0	49.0	50.5	53.50
		3	47.5	44.0	44.5	45.5	45.0	38.5	44.16
		4	53.5	53.5	53.0	53.0	51.0	52.5	52.75
		Av.	51.50	51.12	50.37	51.12	48.50	47.37	49.99
Afternoon	Left	1	52.0	46.0	48.5	49.0	51.0	51.0	49.60
		2	51.1	48.0	50.5	50.1	48.5	42.5	48.45
		3	50.0	52.5	48.5	53.5	52.5	49.8	51.13
		4	52.5	50.5	50.5	61.0	52.5	49.0	52.67
		Av.	51.40	49.25	49.50	53.40	51.12	48.07	50.46



DATA EXPERIMENT A

Series II

Subject I

Time	Hand	Records	T r i a l s (Kgs.)						Average per Trial
			1	2	3	4	5	6	
Morning	Right	1	54.5	53.8	53.8	51.5	52.5	51.5	52.93
		2	54.2	57.2	58.2	57.2	55.0	56.0	56.30
		3	59.2	56.0	55.5	55.5	55.5	56.0	56.28
		4	58.0	56.9	57.9	55.8	55.0	55.6	56.53
		Av.	56.48	55.98	56.35	55.00	54.50	54.78	55.51
Afternoon	Right	1	50.3	52.8	55.0	52.8	53.5	51.2	52.60
		2	55.5	55.0	54.5	55.5	54.5	53.0	54.67
		3	55.0	56.1	57.0	57.0	54.0	57.0	56.01
		4	51.8	55.2	54.0	54.5	54.2	55.0	54.12
		Av.	53.15	54.78	55.13	54.95	54.05	54.05	54.35
Morning	Left	1	55.0	53.0	50.8	51.0	49.0	49.0	51.30
		2	48.5	49.0	47.5	46.8	48.9	47.0	47.95
		3	55.2	54.2	52.0	52.0	52.0	50.5	52.65
		4	57.5	58.0	55.0	52.8	52.0	51.0	54.38
		Av.	54.05	53.55	51.33	50.65	50.48	49.38	51.57
Afternoon	Left	1	53.8	54.0	53.0	53.0	54.5	52.8	53.52
		2	53.5	52.0	50.0	51.0	49.0	48.0	50.58
		3	55.5	55.9	53.6	54.0	54.5	53.5	54.50
		4	53.0	49.2	47.9	47.5	48.0	46.0	48.60
		Av.	53.95	52.78	51.13	51.38	51.50	50.08	51.80

DATA EXPERIMENT A

Series III

Subject I

Time	Hand	Records	T r i a l s (Kgs.)						Average per Trial
			1	2	3	4	5	6	
Morning	Right	1	51.0	55.5	56.7	56.0	56.0	55.0	55.03
		2	53.0	54.0	54.9	53.5	53.2	53.0	53.60
		3	58.0	56.2	56.9	52.5	52.2	52.0	54.63
		4	57.9	56.0	54.8	53.2	51.8	51.3	54.17
		Av.	54.98	55.43	55.83	53.80	53.30	52.83	54.36
Afternoon	Right	1	55.0	57.4	54.4	60.4	58.0	54.0	56.53
		2	52.0	54.2	51.7	53.3	55.0	55.7	53.65
		3	54.0	54.5	54.5	54.0	53.0	53.2	53.87
		4	52.0	53.0	50.0	55.6	55.0	52.4	53.00
		Av.	53.25	54.78	52.65	55.83	55.25	53.83	54.26
Morning	Left	1	54.5	52.0	49.0	50.5	47.0	48.0	50.17
		2	55.0	52.0	50.0	52.0	51.7	49.0	51.62
		3	54.5	52.2	51.8	49.0	50.0	51.0	51.42
		4	51.0	49.0	48.8	49.0	47.4	47.5	48.78
		Av.	53.75	51.30	49.90	50.13	49.03	48.88	50.50
Afternoon	Left	1	55.0	50.0	54.6	52.3	50.6	47.0	51.58
		2	50.9	49.0	53.0	50.2	50.6	51.7	50.90
		3	57.0	53.0	53.2	53.4	49.0	51.0	52.77
		4	50.0	49.0	51.0	51.5	50.0	53.2	50.78
		Av.	53.23	50.25	52.95	51.85	50.05	50.73	51.51



DATA EXPERIMENT A

Series I

Subject II

Time	Hand	Records	T r i a l s (Rotated) (Kgs.)						Average Per Trial
			1	2	3	4	5	6	
Morning	Right	1	45.0	41.0	38.0	38.0	39.0	39.0	40.00
		2	44.2	38.0	35.0	39.0	38.0	37.5	38.61
		3	41.9	40.5	37.0	35.0	38.0	39.5	38.65
		4	41.0	38.0	36.5	36.5	37.5	37.8	37.88
		Av.	43.02	39.37	36.62	37.12	38.12	38.45	38.78
Afternoon	Right	1	44.0	41.0	41.0	40.5	40.5	39.0	41.00
		2	42.5	41.5	37.0	40.0	40.0	37.5	39.75
		3	43.0	39.2	34.2	36.0	35.2	37.2	37.46
		4	40.0	37.5	38.9	39.0	41.1	40.5	39.50
		Av.	42.37	39.80	37.77	38.87	39.20	38.55	39.42
Morning	Left	1	31.5	27.0	27.0	27.0	26.5	26.5	27.58
		2	25.5	24.0	23.5	22.0	21.0	23.0	23.16
		3	30.0	30.0	26.5	26.5	26.0	24.5	27.25
		4	30.0	25.0	26.5	26.0	26.0	22.0	25.91
		Av.	29.25	26.50	25.87	25.37	24.87	24.00	25.97
Afternoon	Left	1	32.0	30.5	29.5	28.5	28.0	26.0	29.08
		2	25.0	26.5	24.5	25.0	24.0	27.0	25.33
		3	31.0	28.0	26.0	27.8	26.0	27.5	27.71
		4	25.5	26.5	26.1	27.0	27.4	27.2	26.61
		Av.	28.37	27.87	26.52	27.07	26.35	26.92	27.18

DATA EXPERIMENT 1

Series II

Subject II

Time	Hand	Repeats	Trials (Sec.)						Average Per Trial
			1	2	3	4	5	6	
Morning	Right	1	42.0	37.5	37.2	37.0	36.8	34.2	37.82
		2	38.0	33.5	33.1	33.0	34.5	37.0	37.82
		3	42.0	33.5	33.1	41.5	33.0	36.3	40.00
		4	41.5	42.5	33.0	35.2	35.1	36.1	39.75
		Av.	41.25	38.75	38.50	38.72	37.10	37.05	38.80
Afternoon	Right	1	39.5	37.5	35.0	33.1	37.0	35.0	36.17
		2	42.1	42.0	38.0	40.8	36.0	33.5	40.25
		3	40.0	43.5	40.5	34.5	33.0	33.0	38.40
		4	39.3	33.0	33.0	33.0	33.0	35.5	37.30
		Av.	40.28	40.00	38.28	38.35	37.70	37.75	38.01
Morning	Left	1	27.3	27.0	26.0	25.9	23.0	22.8	26.47
		2	25.0	25.0	21.0	23.5	22.3	18.0	24.67
		3	23.0	24.3	20.0	23.0	22.0	23.0	23.33
		4	22.0	20.5	21.0	23.0	21.0	20.1	21.75
		Av.	28.78	26.65	27.00	27.05	26.00	23.27	26.31
Afternoon	Left	1	18.0	14.1	22.5	25.1	23.0	21.1	24.30
		2	21.5	19.0	20.5	20.3	27.5	19.0	26.78
		3	21.0	20.5	21.0	20.0	23.0	18.0	20.75
		4	21.5	20.8	23.0	23.3	17.1	20.4	23.67
		Av.	20.73	18.48	27.43	26.73	26.43	17.6	26.34



DATA EXPERIMENT A

Series III

Subject II

Time	Hand	Records	T r i a l s (Kgs.)						Average Per Trial
			1	2	3	4	5	6	
Morning	Right	1	44.0	41.9	41.3	38.8	38.9	37.0	40.32
		2	43.6	39.3	39.8	40.0	41.4	41.6	40.95
		3	37.0	41.5	39.0	39.0	38.0	38.5	38.85
		4	46.2	44.0	40.9	38.9	38.2	39.0	41.20
		Av.	42.70	41.68	40.25	39.18	39.13	39.03	40.33
Afternoon	Right	1	44.9	40.3	43.0	40.0	37.5	38.1	40.63
		2	41.2	41.0	41.5	40.0	40.2	41.5	40.90
		3	46.4	41.3	42.0	41.5	41.8	38.3	41.88
		4	45.5	45.4	41.8	41.2	40.2	40.5	42.43
		Av.	44.50	42.00	42.08	40.68	39.93	39.60	41.47
Morning	Left	1	32.2	32.0	31.0	29.8	30.0	29.8	30.80
		2	32.0	30.5	29.0	29.8	29.0	26.5	29.47
		3	31.0	27.4	27.0	27.0	27.0	26.0	27.67
		4	31.2	31.5	31.2	28.8	29.8	26.8	29.88
		Av.	31.60	30.35	29.55	28.82	28.95	27.43	29.46
Afternoon	Left	1	32.9	30.7	30.5	28.3	27.3	24.1	28.97
		2	32.0	26.5	26.8	28.3	29.0	28.0	28.43
		3	32.5	29.8	29.0	27.0	28.4	23.5	29.37
		4	32.8	31.0	28.0	30.2	30.8	30.0	30.47
		Av.	32.55	29.50	28.58	28.45	28.88	27.90	29.31

DATA EXPERIMENT A

Series I

Subject III

Time	Hand	Records	T r i a l s (Rotated) (Kgs.)						Average Per Trial
			1	2	3	4	5	6	
Morning	Right	1	54.0	56.0	54.5	54.0	56.5	54.2	54.87
		2	53.9	49.5	47.0	52.6	44.0	45.0	48.67
		3	53.0	52.0	51.0	52.0	49.0	47.0	50.67
		4	56.0	56.5	53.0	56.0	54.0	55.0	55.59
		Av.	54.23	53.50	51.38	53.65	50.88	50.30	52.32
Afternoon	Right	1	45.0	48.0	50.9	48.0	47.0	47.0	47.65
		2	47.0	46.0	50.0	46.0	48.0	46.0	47.17
		3	52.5	48.5	44.5	44.1	45.1	42.0	46.12
		4	59.0	52.5	53.5	60.0	56.0	54.5	55.92
		Av.	50.88	48.75	49.73	49.53	49.03	47.38	49.22
Morning	Left	1	45.0	49.0	45.4	49.0	50.0	47.0	47.57
		2	44.0	44.5	42.5	46.5	42.0	44.5	44.00
		3	53.5	51.0	47.5	48.0	48.5	48.0	49.42
		4	54.2	45.5	46.9	50.0	50.0	45.6	48.70
		Av.	49.18	47.50	45.58	48.38	47.63	46.28	47.42
Afternoon	Left	1	46.9	48.0	47.0	46.7	44.0	46.0	46.43
		2	51.0	47.0	43.0	44.0	45.5	40.0	45.08
		3	46.2	41.0	43.0	43.0	39.5	41.0	42.28
		4	53.9	50.5	49.4	48.5	55.0	48.4	50.95
		Av.	43.50	46.63	45.60	45.55	46.00	43.85	46.19



DATA EXPERIMENT A

Series II

Subject III

Time	Hand	Records	T r i a l s (Kgs.)						Average Per Trial
			1	2	3	4	5	6	
Morning	Right	1	52.0	49.9	49.5	49.0	50.5	50.0	50.15
		2	57.0	58.5	55.1	56.5	54.1	49.0	55.33
		3	59.5	58.0	58.2	53.5	55.0	56.2	56.73
		4	59.0	56.1	56.5	53.0	52.9	53.0	55.08
		Av.	56.88	55.63	54.83	53.00	53.13	52.05	54.25
Afternoon	Right	1	59.4	53.5	56.5	52.0	50.5	52.0	53.98
		2	55.5	58.0	55.5	57.0	51.5	54.7	55.37
		3	62.0	57.5	56.0	54.0	54.0	53.9	56.23
		4	57.5	56.1	52.0	53.9	53.0	51.0	53.92
		Av.	58.60	56.28	55.00	54.23	52.25	52.90	54.88
Morning	Left	1	50.0	44.0	46.0	49.9	48.5	42.0	46.73
		2	55.5	48.9	46.5	44.0	47.5	49.0	48.57
		3	52.5	50.0	47.2	48.0	46.8	47.9	48.73
		4	58.0	53.0	48.0	53.0	52.9	50.0	52.65
		Av.	54.00	48.98	46.93	48.73	49.18	47.23	49.17
Afternoon	Left	1	51.0	48.0	50.9	43.0	45.4	46.5	47.47
		2	45.1	50.9	50.9	48.6	48.0	50.0	50.42
		3	55.5	52.0	53.5	51.8	53.1	51.6	52.92
		4	48.0	48.1	46.0	51.2	47.2	45.5	47.67
		Av.	52.16	49.75	50.33	48.65	48.43	48.40	49.62

DATA EXPERIMENT A

Series III

Subject III

Time	Hand	Recorder	T r i a l s (Kgs.)						Average Per Trial
			1	2	3	4	5	6	
Morning	Right	1	50.2	59.0	57.5	58.5	55.0	54.0	56.70
		2	63.2	64.5	59.3	58.2	57.0	55.0	59.53
		3	62.0	60.0	59.0	61.3	58.0	57.3	59.80
		4	59.0	58.5	58.2	57.0	57.0	57.1	57.32
		Av.	60.35	60.50	58.53	58.75	56.75	55.90	58.46
Afternoon	Right	1	59.0	58.8	56.0	54.0	57.0	55.0	56.63
		2	58.0	56.5	54.5	52.8	55.0	54.0	55.30
		3	58.0	58.0	58.1	57.0	56.2	55.0	57.05
		4	61.0	59.0	56.7	56.0	57.0	59.0	58.45
		Av.	59.00	58.08	56.83	55.20	56.20	55.75	56.86
Morning	Left	1	52.0	50.0	54.3	48.0	49.0	47.0	50.05
		2	51.5	51.3	54.1	54.2	55.2	52.2	52.27
		3	52.0	51.0	50.0	53.5	52.5	50.5	51.75
		4	53.5	52.0	53.0	54.0	51.5	51.0	52.50
		Av.	52.25	51.08	52.85	52.45	52.30	50.43	51.89
Afternoon	Left	1	52.5	48.0	52.5	52.0	51.0	52.5	51.58
		2	49.5	50.3	53.0	50.2	48.2	47.0	49.70
		3	52.0	50.0	50.0	48.0	50.2	50.0	50.03
		4	54.2	52.5	50.0	51.0	52.0	52.5	52.20
		Av.	52.30	50.45	51.38	50.30	50.35	50.50	50.88



DATA EXPERIMENT A

Series I

Subject IV

Time	Hand	Records	T r i a l s (Rotated)(Kgs.)						Average Per Trial
			1	2	3	4	5	6	
Morning	Right	1	30.5	29.0	30.5	27.0	31.5	30.5	29.83
		2	34.0	31.0	28.0	27.0	26.5	28.0	29.08
		3	32.8	31.2	30.3	28.5	29.5	26.8	29.85
		4	32.0	30.5	28.0	28.0	25.0	28.0	28.58
		Av.	32.33	30.43	29.20	27.63	28.13	28.33	29.34
Afternoon	Right	1	30.0	31.8	32.5	28.0	32.0	31.0	30.88
		2	30.0	30.5	27.8	30.5	30.1	38.8	31.28
		3	33.5	27.5	23.0	22.0	24.0	26.0	26.00
		4	33.0	28.5	31.0	31.0	27.0	23.0	28.92
		Av.	31.63	29.58	28.58	27.88	28.28	29.70	29.27
Morning	Left	1	26.5	24.5	25.0	23.5	21.5	22.0	23.83
		2	24.0	20.5	22.0	24.0	20.5	22.0	22.16
		3	27.0	25.0	25.0	23.1	26.8	25.0	25.32
		4	24.5	23.5	22.5	24.5	24.5	21.5	23.50
		Av.	25.50	23.38	23.63	23.78	23.33	22.63	23.70
Afternoon	Left	1	25.5	23.2	21.0	22.2	21.5	20.5	22.32
		2	26.0	24.0	25.0	23.5	24.0	23.5	24.33
		3	22.0	22.0	24.5	21.5	23.0	25.0	23.00
		4	26.5	23.5	25.0	23.0	24.8	24.0	24.47
		Av.	25.00	23.18	23.88	22.55	23.33	23.25	23.53

DATA EXPERIMENT A

Series II

Subject IV

Time	Hand	Records	T r i a l s (Kgs.)						Average Per Trial
			1	2	3	4	5	6	
Morning	Right	1	23.0	25.0	25.0	24.1	22.9	26.0	24.33
		2	35.1	32.9	31.0	31.2	28.2	29.5	31.22
		3	30.4	28.5	30.0	27.0	27.0	29.4	28.72
		4	32.4	28.0	28.9	27.9	26.2	29.5	28.82
		Av.	30.23	28.60	28.73	27.55	26.08	28.60	28.29
Afternoon	Right	1	35.0	32.6	30.1	31.1	30.5	30.0	31.55
		2	31.0	30.5	30.2	28.1	27.0	26.0	28.80
		3	29.4	30.2	28.0	28.1	26.0	31.2	28.82
		4	35.0	30.9	31.0	31.5	32.2	31.5	32.02
		Av.	32.60	31.05	29.83	29.70	28.93	29.68	30.30
Morning	Left	1	25.0	23.5	21.5	24.0	25.0	26.0	24.17
		2	28.0	27.9	25.0	25.0	23.5	23.0	25.40
		3	25.0	22.1	21.5	21.5	21.0	19.5	21.77
		4	24.9	21.0	23.5	22.1	22.1	23.2	22.80
		Av.	25.73	23.63	22.88	23.15	22.90	22.93	23.54
Afternoon	Left	1	28.9	28.0	24.4	26.0	25.1	26.2	26.43
		2	27.0	27.0	24.9	25.1	25.9	23.5	25.23
		3	28.1	23.0	23.6	24.4	25.5	24.1	24.78
		4	28.0	26.0	24.5	22.5	25.0	26.1	25.35
		Av.	28.00	26.00	24.35	24.50	24.88	24.98	25.45



DATA EXPERIMENT A

Series III

Subject IV

Time	Hand	Records	T r i a l s (Kgs.)						Average Per Trial
			1	2	3	4	5	6	
Morning	Right	1	32.7	27.0	25.2	25.5	27.2	26.0	27.27
		2	35.3	30.0	29.3	29.0	29.2	28.0	30.13
		3	34.0	31.0	29.0	28.6	26.0	29.8	29.73
		4	30.5	29.2	24.0	24.0	23.5	22.0	25.53
		Av.	33.13	29.30	26.88	26.78	26.48	26.45	28.17
Afternoon	Right	1	36.2	35.2	33.4	30.0	30.5	30.5	32.63
		2	34.0	31.2	31.2	28.8	28.8	29.5	30.58
		3	36.0	33.0	30.5	27.6	32.0	28.0	31.18
		4	33.5	30.3	31.0	31.0	27.5	27.5	30.13
		Av.	34.93	32.43	31.53	29.35	29.70	28.88	31.15
Morning	Left	1	25.8	23.8	23.9	23.5	23.5	22.5	23.83
		2	27.8	25.5	23.4	24.7	24.8	23.0	24.87
		3	28.2	26.0	24.5	24.0	23.0	23.5	24.87
		4	29.0	24.5	23.4	23.4	23.0	23.6	24.48
		Av.	27.70	24.95	23.80	23.90	23.58	23.15	24.51
Afternoon	Left	1	32.5	27.0	26.5	27.4	25.0	24.8	27.20
		2	29.5	25.0	25.5	26.0	25.6	22.0	25.60
		3	29.5	26.0	26.3	25.0	25.0	26.0	26.30
		4	28.0	26.0	24.0	24.6	24.5	23.0	25.02
		Av.	29.88	26.00	25.58	25.75	25.03	23.95	26.03

DATA EXPERIMENT A

Series I

Subject V

Time	Hand	Records	T r i a l s (Rotated) (Kgs.)						Average Per Trial
			1	2	3	4	5	6	
Morning	Right	1	41.5	41.1	39.0	38.0	37.5	37.5	39.10
		2	40.5	38.0	39.1	38.0	40.0	39.0	39.10
		3	37.6	35.5	38.2	37.1	30.5	39.2	36.35
		4	40.0	37.0	38.0	36.0	38.0	36.6	37.59
		Av.	39.90	37.90	38.57	37.27	36.50	38.07	38.04
Afternoon	Right	1	38.2	37.5	39.0	36.0	38.8	36.5	37.67
		2	40.0	40.5	37.5	39.5	40.0	39.0	39.41
		3	41.5	41.5	42.0	42.0	40.6	42.3	41.66
		4	36.5	35.0	41.0	35.2	34.5	33.9	36.01
		Av.	39.05	38.62	39.87	38.17	38.62	37.92	38.63
Morning	Left	1	37.0	36.5	37.5	35.0	36.0	34.5	36.08
		2	37.0	35.5	35.5	36.5	36.0	38.5	36.50
		3	33.5	28.6	32.0	35.0	34.5	35.8	33.23
		4	30.0	34.0	29.0	30.5	28.0	30.0	30.25
		Av.	34.38	33.65	33.50	34.25	33.60	34.70	34.02
Afternoon	Left	1	33.5	35.5	35.8	30.5	32.5	31.0	33.17
		2	35.5	33.0	33.5	38.0	34.0	36.5	35.08
		3	40.0	37.0	37.0	35.5	35.0	35.0	36.58
		4	34.5	34.8	31.9	35.0	33.9	34.0	33.67
		Av.	35.87	35.07	34.55	34.25	33.85	34.12	34.60



DATA EXPERIMENT A

Series II

Subject V

Time	Hand	Records	T r i a l s (Kgs.)						Average Per Trial
			1	2	3	4	5	6	
Morning	Right	1	34.0	33.5	32.5	33.2	29.0	23.6	31.80
		2	34.0	33.5	31.5	33.0	33.5	32.6	33.02
		3	37.0	33.0	33.0	33.0	33.0	36.0	34.17
		4	37.0	33.0	33.0	36.0	34.1	35.5	34.27
		Av.	35.50	33.25	33.25	33.80	32.40	32.43	33.32
Afternoon	Right	1	37.5	34.0	32.8	31.0	30.0	32.0	33.88
		2	34.0	37.5	38.0	36.0	34.3	35.7	36.02
		3	40.2	37.5	35.1	30.0	28.0	32.5	33.88
		4	31.2	35.5	35.9	35.0	35.5	37.0	35.02
		Av.	35.73	36.13	35.45	33.00	33.60	34.30	34.70
Morning	Left	1	25.8	18.0	23.0	23.0	27.0	23.0	23.30
		2	31.0	27.0	27.0	23.5	26.0	32.1	27.77
		3	27.0	29.0	25.0	28.0	27.0	28.0	27.33
		4	29.5	25.5	26.0	26.0	25.9	25.9	26.13
		Av.	28.33	24.88	25.25	25.13	26.48	26.75	26.15
Afternoon	Left	1	31.0	29.1	28.6	26.5	25.0	28.0	28.03
		2	33.5	29.0	30.1	27.2	28.1	30.5	29.67
		3	33.5	29.5	29.2	28.5	27.5	23.0	29.53
		4	38.8	31.5	28.0	29.0	30.1	29.0	31.06
		Av.	34.20	29.78	28.98	27.80	27.68	29.13	29.58

DATA EXPERIMENT A

Series III

Subject V

Time	Hand	Records	T r i a l s (Kgs.)						Average Per Trial
			1	2	3	4	5	6	
Morning	Right	1	39.4	38.6	37.8	38.6	37.6	38.2	38.37
		2	37.6	38.2	38.8	39.2	39.5	37.2	38.42
		3	42.6	41.9	40.0	40.6	39.5	37.5	40.35
		4	41.4	39.8	41.0	40.8	38.4	39.0	40.07
		Av.	40.25	39.63	39.40	39.80	38.75	37.98	39.30
Afternoon	Right	1	39.8	39.2	40.0	40.8	41.9	41.0	40.45
		2	46.2	44.0	41.5	40.4	40.0	41.0	42.18
		3	41.0	39.0	39.0	38.6	38.9	34.9	38.57
		4	42.0	42.0	38.0	39.5	38.8	39.0	39.88
		Av.	42.25	41.05	39.63	39.83	39.90	38.98	40.27
Morning	Left	1	33.9	34.0	31.8	31.3	30.6	32.8	32.40
		2	35.3	37.2	36.4	35.8	33.6	32.8	35.18
		3	35.5	37.0	39.0	35.0	36.2	37.7	36.73
		4	40.0	41.0	38.0	37.4	38.0	37.0	38.57
		Av.	36.18	37.30	36.30	34.88	34.60	35.08	35.72
Afternoon	Left	1	35.2	41.5	36.0	35.0	36.8	31.0	35.92
		2	36.0	32.4	37.1	37.8	37.0	35.2	35.92
		3	36.6	35.0	36.8	35.8	36.0	36.5	36.12
		4	41.2	41.0	37.2	38.2	37.0	37.0	38.60
		Av.	37.25	37.47	36.78	36.70	36.70	34.93	36.64



DATA EXPERIMENT A

Series I

Subject VI

Time	Hand	Records	T r i a l s (Rotated) (Kgs.)						Average Per Trial
			1	2	3	4	5	6	
Morning	Right	1	48.5	47.5	46.5	47.5	46.0	43.5	46.58
		2	49.5	49.0	41.8	46.0	40.0	41.5	44.63
		3	47.8	43.5	39.0	42.5	49.5	41.9	44.03
		4	56.0	55.2	51.0	51.0	51.8	55.0	53.33
		Av.	50.45	48.80	44.58	46.75	46.83	45.48	47.15
Afternoon	Right	1	54.0	50.5	49.0	49.5	44.0	49.0	49.33
		2	56.0	53.5	49.0	50.5	48.0	46.9	50.65
		3	61.5	55.2	53.0	52.0	54.5	53.2	54.90
		4	59.0	56.0	53.5	56.7	53.5	57.9	56.10
		Av.	57.63	53.80	51.13	52.18	50.00	51.75	52.75
Morning	Left	1	44.6	40.0	37.0	37.0	39.0	35.5	38.85
		2	46.0	39.0	37.0	39.9	36.5	38.0	39.40
		3	39.2	38.0	36.4	36.0	37.0	36.5	37.18
		4	48.5	44.0	43.0	43.0	45.5	43.2	44.53
		Av.	44.58	40.25	38.35	38.98	39.50	38.30	39.99
Afternoon	Left	1	48.0	46.0	46.5	44.0	46.0	47.0	46.25
		2	44.2	39.0	42.0	41.0	44.1	40.1	41.73
		3	67.0	54.0	49.5	46.2	49.0	48.5	52.37
		4	48.0	47.0	48.8	45.5	46.0	48.0	47.22
		Av.	51.80	46.50	46.70	44.18	46.28	45.90	46.89

DATA EXPERIMENT A

Series II

Subject VI

Time	Hand	Records	T r i a l s (Kgs.)						Average Per Trial
			1	2	3	4	5	6	
Morning	Right	1	59.1	41.5	45.0	45.8	44.5	44.5	46.73
		2	43.0	42.1	38.1	40.5	40.9	42.8	41.23
		3	56.1	51.2	50.2	48.9	48.1	47.9	50.40
		4	54.7	57.0	54.9	50.8	50.5	49.2	52.85
		Av.	53.23	47.95	47.05	46.50	46.00	46.10	47.80
Afternoon	Right	1	50.5	46.5	44.0	40.0	41.2	42.5	44.12
		2	58.5	49.9	49.8	48.8	52.2	53.0	52.03
		3	59.9	58.5	52.5	53.9	58.5	54.1	56.23
		4	56.0	51.5	50.5	48.5	49.0	52.0	51.25
		Av.	56.23	51.60	49.20	47.80	50.23	50.40	50.91
Morning	Left	1	44.4	39.0	39.5	40.0	37.8	37.8	39.75
		2	42.1	38.8	37.2	38.9	38.0	38.9	38.98
		3	46.1	44.1	43.0	43.1	44.4	42.5	43.87
		4	50.5	40.0	43.5	42.6	41.9	42.1	43.43
		Av.	45.78	40.48	40.80	41.15	40.53	40.33	41.51
Afternoon	Left	1	39.0	35.0	35.5	34.2	35.5	32.5	35.28
		2	50.0	50.0	46.1	46.2	46.1	44.0	47.07
		3	53.8	48.5	48.1	47.5	46.2	47.0	48.52
		4	48.0	45.0	46.0	43.0	42.0	41.5	44.25
		Av.	47.70	44.63	43.93	42.73	42.45	41.25	43.78



DATA EXPERIMENT A

Series III

Subject VI

Time	Hand	Records	T r i a l s (Kgs.)						Average Per Trial
			1	2	3	4	5	6	
Morning	Right	1	57.0	51.5	51.5	50.0	47.5	49.0	51.08
		2	60.0	56.0	55.0	52.6	51.2	53.0	54.63
		3	53.0	51.0	50.6	49.0	50.0	49.0	50.43
		4	58.5	55.0	56.0	55.0	53.5	50.5	54.75
		Av.	57.13	53.38	53.28	51.65	50.55	50.38	52.72
Afternoon	Right	1	62.4	59.0	57.6	56.0	57.0	56.5	58.08
		2	61.5	57.5	52.0	53.0	54.0	52.5	55.08
		3	67.0	64.0	61.5	61.5	57.5	59.0	61.75
		4	62.0	56.5	58.0	56.0	57.6	57.0	57.85
		Av.	63.23	59.25	57.28	56.63	56.53	56.25	58.19
Morning	Left	1	46.0	44.0	42.0	46.0	53.0	55.5	48.58
		2	51.0	49.0	48.5	48.0	48.5	50.0	49.17
		3	49.0	49.0	48.0	47.0	46.0	46.3	47.55
		4	50.0	50.0	48.0	48.0	47.5	46.0	48.25
		Av.	49.00	48.00	46.63	47.25	50.00	49.45	48.39
Afternoon	Left	1	61.0	50.0	53.0	49.0	49.0	56.5	53.08
		2	54.0	50.0	48.0	52.0	50.5	51.0	50.92
		3	55.0	52.5	50.0	54.0	52.5	52.0	52.67
		4	56.5	53.4	50.0	49.7	51.0	50.0	51.77
		Av.	56.63	51.48	50.25	51.18	50.75	52.38	52.11

DATA EXPERIMENT B

HYPNOTIC STATE

Subject I

Time	Hand	Records	T r i a l s (Kgs.)						Average Per Trial
			1	2	3	4	5	6	
Morning	Right	1	50.5	51.0	50.5	47.0	52.2	46.5	49.62
		2	51.0	51.0	50.5	51.0	50.0	49.5	50.50
		3	54.0	51.9	48.5	49.0	51.0	49.1	50.58
		4	56.2	55.0	52.0	54.0	50.0	52.5	53.28
		Av.	52.93	52.20	50.38	50.25	50.80	49.40	50.99
Afternoon	Right	1	53.0	52.0	47.0	53.0	53.2	52.0	51.70
		2	55.0	52.5	52.0	52.9	50.9	53.0	52.72
		3	53.5	51.5	47.0	45.8	47.5	47.0	48.72
		4	50.5	49.3	46.5	46.0	44.0	45.0	46.84
		Av.	53.00	51.33	48.13	49.43	48.90	49.25	50.00
Morning	Left	1	51.0	49.9	45.0	48.1	45.1	48.0	47.85
		2	50.1	53.0	47.0	54.0	49.0	49.0	50.35
		3	52.0	45.5	44.0	46.0	46.5	46.0	46.67
		4	50.0	49.0	46.0	44.0	47.0	47.0	47.17
		Av.	50.78	49.35	45.50	48.03	46.90	47.50	48.01
Afternoon	Left	1	53.5	51.5	48.0	45.0	47.5	40.0	47.58
		2	53.0	50.6	45.0	52.1	47.3	46.0	49.00
		3	42.0	44.5	44.0	45.0	47.0	47.0	44.92
		4	49.0	49.0	47.0	45.0	46.0	52.0	48.00
		Av.	49.38	48.90	46.00	46.78	46.95	46.25	47.38



DATA EXPERIMENT B

WAKING STATE

Subject I

Time	Hand	Records	T r i a l s (Kgs.)						Average Per Trial
			1	2	3	4	5	6	
Morning	Right	1	52.8	53.0	52.2	48.7	50.0	45.0	50.28
		2	53.0	54.0	52.1	50.5	53.8	52.9	52.72
		3	53.5	51.5	48.0	47.0	50.0	49.2	49.87
		4	58.9	57.9	54.0	54.0	52.0	56.0	55.47
		Av.	54.55	54.10	51.58	50.05	51.45	50.78	52.09
Afternoon	Right	1	52.0	53.8	51.0	51.1	51.1	48.4	51.23
		2	56.0	54.5	54.0	56.5	57.0	52.0	55.00
		3	50.0	47.5	44.0	46.0	46.0	43.5	46.17
		4	49.5	51.5	47.0	46.2	46.0	53.0	48.87
		Av.	51.88	51.83	49.00	49.95	50.00	49.20	50.31
Morning	Left	1	51.0	49.5	49.0	47.0	43.4	44.0	47.32
		2	50.8	50.0	50.6	50.4	49.0	47.5	49.72
		3	49.0	47.0	45.0	45.0	44.5	43.5	45.67
		4	50.5	46.2	49.0	47.0	44.4	50.5	47.93
		Av.	50.33	48.18	48.40	47.35	45.33	46.38	47.66
Afternoon	Left	1	52.5	50.0	45.5	47.0	46.9	47.5	48.23
		2	50.0	48.0	50.0	48.0	47.0	48.5	48.58
		3	51.0	48.0	43.0	45.0	46.0	45.1	46.35
		4	50.0	46.5	47.0	47.8	46.0	48.0	47.55
		Av.	50.88	48.13	46.38	46.95	46.48	47.28	47.68

DATA EXPERIMENT C

Subject I

Part	Trials: Right Hand						Trials: Left Hand						Av.
	1	2	3	4	5	6	1	2	3	4	5	6	
I	54.0	52.5	52.2	56.0	55.0	52.4	51.9	47.2	47.0	53.9	45.6	48.0	48.93
II	58.0	55.0	53.0	55.0	52.8	55.0	50.5	50.0	47.4	48.9	48.8	48.9	49.08
III	56.5	52.5	51.0	54.5	52.0	52.5	47.8	46.5	45.8	44.0	43.9	45.0	45.50
IV	56.0	53.0	52.0	54.8	56.0	55.2	50.0	49.2	51.0	49.5	48.3	49.2	49.50

Subject VII

I	30.5	33.9	32.9	35.0	31.5	31.0	24.0	25.1	24.9	22.0	25.0	26.0	24.50
II	33.5	31.0	33.5	30.0	31.0	29.8	24.5	24.0	25.5	25.0	20.5	24.0	23.90
III	32.0	31.5	31.0	32.0	30.4	33.0	28.0	25.5	27.0	24.8	25.0	21.5	25.30
IV	35.8	33.0	35.0	32.0	33.0	32.5	26.5	23.0	22.0	25.0	23.0	25.5	24.20

Subject VIII

I	36.0	34.0	34.5	32.0	33.9	30.0	30.5	31.5	30.2	30.1	29.5	29.1	30.15
II	32.0	32.5	31.0	30.0	30.5	23.0	31.0	29.5	29.0	27.0	27.5	29.0	28.80
III	34.0	30.0	30.0	26.0	27.0	28.0	26.0	31.0	27.5	27.0	28.0	27.0	27.75
IV	34.0	30.0	31.1	31.0	31.0	28.7	31.2	32.7	31.0	29.6	28.9	29.9	30.55



Approved by:

FM Glick

Wm. C. Suetway

Rollin H. Barrett

Graduate Committee.

Date June 8, 1938





