Effect of set on the estimation of time

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THE EFFECT OF SET
ON THE ESTIMATION OF TIME

by

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B.A., Carroll College, 1938

Presented in partial fulfillment
of the requirements for the degree of
Master of Arts

MONTANA STATE UNIVERSITY
1954

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Date
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CHAPTER I

HISTORICAL BACKGROUND

Although it is known that people commonly have had the experience of feeling a period of time to have been longer or shorter than was actually the case, and although it is also generally believed that conditions motivating an individual have some influence on his judgement of duration of any given period, there has been very little experimental study of the relationship between motivation and perception of time. In fact, major theories of time perception, none of which has general acceptance, do not stress motivational conditions and their influence on temporal perception.

The question of how motivating conditions in relation to estimation of time fit into the structure of general theories of time perception, which at present form two principal classes, those emphasizing physiological factors, and those dealing with complexity of mental states during an interval, is interesting and important but as yet unanswered.

In this chapter is presented a review of several representative investigations which directly or indirectly give evidence of a relationship between motivation and time estimation, and in succeeding chapters the writer
will present a report of his own study pertaining to this problem.

The first investigation to be summarized is that of Filer and Meals\(^1\), mainly because it served as the inspiration, and to a certain extent, the model, for the writer's own experimental work.

Filer and Meals decided to test the hypothesis that subjects who are motivated to have time pass will estimate a given period of time to be of longer duration than will subjects who are not so motivated.

They designed two experiments in which it was believed that subjects would desire a stated period of time to pass, and a control in which it was believed there would be no particular motivation for wanting the quick passage of a stated time interval.

In planning the first experimental procedure, it was assumed that college students liked to get out of class early and would desire the end of a task which had a time limit and which hindered them from leaving class. In the second experimental procedure it was assumed that if subjects believed they had a good chance of obtaining a prize at the end of a period of time they would desire that time to pass. Because subjects were given the impression that the task they were asked to perform could be completed by many individuals in the time allowed, they would want

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the time interval to pass quickly because they would be
likely to associate the awarding of a prize with the end
of the time period. In the control procedure no special
motivation in the way of a goal at the end of the time inter-
val was given the subjects.

Experimental group I was made up of three under-
graduate psychology classes, comprising a total of 67 sub-
jects. Classes were asked to cooperate in a short experi-
ment, were given paper 8 by 11½ inches in size, and had
read to them the following instructions:

You are now to perform a ten minute task. When
you have finished, you will be able to leave for the
day. On the sheet of paper provided you are to
write down as many words as you can think of using
alternate letters of the alphabet, beginning with A,
as the first letter of the words. That is, you may
use A, C, E, G, etc. as the first letter but not B, D, F,
etc. Write as many words as you can think of be-
ginning with A. When you have written all the words
you can think of beginning with A go on to C. When
you have finished with one letter, skip a letter and
go on to the next. You may use proper names. Are
there any questions? This is a ten-minute task.
You will start when I say "Go". As soon as you have
finished you will be through for the day.

After four minutes and 37 seconds subjects were told
to stop working as follows:

Stop! Everyone stop working! Do not look at
your watches. On the back of your paper in the
lower right hand corner estimate the amount of
time you have been working at this task, that is,
time from the signal go, until you were
stopped. The task was not actually ten minutes
in length. Indicate your estimated time in min-
utes and seconds. If you have looked at your
watch at any time after you started until now,
please, make a note of it beside the time estimate.

1 Ibid. p. 328
2 Ibid. p. 328
Experimental group II consisted of 71 subjects from two mixed classes, who were each given a sheet of paper measuring 8 by 11 3/4 inches in size and to whom the following instructions were read:

We are going to ask you to do a ten minute task for which you can win a prize. It has been found that many people can do this task. This is actually a contest against time. Each of you who wins will receive a box of candy exactly like this one. (A box of chocolates was shown to the group.) You are to perform a ten minute task. On the sheet of paper provided you are to write down as many words as you can think of using alternate letters of the alphabet beginning with A as the first letter but not B, D, F. Write as many words as you can think of beginning with A. When you have written all the words you can think of beginning with A go on to C. After you have finished with one letter skip a letter and go on to the next. You may use proper names. Each of you who succeeds in writing 150 words or more within this ten minute period will receive a one pound box of Whitman's chocolates. Are there any questions? 

After 4 minutes and 37 seconds, the Ss were requested to cease working as follows:

Stop! Everyone stop for just a moment. Do not look at your watches. In the upper right hand corner of your paper write your estimate of the amount of time you have been working at this task. That is, the time from the signal begin until you were stopped. The task was not actually ten minutes in length. Indicate the estimated time in minutes and seconds. If you have looked at your watch at any time after you started until now, please, make a note of it beside the time estimate.

After the Ss had made their estimates they were asked to write their name and sex on the paper, and were informed that as they were not allowed to complete the task, the person who wrote the largest number of words would be awarded the

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Ibid., p. 328

Ibid., p. 328
box of candy.

For the control group, there were sixty undergraduates, 31 women and 29 men. They were given instructions similar to those given to experimental group I, except that they were told they would go on with the class work at the completion of the task. The task was administered at the beginning of the class session, the subjects were interrupted after 4 minutes and 37 seconds, and asked to estimate the time they had been working.

Results showed a mean time estimate of 290.2 seconds and sigma of 108.3 seconds for the control group, a mean time estimate of 326.5 seconds and sigma of 77.2 seconds for experimental group I, and a mean time estimate of 330.5 seconds and sigma of 126.1 seconds for experimental group II. Statistical study revealed significant differences between the control group and each of the experimental groups.

The writers suggested as a tentative explanation of the observations that the attractiveness of a goal affects the psychological distance to the goal.

Another experiment, that of Hindle\(^1\), had as its purpose the study of the dependence of estimates of time spent at an activity upon the distance traveled in the activity (as measured by the score attained) and upon the relative clarity of the goal of the activity. The two hypotheses tested by the experiment were that there is an interaction

\(^{1}\) Hindle, Helen Morris, "Time Estimates as a Function of Distance Traveled and Relative Clarity of a Goal." J. Personal., 1951, 19, 483-501.
between these variables in estimating time intervals late, in an activity, but not in the early portion.

Ninety-six women, college undergraduates, took part in the experiment which required giving estimates of time spent on five tasks consisting of number, serial association, finger dexterity, bi-manual, and card sorting tests. Three tasks required about one and a half minutes for completion, and two required four to five minutes for completion. Low and high scores were predetermined for each task as points at which subjects would be interrupted and asked for a time estimate. For some tasks, subjects would be informed at the start the score they were expected to achieve, while for others no mention of goal would be made. For all tasks but card sorting the low and high score points both occupied past the point midway to the goal while for card sorting the low and high scores decided upon were less than half way to the goal.

Analysis of results showed significant interaction between score and goal clarity for all tasks except card sorting, thus supporting the hypotheses. Statistical study also revealed significant differences between estimated and actual times for all five tasks.

The suggestion was made that the factor of perceived rate of progress may have made the principal difference in time perception between goal and no-goal groups.

To discover how situations which are unlike in character influence perception of time, an experiment was
designed by Gulliksen in which 326 students forming eight groups of 36 to 45 each were asked to estimate the length of each of eight periods during which they engaged in eight different types of activity. Two hundred seconds was the actual length of each period. The eight situations included 1) rest, with eyes closed and heads laying on arms, 2) listening to a rapidly beating metronome, 3) listening to a slowly beating metronome, 4) working problems in long division, 5) following simple directions read from cards by means of mirrors, 6) enduring pain resulting from pressure of heel of palm on small point in board, 7) holding arms extended to the sides with palms upward, 8) writing from dictation.

The results for all subjects, ranked according to magnitude of mean estimates from least to greatest, with means and sigmas in seconds are, 1) division 168.9, 70.2; 2) dictation 174.6, 77.4; 3) mirror 181.8, 77.6; 4) pain 210.2, 78.4; 5) rapid metronome 214.1, 85.2; 6) slow metronome 223.7, 92.4; 7) fatigue 228.4, 96.2; 8) rest 241.7, 107.8.

Statistical study revealed that, although factors such as position of a situation in the series, or general average of a section of subjects, might have had some effect on results, the greatest influence was from the situations themselves.

Comparison of means of men and women showed that the women tended to estimate the periods of time as longer than did the men, but use of the Pearson co-efficient of variability showed no general tendency in any direction on

account of sex differences.

A frequently cited experiment in the field of temporal perception is the study of Rosenzweig and Koht of the effect of need-tension upon the experience of temporal duration. The term need-tension is explained to mean a state of strain, accompanied sometimes by emotional excitement, that results whenever any need (equivalent on the conscious level to desire) is aroused.

The writers describe their treatment of this problem of temporal perception as preliminary in character with the results showing the likelihood of a significant relation between the presence of need-tension and the experience of duration. They use the term intermediate time lengths, or periods ranging from about a minute to about an hour, and believe these intervals are observed neither directly nor through much mediation of memory and other complex processes. The intermediate time lengths actually used in their experiments ranged from one to ten minutes, and were filled with activity conforming reasonably to everyday experience.

During two periods of the same objective duration, the subjects were asked to work on jigsaw puzzles, which, although they looked easy, were really unsolvable. The difference in the two periods was brought about by the instructions, according to which the first puzzle was attempted for practice while the second puzzle was part of a test. It was intended that there be greater need-tension in the second

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than in the first period.

The procedure generally followed included seating the subject at a table on which there was a completed four piece puzzle. The experimenter then asked the subject if he had ever done that sort of puzzle, and if he had heard anything of the tests done at the laboratory, saying further that an intelligence test involving such puzzles would be given the subject. The experimenter would announce a pretext for leaving the room for awhile, offer the subject an unsolvable puzzle for practice, and go to an adjoining room to observe and record the subject's behavior, returning after a predetermined period of time, and asking the subject "How long would you estimate that I was gone?" The experimenter would then tell the subject it was time for the test, which was to be an intelligence test consisting of puzzles to solve, and that the work should be done rapidly for each puzzle was allotted a specified time within which it was to be solved or the subject would be stopped.

The subject would then be given an unsolvable puzzle to work on, with the experimenter making obvious use of a stop watch. The experimenter would also make notes of the subject's behavior, and at the end of a period of time equal to that allowed for the practice puzzle, he would call time and ask the subject to estimate how long he had worked on that puzzle. If the subject gave the same time estimate as for the previous period he would be asked whether one or the other period had seemed longer. The subject would next be asked to describe
In writing his feelings and emotions during the time spent in the room, especially with regard to the passing of time. In some cases, some supplementary questions were asked.

The experiments were grouped in two series: A, and B1 and B2.

The 89 subjects gave 176 estimates, one subject being unable to make up his mind about the required estimates. Compared with the actual time in each case, 74 periods were overestimated, 33 were accurately estimated, and 69 were underestimated. The writers believe chance played an important part in the large number of correct estimates because of preference for numbers with the end digit zero or five. Since the emphasis in this experiment was on the relation between the two estimates given by each subject under different degrees of tension, because of the probability the second period was estimated in comparison with the first, and because the relation of the two estimates may have been made with reference to a common standard, the tendency toward estimating in round numbers was not considered of great importance.

A study of estimates grouped according to whether the actual times were 1) from one to three minutes, 2) from four to seven minutes, or 3) from eight to ten minutes, indicated that overestimations tended to diminish as the objective time interval increased and that underestimations tended to increase as the objective time interval increased. The many correct estimates in the group of series A where
actual times were from four to seven minutes and in series B where the period was likely due to the inclination to use round numbers.

Analysis of results revealed that sex differences or membership in a psychology class had no significant influence upon results.

A comparison of the two estimates by each subject showed that in series A, 29 subjects estimated the first period as longer, four estimated the two periods as equal, and nineteen estimated the first period as shorter, while in series B, 22 subjects estimated the first period as longer, none estimated the two periods as equal, and fourteen estimated the first period as shorter. This pointed to a tendency for the practice period to be estimated as the longer.

Observation of subjects' behavior during, and their verbal reports immediately after the experiment gave interesting qualitative results. Typical attitudes seemed to be: 1) boredom, 2) interest, eagerness, hopefulness, 3) despair. In general, when boredom or despair was the prominent feeling, especially if either increased during a period, the time tended to be estimated as longer than when eagerness, interest, and hopefulness were dominant.

The writers referred to possible shortcomings in their experiment which would have to be eliminated from future investigations. These were: 1) the fact that unsolvable puzzles created suspicion which may have interfered with the study, 2) the giving of the same puzzle in the same period,
(3) the constant difference between the two periods brought about by having the subject alone during the first and with experimenter during the second, (4) the constant difference arising from the order of the practice and test periods, (5) the possible difference resulting from having some subjects tell how long time seemed to be instead of having him estimate, (6) the difference between indirect (numerical) and direct comparison of the lengths of the two periods.

Theoretical considerations offered were suggested as developing from but not necessarily dependent on the experimental data. These considerations are: (1) when attention is focussed on a task, time seems rather short, while if attention is given to the passing of time itself, duration seems comparatively longer, (2) time empty of activity seems longer than time filled, (3) time pleasantly filled has been said to seem shorter than time unpleasantly filled, but when a need is felt the pleasantness or unpleasantness of an experience is probably affected by the need, (4) comparatively speaking, duration seems long when we want it to be short and short when we want it to be long, in other words, need-attitude seems to be a factor in judgment of duration.

Also concerned with time estimation is Harton's report of three attempts to vary the time judgments of

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individuals by varying their activities in listening to the beats of the metronome.

The first experiment attempted to determine the effect a mere change in rate of beats would have on the subjects' estimation of time, with nineteen undergraduate men students taking part.

The procedure of this experiment included a norm period of 47 seconds during which the subject counted one hundred beats of a metronome, the beats occurring at the rate of 126 per minute. The experimenter then instructed the subject that the next time the metronome would beat at a slower rate, and that he should count the beats until he believed he had counted for as long a period of time as it had required for him to count to one hundred, saying "Now" aloud as a signal that he had counted as long a time as before.

After the duration of the subjects' first trial period had been recorded, another norm period would then be gone through, and instructions for a second reproduction period would be given like those for the first except that subjects would be told that the metronome would beat faster in the second period.

Results showed that eighteen of the subjects allowed the metronome to run longer at the fast rate than at the slow rate, showing a proportion which is statistically reliable.

Seventeen reported using the rate of beats as a basis for deciding how many to count, and sixteen of these stated they adjusted their stopping point after counting awhile by their feelings as to whether the proper amount of time had
passed. Two reported not using the rate of beats at all in judging the duration of the periods.

Most subjects declared it was more difficult to count at the fast rather than the slow rate.

As a result of this first experiment, two experiments were planned to test the hypothesis that periods of time spent at difficult tasks are estimated less than equal periods spent at less difficult tasks, if it could be arranged so that under one set of conditions the fast rate would be more difficult (as above) and under another set of conditions so that the slow rate would be more difficult.

In the first experiment of the two, called by the author the metronome hearing experiment, the subjects, 33 undergraduate students, were told to listen to the beats of the metronome with eyes closed, and say the nonsense rhyme, "eeeh, meena, mina, mo", so that the syllables of the nonsense rhyme would synchronize with the beats of the metronome. The subjects were instructed not to count beats, or repetitions of the rhyme in either norm or reproduction periods, but to depend only on how they felt about the lapse of time in giving their judgments.

The saying of the nonsense rhyme was expected to be more difficult at the fast rather than the slow rate.

After his judgments on lapse of time were recorded, each subject was asked whether the slow or fast beats were the more difficult to keep up with, and whether he had used counting or other means to determine when to say, "Now."
Twenty-eight subjects said that it had been more difficult to keep up with the fast beats; five said the slow beats were more difficult to keep up with.

The analysis of the results showed that sixty-two percent of the judgments are less at fast rates than at slow rates, when no account is taken of difficulty, but when consideration is given to results on the basis of difficulty, as corrected by subjects' retrospections, it turns out that seventy-five percent of the judgments are smaller for intervals of greater difficulty.

Each subject gave two pairs of judgments, each pair consisting of judgments of time lapse at the slow and at the fast rates. When the ratios of each subject for each pair of judgments were averaged it was found that twenty-nine, or eighty-eight percent, had ratios showing smaller judgment for periods they thought were more difficult, and four subjects, or twelve percent, who gave judgments of less for the easy periods. This is a reliable proportion.

The five people who declared the slow rate the more difficult consistently judged the time to be less at the slow rate.

Because of the arrangement of this experiment, there were seventy-two instances where judgments of like periods followed in succession. A comparison of relations between difficult–easy judgments and relations between judgments of like periods showed a reliably greater difference in judgments between the difficult and easy periods than the
difference shown between periods of like activity.

The average judgment for periods of difficult activity was 56.2 seconds, and for periods of easy activity, 45.5 seconds.

In the metronome rhythm experiment the subjects were to listen to the metronome beating in groups of three and state when they believed the reproduction period was equal to the norm period. The rate of beats of the metronome for both the norm and fast persons was the same, 126 beats a minute, with a few exceptions, and for the period of reproduction at the slow rate, the metronome beat 40 times a minute.

There was variation in the order in which subjects listened to the reproduction periods, but twenty-two of the thirty-three subjects had the order: norm-fast, norm-fast, norm-slow, norm-slow, norm-fast. The very first reproduction period was not paired with any other as part of the effort to control factors associated with position.

The general procedure in this experiment was very much like that of the metronome hearing experiment. It was believed, however, that hearing beats of the metronome in groups of three would be more difficult at the slow rate.

The results of the judgments of time showed that of sixty-six pairs of judgments the period at the slow rate was estimated less than the period at the fast rate sixty times, the same as the fast rate once, and greater than the fast rate five times. This result shows a reliably greater
proportion of smaller judgments at the slow rate.

In this experiment there were sixty-nine instances in which judgments of like periods followed in succession. A comparison made of relations between difficult-easy judgments with relations between judgments of like periods show that reliably greater differences existed between the contrasting periods than existed between the periods of like activity.

The average of judgments for the periods at the fast rate came to 46 seconds, and for the slow rate it totaled 6 seconds.

Subjects themselves declared the activity was more difficult at the fast rather than slow rate. The findings based on their judgments showed time seemed less to them at the slow rate of the metronome. The results of this experiment conform to the results of the preceding experiment, both indicating that difficulty of activity during the periods is the variable between them affecting estimation of time.

Because an earlier study of the effect of temporal proximity upon children's preferences for objects indicated that, in general, the subjects tended to show preference for an object which they were to receive right away, over an object which they wouldn't receive until an interval of ten minutes or one week had passed, Irwin, Orchinik, and Weiss.

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set up a procedure to determine if similar results would occur with adults. In addition to studying adults' preferences for objects as affected by temporal proximity, a study was made of the effect of temporal proximity upon preferences between two tasks.

In experiment I-A, 64 students at the University of Pennsylvania, serving as volunteers, were seen individually and asked if he would take two tests, one at that time and the other a week later. After the test the experimenter showed two postcard reproductions of famous paintings in color and said:

To show you we appreciate your effort we are giving you these two fine prints of famous paintings. You may have this one now (indicating one print), and I will mail this one to you next week. (Then casually) By the way, which picture do you like better? Why?

Pictures were used unequal numbers of times, but each picture was given immediately in half its instances, and deferred in the other half. A careful effort was made too, to match the pictures with regard to esthetic value, similarity of content, and period.

The results were similar to those found in the experiment with children. Of the 64 subjects, 41 expressed a preference for the picture which was to be received immediately, and 23 stated preference for the picture which was to be received a week later. Six of the ten pictures used were preferred more often when deferred than when immediate.

Although the results indicate the influence of the temporal factor on the statements of preference, none of the

\footnote{Ibid., p. 460}
subjects mentioned it as a reason for his choice.

Experiment I-B was designed as an attempt to confirm the results of experiment I-A. Forty women students of the University of Pennsylvania volunteered as subjects. Seen individually, they were offered black and white postcard prints as rewards for performing a simple code-writing and deciphering task. After each subject completed the task, the experimenter would say:

That's all there is to the test. Thank you very much. (The experimenter handed the students two pictures.) It's so hard to get subjects for our experiments that we would like to show our appreciation in some way. Here are a couple of prints of famous paintings which I would like to give to you. This one (indicating one of the prints) you can have now. The other one is the only copy I have like it, and I'm afraid I'll have to wait a week until I can get some more in order to give you one. So, you'll get this one now and that one in a week. (There ensued a brief conversation, during which the experimenter asked casually.) Which one do you like better? Why do you like that one better? 1

Only those stating a preference were considered, and, of these, 25 declared a preference for the immediate reward, and 11 expressed a preference for the deferred reward. Because the chi-square test showed no significant difference in the results of the two experiments, they were combined and the P-value\(^2\) for the departure from symmetrical distribution which occurred was greater than 0.01.

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1 Ibid., p. 461

2 The probability of obtaining chance distribution as poor as or worse than the one obtained from observed data.
Of the fourteen pictures used in this experiment ten were preferred more often when immediately offered than when deferred, four were preferred equal numbers of times under the two conditions, and none was preferred oftener when its presentation was deferred rather than immediate.

Subjects gave reasons for their preferences which were similar to those given by subjects in experiment I-A. Three of the subjects merely indicated they were satisfied with the picture they were being given right away.

From a consideration of the results of the two experimental procedures it seemed that the variable of temporal proximity was as effective with college students as it had been with the children. The writers stated that if the time interval is considered a barrier, the results would be interpreted as in contrast to Wright's conclusion that the interposition of a barrier increases a positive valence, or that on the other hand, the possibility that what Wright called contingent properties, associated with the time-intervals, were decisive, should not be excluded.

For experiment II, 61 of the 64 subjects of experiment I-A were used, and the procedure included the portion of experiment I-A before the offering of the rewards. The following instructions were given:

As is customary in psychological investigation, we are unable to discuss the purpose of this experiment until after its completion. You are required to take two tests, one to test your ability to learn mental arithmetic, and the second to test your ability to learn nonsense syllables. You are required to take the test on one of the two now. Next week you will
be required to take the test on the other. By the way, which test do you like better? Why? 1

Twenty-nine of the subjects stated they liked the test to be given immediately better while 32 declared a preference for the deferred test. This difference does not have statistical significance, a result which indicates no influence of the temporal variable on the preference, and may be an outcome of a difference in the set of subjects who compared rewards they would receive, and who compared activities which, although leading to goals, did not function as rewards.

A study of interest here because it involves an aspect of psychological distance is one done by Crutchfield 2 in which he studied psychological distance as a function of psychological need. The investigation was an attempt to find an answer to the question whether the magnitude of a psychological distance to a goal is directly influenced by the intensity of need which is directing behavior toward this goal. The experiments were mainly concerned with the energy-expenditure, or work dimension of psychological distance, and were carried out with the use of rats whose hunger need was varied in a distance-discrimination problem.

The apparatus for the first experiment consisted of an elevated main runway 15' long and 3.5' wide, having ten short side paths, 9' long, at right angles to the main

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1 Ibid., p. 461
2 Crutchfield, R.S., "Psychological Distance as a Function of Psychological Need." J. Comp. Psychol. 1939,28 447-469.
runway, at intervals of one foot along it. A similar short path led from a starting platform to the main runway. A foot to the left of the starting path and a foot beyond the tenth side path were blocks on the main runway. All side paths were blinds except for number six which had a continuation of its path leading to a food platform. The effective length of the runway was eleven feet, with the extra four feet allowing for varying the location of the side-paths. The path leading to the food platform was always six feet from the starting point.

The problem for the rat was to discriminate a distance of six feet along the runway. He would run from the starting point by way of the main runway until making the correct turn and eat for fifteen seconds to complete each trial.

To eliminate visual cues, blind rats were used, and to disturb olfactory or tactual cues the side paths were shifted in random fashion and the whole pattern of side paths was shifted along the main runway between trials.

There were sixty-one days of training trials for the twenty rats used in the experiment during which hunger need was maintained at a constant level. The behavior of the rats during the last five days of this training period was used as a basis of comparison with the next six days of test trials during which the hunger need of the rats was varied.
In handling the results of the experiment, the measure used as an index of the rats' psychological distance was the distance the rats traveled from the starting point to their first turns into a side path.

The average distance traveled by the rats, from starting point to first turn, in 500 trials during the last five days of training, was 4.90', with a standard deviation of 1.18', indicative of a high level of distance discrimination.

Because the results might not really demonstrate distance discrimination if it could be shown that the rats made the turns in relation to a general location on the runway or to general orientation in the environment of the room the data for the 500 trials were divided into sets of 100 each, corresponding to the five different locations along the main runway of the entire arrangement of bypaths and analyzed to see if there were significant variations in the five distributions. It was found that the distributions were very much alike, the means being 5.05, 4.84, 5.00, 4.81, 4.79 with the respective standard deviations being 1.18, 1.18, 1.29, 1.15, 1.10. The lack of significant variation in the data revealed that the factor of spatial orientation did not contribute to the discrimination of distance.

The possible explanation that the animals responded with respect to the number of turns was countered by evidence from a preliminary experiment wherein it was found that changes made in the number of side paths did not bring
about impairment of the distance discrimination.

The suggestion that the time interval from starting point to first turn might be the basis for the discrimination was not acceptable, as evidenced by the data which showed that very small variations in distance traveled by a given animal was accompanied by wide variations in the time of running.

Following the five days of training trials, there were six days of test trials in which hunger need was varied by increases and decreases from the regular twenty-four hour level. There was also one day of training trials subsequent to the test trials. The only difference between training and test trials was the change in the intensity of the hunger need. The twenty rats were divided into two groups of ten each for the test trials to permit of comparisons.

A comparison of distributions of first turns under conditions of 48 hour, 24 hour, and 12 hour intensities of need show means of 5.61, 4.90, and 4.01 respectively. The distributions are similar, with the main difference being the level on the scale of distance according to intensity of need.

The results show a clear influence of intensity of psychological need on magnitude of psychological distance, the distance traveled up to the first turn.

Since small variations in the rate of running along a straight runway might have caused an animal to overrun or to under-run an expected turn it was decided to devise
a second experiment providing the animal a clearer differentiation of units of distance along the path to the goal.

The apparatus for the second experiment was an elevated linear maze having ten identical T-units placed in a straight line, with a wall twelve inches high, at right angles to the main axis of the maze in each unit, so that the animal would be forced to turn either to the right or left to get around it. There was also a block on each unit, on the left or the right, depending on which was the blind for the unit. There were short paths from the starting point to the first unit, and from the tenth unit to the food platform. The correct turn for each unit was to the right, except for number eight, in which the correct turn was to the left.

The magnitude of the distance traveled by the animal up to the first left choice was decided to be a reasonable index of the "psychological distance", corresponding to the true distance from the starting point to the correct left turn.

Shifting of parts of the maze, and moving the whole apparatus about in the room was intended to destroy olfactory and tactual cues, and cues provided by orientation in the room, regarding the correct left turn. Blind rats were used, to avoid visual clues.

The six rats used in the experiment had 275 training trials, over a period of thirty-six days, and two days of test trials. Intensity of hunger need was increased to
the level of forty-eight hours of deprivation for the first
day of test trials, and was reduced to the level of twelve
hours of deprivation for the second day of test trials.

The final 25 of the 275 training trials was used
for comparison with trials carried out under the test con-
ditions. A break-down of twenty-five training trials into
five sets of five trials each corresponding to the five
different room locations used during these trials reveals
that no important difference in distance was brought about
by the factor of orientation in the room. The means for the
five distributions are similar: 5.41, 5.48, 4.92, 5.14, and
4.86.

A comparison of the three distributions of dis-
tances traveled corresponding to the 48 hour, 24 hour, and
12 hour intensities of hunger need shows means of 6.05,
5.15, and 3.71 respectively. The calculation of Fisher's
t to determine the reliability of the difference in average
distance produced a t value of 3.22 for the difference be-
tween the 12, and the 24 hour values, and a t value of 3.22
for the difference between the 24 and the 48 hour values.
These values are statistically significant.

By the results of this experiment, it is clear,
that discrimination of distance was not actually a function of some time interval, for regard-
less of the magnitude of the distance traveled, always
the average rate of running remained relatively constant.

Since it might be argued that under lessened
hunger the activity of the animal might have been non-goal-directed, four considerations of the animals' behavior under 12 hour need are offered in refutation of this objection: 1) the rats showed no tendency to retrace, 2) none made a left turn at the first unit, 3) after making an initial left turn, rats continued left-turning behavior until finding the correct left turn, 4) after making correct left turn, no rats made any further left turns on the way to the goal.

The writer suggested the concept of psychological potential, and theorized that there exists a relationship between intensity of hunger need and magnitude of psychological potential, so that it is predicted that increased psychological distance to a goal results from increased need, and decreased psychological distance to a goal results from decreased need.

---

1 Induced quasi-need for means-end behavior leading to the goal.
CHAPTER II

STATEMENT OF THE PROBLEM AND PROCEDURE

In planning their experiments investigating the relationship between motivation and estimation of time, Filer and Meals\(^1\) confined themselves to a design which had the purpose of causing subjects to desire the passing of a time interval so as to arrive at an attractive goal, which for one group was dismissal from class for the day, and for the other the winning of a prize.

Results obtained did bear out the hypothesis that subjects who are motivated to have time pass will estimate a given period of time to be of longer duration than will subjects who are not so motivated.

Since the goals presented to their subjects were attractive in nature, Filer and Meals, in discussing the results, mentioned the need for investigation of the effect an undesirable event at the end of a given distance would have upon estimations of distances.

Interest in the results of the Filer and Meals study plus curiosity about the effect of an unattractive goal on judgment of duration of time led to the present

experiment testing the following two hypotheses:

\[
\begin{array}{cccc}
S & A & B & C & D \\
4'37'' & 9'14'' & 13'51''
\end{array}
\]

**HYPOTHESIS A:** Given the temporal distance SD, from a starting time to a desirable goal, and three points A, B, and C along SD, such that SB=2SA, and SC=3SA, subjects given a set to attain the desirable goal will estimate SA, SB, and SC to be of longer duration than will subjects in a control group not given such a set.

\[
\begin{array}{cccc}
S & A & B & C & U \\
4'37'' & 9'14'' & 13'51''
\end{array}
\]

**HYPOTHESIS B:** Given the temporal distance SU, from a starting time to an undesirable goal, and three points A, B, and C along SU, such that SB=2SA, and SC=3SA, subjects given a set to reach the undesirable goal will estimate SA, SB, and SC to be of shorter duration than will subjects in a control group not given such a set.

The procedure involved the use of nine mixed groups of undergraduate students at Montana State University. Three groups, IA, IIA, and IIIA worked toward the desirable goal. The three groups IB, IIB, and IIIB performed the same task, with an undesirable experience to follow the end of the time period. Three groups, IC, IIC, and IIIC also carried on the same task, but without any special motivational set, as in the case of the A and B groups. They were
merely asked to follow instructions, and had the expectation of continuing regular class work at the end of their task performances.

The desirable goal adopted was the same one that Filer and Meals used for their experimental group I, that is, the promise of dismissal from class at the end of the task period. This goal was decided upon because of the acceptance of their assumption that students liked to get out of class early and would desire the end of a time period which had to pass before they might leave, and because of the interesting comparisons which might be made between results obtained at least partly through offering the identical goal.

For an undesirable goal it was decided to inform the subjects taking part that at the end of the performance of the written task, the group would move to a nearby laboratory where individual tests would be made of tolerance to electric shock. It was assumed such an event would be undesirable to the subjects because of the generally existing fear and abhorrence of electric shock, yet, would not seem so unusual or objectionable but that they would submit to such tests, however reluctantly.

The task performance required of the subjects was similar to that used in the Filer and Meals experiments.

A total of 385 men and women undergraduates participated in the experimental studies. There were nine different groups, numbering from thirty-two to sixty-five
subjects. Groups IA, IIA, and IIIA, working toward a desirable goal, were stopped after 4:37, 9:14, and 13:51 respectively. Groups IB, IIB, and IIIB, working toward an undesirable event, were stopped after 4:37, 9:14, and 13:51 respectively. Groups IC, IIC, and IIC, serving as control groups, were stopped after 4:37, 9:14, and 13:51 respectively.

In all cases, administration of the tasks was carried out at the beginning of class periods.

Each subject in positive groups IA, IIA, and IIIA was given a sheet of ruled paper and the following instructions were read:

You are now to perform a twenty minute task. When you have finished you will be dismissed from this class. On the sheet of paper provided, you are to write down as many words as you can think of using alternate letters of the alphabet, beginning with A, as the first letter of the words. That is, you may use A, C, E, G, etc., as the first letter but not B, D, F, H, etc. Write as many words as you can think of beginning with A. When you have written all the words you can think of beginning with A, go on to C. When you have finished with one letter, skip a letter and go on to the next. You may use proper names. Are there any questions? This is a twenty minute task. You will start when I say "Go". As soon as you have finished you will be through for this period.

The following instructions were read to stop subjects:

Stop! Everyone stop working! Do not look at your watches. On the back of your paper in the lower right hand corner estimate the amount of time you have been working at this task, that is, the time from the signal "Go", until you were stopped. The task was not actually twenty minutes in length. Indicate your estimated time in minutes and seconds. If you have looked at your watch at any time after you started until now, please, make a note of it beside the time estimate.
After it was ascertained that the time estimates had been recorded, subjects were asked to answer the following two questions:

1. Did you, while you were working at the task, experience a desire to have time pass more slowly or more quickly than it seemed to be passing? In answer, state that you wanted time to pass more quickly, or more slowly or that you did not think about the passage of time.

2. Did you, while you were working at the task, think you were writing more words or fewer words than an average person might write in the same length of time, an average number of words, or did you not think about the number of words you were writing? In answer, state that you thought you were writing more, fewer, an average number, or that you didn't think about the number of words you were writing.

Each member of groups IB, IIB, and IIIB was handed a sheet of ruled paper, after which the following instructions were read:

You are now to perform a twenty minute task. When you have finished, you will be taken to the laboratory where your tolerance to electric shock will be tested. On the sheet of paper provided you are to write down as many words as you can think of using alternate letters of the alphabet, beginning with A as the first letter of the words. That is, you may use A, C, E, G, etc., as the first letter but not B, D, F, H, etc., Write as many words as you can think of beginning with A. When you have written all the words you can think of beginning with A, go on to C. When you have finished with one letter, skip a letter and go on to the next. You may use proper names. Are there any questions? This is a twenty minute task. You will start when I say "Go." When you have finished you will be taken to a laboratory for a test of your tolerance to electric shock.

The same stopping instructions were read to groups IB, IIB, and IIIB as were used to stop groups IA, IIA, and IIIA and the same two questions regarding consciousness of the passing of time, and of number of words being written,
were addressed to these groups as were put to the three positively motivated groups.

In the case of the control groups IC, IIC, and IIC, the instructions for the task were like those given to the other six groups, with the exception that no special desirable event to follow the performance of the task was suggested. These groups were also stopped in the same manner as the others and the two questions put to the others were asked of them.

At the end of the procedure in every class taking part, the experimenter asked members not to discuss the experiment outside of the class. There was apparently fine cooperation, for only one prospective subject admitted having beforehand knowledge, and she was not allowed to take part.

Of the 383 students constituting the nine groups participating in the experiment, 52 declared they had looked at their watches during the task periods. The estimates of these subjects were discarded, only the data from the remaining 331 subjects being considered in studying the results, with the nine groups finally numbering from thirty to forty-eight.
RESULTS

Results obtained do not bear out the predictions of the hypotheses. Statistical study of the three groups in Table I revealed a difference in means beyond the .05 level only between IA and IB. Differences in means between the control and the other two groups are not significant.

TABLE I

Number of Cases, Mean Time Estimates and Standard Deviations (in sec.) of groups IA, IB, and IC Stopped After Working at Task Four Minutes and Thirty-seven Seconds

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA Positive Goal Group</td>
<td>30</td>
<td>311</td>
<td>127</td>
</tr>
<tr>
<td>IB Negative Goal Group</td>
<td>35</td>
<td>322</td>
<td>155</td>
</tr>
<tr>
<td>IC Control Group</td>
<td>44</td>
<td>377</td>
<td>170.3</td>
</tr>
</tbody>
</table>

There are no statistically significant differences in means among the three groups listed in Table II, or among the groups in Table III.
-35-

TABLE II
Number of Cases, Mean Time Estimates and Standard Deviations (in sec.) of Groups IIA, IIB, and IIC Stopped After Working at Task Nine Minutes and Fourteen Seconds

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIA  Positive</td>
<td>35</td>
<td>612</td>
<td>173.3</td>
</tr>
<tr>
<td>IIB  Negative</td>
<td>31</td>
<td>625</td>
<td>160</td>
</tr>
<tr>
<td>IIC  Control Group</td>
<td>33</td>
<td>585</td>
<td>186.3</td>
</tr>
</tbody>
</table>

TABLE III
Number of Cases, Mean Time Estimates and Standard Deviations (in sec.) of Groups IIIA, IIIB, and IIIIC Stopped After Working at Task Thirteen Minutes and Fifty-one Sec.

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIIA Positive</td>
<td>48</td>
<td>839</td>
<td>192.2</td>
</tr>
<tr>
<td>IIIB Negative</td>
<td>37</td>
<td>814</td>
<td>174.2</td>
</tr>
<tr>
<td>IIIIC Control Group</td>
<td>38</td>
<td>805</td>
<td>160.8</td>
</tr>
</tbody>
</table>

Totals in every one of the nine groups were broken down into seven sub-groups each, according to subjects' statements as to whether they, 1) had wanted time to pass more slowly than it seemed to be passing, 2) had wanted
time to pass more quickly than it seemed to be passing,
3) had not given thought to the passage of time, 4) had
thought that they were writing as many words as an average
person might write in the same period of time, 5) had
thought that they were writing more than the average,
6) had thought that they were writing fewer than the average,
7) had not thought about the number of words they were
writing.

Tables IV to IX, inclusive, give a breakdown of
number of cases, mean and standard deviation for the various
groups in each of the above categories.

TABLE IV

Number of Cases, Mean Time Estimates and Standard Devia-
tions (in sec.) of Those in Groups IA, IB, and IC Who
Had Wanted Time to Pass More Slowly or More Quickly Than
It Seemed to be Passing or Who Gave No Thought to the
Passage of Time and Who Were Stopped After Four Minutes
and Thirty-Seven Seconds

<table>
<thead>
<tr>
<th>Groups</th>
<th>More Slowly</th>
<th>More Quickly</th>
<th>No Thought of Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>IA Positive Goal Group</td>
<td>12</td>
<td>355</td>
<td>109</td>
</tr>
<tr>
<td>IB Negative Goal Group</td>
<td>9</td>
<td>422</td>
<td>138</td>
</tr>
<tr>
<td>IC Control Group</td>
<td>14</td>
<td>394</td>
<td>239</td>
</tr>
</tbody>
</table>
### TABLE V

Number of Cases, Mean Time Estimates and Standard Deviations (in sec.) of Those in Groups IIA, IIB, and IIC Who Had Wanted Time to Pass More Slowly or More Quickly Than It Seemed to be Passing or Who Gave No Thought to the Passage of Time and Who Were Stopped After Nine Minutes and Fourteen Seconds

<table>
<thead>
<tr>
<th>Groups</th>
<th>More Slowly</th>
<th>More Quickly</th>
<th>No Thought of Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>IIA Positive Goal Group</td>
<td>30</td>
<td>603</td>
<td>162</td>
</tr>
<tr>
<td>IIB Negative Goal Group</td>
<td>14</td>
<td>573</td>
<td>174</td>
</tr>
<tr>
<td>IIC Control Group</td>
<td>10</td>
<td>491</td>
<td>191</td>
</tr>
</tbody>
</table>

### TABLE VI

Number of Cases, Mean Time Estimates and Standard Deviations (in sec.) of Those in Groups IIIA, IIIB, and IIIC Who Had Wanted Time to Pass More Slowly or More Quickly Than It Seemed to be Passing or Who Gave No Thought to the Passage of Time and Who Were Stopped After Thirteen Minutes and Fifty-one Seconds

<table>
<thead>
<tr>
<th>Groups</th>
<th>More Slowly</th>
<th>More Quickly</th>
<th>No Thought of Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>IIIA Positive Goal Group</td>
<td>23</td>
<td>797</td>
<td>155</td>
</tr>
<tr>
<td>IIIB Negative Goal Group</td>
<td>14</td>
<td>865</td>
<td>123</td>
</tr>
<tr>
<td>IIIC Control Group</td>
<td>29</td>
<td>825</td>
<td>155</td>
</tr>
</tbody>
</table>
TABLE VII

Number of Cases, Mean Time Estimates and Standard Deviations (in sec.) of Those in Groups IA, IB, and IC Who Had Thought They Were Writing an Average Number of Words, More or Fewer Numbers of Words Than Average, or Who Gave No Thought to the Number of Words They Were Writing and Who Were Stopped After Four Minutes and Thirty-seven Seconds

<table>
<thead>
<tr>
<th>Groups</th>
<th>Average</th>
<th>More</th>
<th>Fewer</th>
<th>No Thought of Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>M</td>
<td>SD</td>
<td>N</td>
</tr>
<tr>
<td>IA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goal Group</td>
<td>1</td>
<td>450</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goal Group</td>
<td>10</td>
<td>391</td>
<td>162</td>
<td>3</td>
</tr>
<tr>
<td>IC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>19</td>
<td>388</td>
<td>181</td>
<td>2</td>
</tr>
</tbody>
</table>

TABLE VIII

Number of Cases, Mean Time Estimates and Standard Deviations (in sec.) of Those in Groups IIA, IIB, and IIC Who Had Thought They Were Writing an Average Number of Words, More or Fewer Numbers of Words Than Average, or Who Gave No Thought to the Number of Words They Were Writing and Who Were Stopped After Nine Minutes and Fourteen Seconds

<table>
<thead>
<tr>
<th>Groups</th>
<th>Average</th>
<th>More</th>
<th>Fewer</th>
<th>No Thought of Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>M</td>
<td>SD</td>
<td>N</td>
</tr>
<tr>
<td>IIA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goal Group</td>
<td>6</td>
<td>748</td>
<td>108</td>
<td>2</td>
</tr>
<tr>
<td>IIB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goal Group</td>
<td>17</td>
<td>650</td>
<td>133</td>
<td>4</td>
</tr>
<tr>
<td>IIC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>10</td>
<td>633</td>
<td>216</td>
<td>2</td>
</tr>
</tbody>
</table>
TABLE IX

Number of Cases, Mean Time Estimates and Standard Deviations (in sec.) of Those in Groups IIIA, IIIB, and IIIC Who Had Thought They Were Writing an Average Number of Words, More or Fewer Numbers of Words Than Average, or Who Gave No Thought to the Number of Words They Were Writing and Who Were Stopped After Thirteen Minutes, Fifty-one Seconds.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Average</th>
<th>More</th>
<th>Fewer</th>
<th>No Thought of Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>M</td>
<td>SD</td>
<td>N</td>
</tr>
<tr>
<td>IIIA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>19</td>
<td>673</td>
<td>237</td>
<td>5</td>
</tr>
<tr>
<td>Goal Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IIIB</td>
<td>8</td>
<td>796</td>
<td>150</td>
<td>1</td>
</tr>
<tr>
<td>Negative</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goal Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IIIC</td>
<td>2</td>
<td>811</td>
<td>91</td>
<td>2</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Students' "t" test of Significance, applied to 144 combinations of categories within the nine groups of subjects, resulted in significant differences in means between only five pairs of sub-groups.

In groups IA and IB there is a significant difference in means beyond the .05 level between those who gave no thought to the passing of time. (See TABLE IV)

Within groups IA and IC there is a significant difference in means beyond the .05 level between those who gave no thought to the number of words they were writing. (See TABLE VII)

With regard to group IIA, a significant difference in means at the .05 level occurs between those who thought
they wrote an average number of words and those who thought they wrote fewer than average.

In group IIIB, between those who said they had wanted time to pass more slowly and those who had wanted it to pass more quickly than it seemed to be passing, there was a difference in means significant beyond the .01 level, and in the same group those who wanted time to pass more quickly and those who gave no thought to the passage of time had a difference in means significant beyond the .05 level.
CHAPTER IV

DISCUSSION OF RESULTS

Results from the experiments do not confirm hypothesis A that subjects offered a desirable goal at the end of a given temporal distance will overestimate periods of time along that distance in comparison with control groups not offered a special goal, or hypothesis B that subjects expecting to reach an undesirable goal at the end of a given temporal distance will underestimate periods of time along such a distance in comparison with control groups not looking forward to any special goal.

Among groups IA, IB, and IC, the mean time estimate for subjects in IB, moving toward an undesirable goal, is higher than the means of the other two groups. Further, the mean of IA, instead of being larger, as expected, is smaller than the mean of the control group. Only between IA and IB is there a significant difference in means, and that difference is in a direction opposite that which the hypotheses would suggest.

In comparing groups IIA, IIB, and IIC, one notices again that the negatively motivated group has the highest mean time estimate of the three. The control group has the smallest mean, but the differences in mean among the three are relatively slight, and are not statistically significant.
With regard to groups IIIA, IIIB, and IIIC, results show that although the group expecting to attain a desirable goal has the highest mean time estimate of the three, the differences between its mean and those of the other two have no statistical significance. As in the case of the I and II groups, and contrary to expectations, subjects in IIIB, expecting to reach an undesirable goal, have a higher mean time estimate than subjects in the control group, but not, however, significantly higher.

Results for Groups IA and IC, which are the only data in this experiment directly comparable, conflict with results obtained by Filer and Meals\(^1\) from their first experiment, for the mean time estimate of their control was significantly smaller than the mean of their experimental group.

That subjects working toward the desirable goal would want time to pass, as assumed by Filer and Meals, is questionable, for in answer to the first of two questions asked of subjects in groups IA, IIA, IIIA in this experiment, 55 answered that they had wanted time to pass more slowly, 8 replied that they had wanted time to pass more quickly, and 50 said that they did not think about the passage of time. There were, however, no significant differences in mean time estimates among those giving these responses within the various groups. If subjects should want time to pass so as to

reach a desirable goal, then the majority of replies to the question about passage of time should have stated a desire to see time pass more quickly.

It is noteworthy that in the groups IB, IIB, and IIIB, approaching an undesirable goal, 37 subjects expressed a desire to have time pass more slowly, five wanted time to pass more quickly, and 61 stated they gave no thought to the passage of time. The assumption that subjects in these groups should want time to pass slowly is at least questionable.

Fifty-three subjects in the control group declared that they had wanted time to pass more slowly, nine replied that they had desired to have time pass more quickly, and fifty-three said they had given no thought to the passage of time.

The scarcity of significant differences in mean time estimates in the various groups based on answers to the question regarding desire for the passage of time makes it impossible to detect any tendency for subjects to judge duration of time according to whether they want time to pass more slowly or quickly or do not advert to the passing of time.

Of the total number of subjects taking part in the experiment, 92 declared they had thought they were writing an average number of words, 24 stated they had thought they were writing more words than average, 114 replied that they had thought they were writing fewer words than average, and 101 responded that they had not thought about the number of
words they were writing. Comparison of means among the sub- groups did not reveal significant differences indicating a trend related to judgments about number of words being written.

In general, answers to the two questions asked of all subjects after they had given their time estimates would suggest a functional relationship between the type of task they performed and the psychological distance.
CHAPTER V

SUMMARY AND CONCLUSION

1. This experiment was designed to test two hypotheses, 1) that subjects given a set to attain a desirable goal will estimate periods of time along a temporal distance to the goal as greater in duration than will subjects in control groups not given such motivation, and 2) that subjects given a set to reach an undesirable goal will estimate periods of time along a temporal distance to the goal as shorter in duration than will subjects in control groups not so motivated.

2. Nine groups of subjects participated in performing a task which they were told would last 20 minutes. Three groups were stopped after 4:37, three after 9:14, and three after 13:51, and asked to estimate the length of time they had been working. Within each time period there were a positively motivated, a negatively motivated, and a control group. They were also asked if they had wanted time to pass more quickly or slowly, and if they had thought of the number of words they were writing.

3. Results did not support the hypotheses. There were no statistically significant differences between means of the control and the negatively motivated groups, or
between the means of the control and the positively motivated groups. In fact mean time estimates of the negatively motivated groups were in each case slightly higher than those of the control groups.

4. Answers to questions were compiled and mean time estimates of subjects giving various answers were compared but significant differences in means between comparable subgroups were too few to disclose any particular trend.

5. Totals of various answers indicated that the assumption that subjects offered a desirable goal following a given period of time would want time to pass is not valid, and also that the converse of this assumption does not hold true.

6. Subjects' answers to the two questions suggest that the effect of desirability or undesirability of a goal upon psychological distance to the goal is importantly related to type of task performed during the period of time separating one from the goal.

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