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The effects of two kinds of drive on intentional and incidental learning.

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THE EFFECTS OF TWO KINDS OF DRIVE ON INTENTIONAL AND INCIDENTAL LEARNING

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ABSTRACT

The present study was undertaken to test a hypothesis put forward by Easterbrook (1959), which stated that a restriction or narrowing in the range of cue utilization produced by increments in drive level may either facilitate or impair intentional learning, but will always impair incidental learning.

Forty introductory psychology students were used as Ss, ten assigned to each of the four conditions: control, experimentally induced failure, two hour deprivation of cigarettes from habitual smokers, and the combination of failure and deprivation. The intentional learning task was to memorize the shapes of a serial list of 14 geometrical figures of different colours to a criterion of one correct anticipatory recital. The Ss were then tested for incidental learning by matching the shapes of the figures with their colours, colour being the incidental cue.

Analysis of variance revealed no significant effect of the conditions on incidental or intentional learning.

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CHAPTER I

THE PROBLEM

The psychological literature of recent years seems to have been increasingly concerned with the possibility of reconciling the extreme positions held by continuity and discontinuity theories of learning. Bruner, Matter, and Papenek (1955) hold that the difference between the two positions can be reduced to a question about the range of cues to which the subject (S) is responding in a given situation, and question the necessity for any theory of learning to take an axiomatic position on this issue. It is considered, rather, as an important empirical question. The authors relate "breadth of learning" to both over-motivation and overlearning.

Easterbrook (1959) states that the concept "range of cue utilization" can account for the different degrees of continuity of learning and for the different amounts of latent learning that have been observed by various workers. He attempts a generalization based on this concept to reconcile the controversy concerning emotion and the organization of behavior.

The present study proposes to test the hypothesis put forth by Easterbrook (1959) that emotional arousal acts consistently to reduce the range of cues that an organism uses, and that the reduction in range of cue utilization influences action in ways that are either organizing or disorganizing, depending on the behavior concerned. Specifically, Easterbrook hypothesizes that the restriction in the range of cue use produced by increments in drive level may facilitate or impair the learning of relevant cues, depending on the complexity of these cues, but will always impair the learning of peripheral, irrelevant cues.

CHAPTER II

A SURVEY OF THE LITERATURE

The Theoretical Aspects

The classical reinforcement theorists (e.g., Hull, 1943) assume behavior to be determined primarily by general, non-specific drive state D and a variety of learned (sHr) and unlearned (sUr) reactive or associative tendencies. This relationship is considered to be multiplicative, in that drive D combines with any reactive tendency in a multiplicative fashion to yield a response-determining resultant, excitatory potential, sEr. The relationship is stated in the equations sEr = D x sHr for learned associative tendencies (habit strengths), and sEr = D x sUr for unlearned associative tendencies. In this system, since D is simply a numerical multiplicative factor, it cannot determine the direction of behavior. The directive functions are to be found in the reactive tendencies of the organism. Moreover, drive D, as a non-specific activator, has only the one multiplicative function, irrespective of its source. A second main point is that learning is represented by habit strength (sHr), and performance is determined by excitatory potential, sEr.

Brown (1961) outlines the practical implications of the reinforcement theory. The theory implies that any motivational variable can, within unspecified limits, be substituted for another, since the drive D provided by each is identical. A response can thus be elicited by the same or similar stimuli under different motivational conditions, such as food, water, or sex deprivation. In principle, the response R could be either learned or unlearned, since both kinds are affected by D in the same way. The actual response elicited is determined by the hypothetical associative tendencies functioning in combination with both internal and external stimuli.

A second implication is that variations in the strength of D produced by changing the amount of drive should ordinarily alter the quantitative but not the qualitative features of the response. Increasing drive D should increase speed, amplitude, frequency, and so on, of the response R, but the direction of R should remain unaltered. Positive results could be expected only if the motivational variable does not lead to marked changes in stimuli, that is, to a modification of cues to which R is attached in addition to changes in drive D.

Thirdly, increase in D, because of its multiplicative nature, should enhance a wade variety of responses, and a decrease in D should inhibit responses.

A fourth and important assumption is that performance will be inhibited by an increase in drive D whenever the reactive tendencies corresponding to incorrect responses are stronger than those corresponding to correct reactions. In this case, a lowering of D would presumably tend to improve performance. When performance improves in this situation, it is assumed that an increase in D increases the absolute difference between the strengths of the correct excitatory potential E_c and the weaker, competing E_g. When the correct habit is dominant prior to an increase in D, and performance declines, it is assumed that other, incorrect habits have displaced the correct ones at the top of the hierarchy of habits.

Spence (1948, 1956) has developed a theory of learning that closely parallels Hull's conception. Spence's multiplicative drive is held to be a direct consequence of deprivation, but such variables as unconditioned stimuli and shock affect drive indirectly via the elicitation of an emotional response. Since drive strength is taken as proportional to the vigour of this emotional response, such descriptively different factors as individual differences in emotional reactivity to stress, the number of prior exposures to aversive stimuli, and stimulus intensity can all affect drive D and hence performance. Spence further departs from Hull in positing incentive motivation K. As a behavior determinant, K is assumed to combine with D in an additive manner, and like D, it therefore multiplies reactive tendencies. K is a function of the magnitude of the reward, the number of times rewarded, the palatability of the reward, the length of the response chain, and, perhaps, the time interval between the initiation of the response and the receipt of the incentive. K is the consequent of the occurence of a classically conditioned partial consummatory goal response, r_g. The responses in anticipation of reward provide the motivational increment, K. (Brown, 1961).

At the opposite pole to the reinforcement theorists are those who hold that the manipulation of a motivational variable leads to changes in the stimulus conditions effective at the time performance is measured. The altered stimuli in turn assumedly affect behavior through changes in number, relative strengths, or kinds of associations between those stimuli and overt reactions. These are known as the non-motivational or associative theories of the role of motivational variables. They make no reference to such a construct as drive D, and in fact, several such writers suggest that the drive construct might be superfluous. It remains a moot question, with evidence supporting both contentions.

Estes (1958) seems to have formulated the most explicit associative theory of the effects of motivational variables. The probability that a response will occur depends on the proportion of the stimulus elements in a situation that have been conditioned to the response. In the case of a variable such as food deprivation, the internal drive stimuli assume an important role. Increases in deprivation time result in an increase in the probability of occurence of a drive stimulus, and a decrease in the probability of occurence of stimuli characteristic of satiation. The theory specifies that if training is carried out at a single level of deprivation, asymptotic performance will be higher the more severe the deprivation. However, if training is carried out at a moderate deprivation level, performance should become worse if deprivation is suddenly enhanced, since an increase in deprivation will assumedly change the drive-stimulus complex by introducing new elements not previously associated with the response. It is also predicted that if a single group is trained at several deprivation levels, performance should vary with deprivation if behavior on all trials is counted, but not if those trials on which competing responses occur are eliminated.

Review of Relevant Material

The continuity hypothesis, referred to in a previous section, is a theorem derived from stimulus-response reinforcement theory. Bruner, Matter, and Papanek (1955) question whether it is necessary to assume that reinforcement operates to strengthen response tendencies to all discriminable cues present in a given situation. The authors argue that rats in a jumping-stand situation learn more rapidly to respond to cues close to the bottom of the card, near the edge to which they are jumping (e.g. Ehrenfreund, 1948), and that a "set" to attend to certain kinds of objects or events in the environment leads to faster and better identification and learning of these than of so-called incidental material, although both kinds of materials are impingeing on the organism's sensory apparatus. In support, the authors cite works by Chapman (1932) and Postman and Senders (1946) and others.

The discontinuity hypothesis seems to be attached to cognitive theory, and holds that an organism responds in terms of one cue, or that the effective range of cues comprises only one set of discriminable cues at a time, or maybe two sets of cues in the event that the organism is entertaining a couple of hypotheses simultaneously. Bruner et al. (1955) argue that the presence of a "hypothesis" or systematic response tendency, does not necessarily limit, or blind, the organism to all else. There is an imposing array of evidence indicating that while responding to one feature of a situation, animals learn others of the situation. Such latent learning is demonstrated in the Chapman (1932) and Postman and Senders (1946) studies, where animals do seem to pick up features of the stimulus to which they have not been set, and learning of materials does occur without a set to learn, and in many other works on transfer, cue reversal, and so on. Bruner et al. argue that to hold the one-cue-at-a-time position is to deny that there can be anything approximating a "general set" or "looking around" behavior, a highly restrictive premise for a cognitive theory of learning.

Bruner et al. consider the critical question to be "what determines breadth of learning or the range of cues about which the organism picks up information in the course of a particular learning sequence?" The authors feel that the answers to this question would increase the richness of either the cognitive or reinforcement theory of learning.

Tolman, in his paper "Cognitive Maps in Rats and Men" (1948), states that one of the determinants of a broad or a narrow map is the range of cues utilized by an organism during cognitive acquisition, and one of the conditions affecting the range of cues appears to be motivational level. Tolman suggests that excessive motivation or frustration narrows the cognitive map, i.e., reduces the breadth of learning. Thistlethwaite (1951) reviewed the literature regarding latent learning, and concluded "the stronger the drive, the poorer the irrelevant-incentive learning". Melton (1950) reached much the same conclusion in his review of the literature. Johnson (1952) has demonstrated that the degree of learning of the position of an irrelevant reward depends upon the strength of the drive conditions operative during learning. Animals run in a T maze while moderately thirsty and satiated for food learned the position of the food better than animals which were satiated for food but extremely thirsty. The Johnson experiments seem to confirm the generalizations of Melton and Thistlethwaite, above, since only drive level was systematically varied.

Another source of evidence for the position posited by Bruner et al., breadth of learning, comes from studies of incidental learning and "incidental attention" under conditions of increased incentive. Bahrick (1954) has shown that while intentional learning was faster when the incentive given his 74 human subjects (Ss) was increased, the amount of incidental learning decreased. Similarly, Bahrick, Fitts, and Rankin (1952) have shown that an increase in incentive leads to a higher degree of selective attention for those parts of a complex task that Ss interpret as more important, with a concomitant tendency to pay less attention to other features of the situation.

Review of Specifically Pertinent Literature

The concept "range of cue utilization" is defined by Easterbrook (1959) as "the total number of environmental cues in any situation that an organism observes, maintains an orientation towards, responds to, or associates with a response". The range of cue utilization is said to have shrunk when the use of peripheral (occasionally or partially relevant) cues has been reduced, although the use of central or immediately relevant cues has been maintained. Such a change is associated with improvement of central performance, or with the maintenance of proficiency under stress (Easterbrook, 1959). The range of cue utilization is said to have fallen when the amount of incidental learning has been reduced, although task learning has remained constant or been improved (e.g., Aborn, 1953; Bahrick et al., 1952; Bahrick, 1954; Bruner et al., 1955).

Easterbrook notes that in each of these studies, and in others, shrinkage or reduction in the range of cue utilization was found to have been associated with an increase in drive level. Easterbrook concludes that "when the direction of behavior is constant, increase in drive is associated with a reduction in the range of cue use". This restriction may facilitate or impair the learning of relevant cues, depending on the complexity of these cues, but will always impair the learning of peripheral or irrelevant cues (Kausler and Trapp, 1960). Easterbrook points out that with some tasks the reduction in range improves performance since irrelevant cues are excluded, and drive then becomes organizing or motivating. In other tasks, however, proficiency demands the use of a wide range of cues, and drive then becomes disorganizing. There seems to be an optimal range of cue utilization for each task.

Kausler and Trapp (1960) take exception to Easterbrook's generalization. These authors hold that he is referring to the effects of general, emotionally-based drive D on cue utilization, citing his definition of drive:

> The term drive...refers to a dimension of emotional arousal or general covert excitement, the innate response to a state of biological deprivation or noxious stimulation, which underlies or occurs simultaneously with overt action and affects its strength and course.... (Easterbrook, 1959, p. 184)

Kausler and Trapp contend that Easterbrook cites as support for his position studies that clearly do not manipulate generalized drive D, but rather manipulate motivational states aroused by specific sets. One of these references is a study by Bahrick (1954) in which motivation was augmented by financial rewards for good performance. Further, Kausler et al. (1960) cite an experiment by Bahrick, Fitts, and Rankin (1952) which related motivation to perceptual motor performance, and in which the motivation of the 100 Ss was again manipulated by financial incentives. Finally, Kausler et al. (1960) cite an experiment by Kausler, Trapp, and Brewer (1959) which duplicated Bahrick's (1954) study, except that motivation was provided by a generalized drive, anxiety, instead of being manipulated by an incentive-oriented set, monetary reward. Bahrick, using 74 Ss, found that a high incentive group learned a serial list of geometric forms, the relevant cues, more efficiently than a low incentive group. However, the high incentive group displayed significantly less incidental learning than the low incentive group, the incidental or irrelevant cues being the colours filling in the geometric forms. These results would be predicted by S-R reinforcement theory and Easterboook's generalizations.

However, the same experiment conducted by Kausler et al. (1959) using general drive D, yielded conflicting results. In this study, two separate experiments were performed. In the first, anxiety was defined for 50 Ss by extreme upper and lower scores on the Taylor Manifest Anxiety Scale (MAS), and in the second study, anxiety was induced into 50 Ss by intense ego-involving instructions. In both experiments, the high drive groups did significantly better on the intentional task (learning the series of geometrical figures) than the low drive groups, as found in the Bahrick study, but unlike that study, no difference was found between the two groups on the incidental task (learning the colours filling in the forms).

Kausler and Trapp (1960) cite further support from Farber's (1955) assertion that non-generalized motives have directive or associative aspects, but do not have dynamogenic (drive) properties. Farber states:

> The supposition that motivational variables have steering (associative) properties as well as energizing and reinforcing (drive) properties does not....imply that the two kinds of properties are identical.....The associative function of a motive or any other variable is identified in terms of its tendency to elicit or facilitate a limited class of responses only. The drive function of a variable is demonstrated if: (a) its presence energizes or intensifies indiscriminately all reaction tendencies existing in a given situation; and/or (b) its elimination or reduction in magnitude is reinforcing, i.e., leads to the increased probability of recurrence, in the same situation, of the responses preceding its modification. Motives, it is presumed, have both functions, and if a variable clearly does not have both, its status as a motive is questionable. (Farber, 1955, pp. 311-312).

On the basis of this evidence, Kausler and Trapp feel that this tendency to equate motivational states aroused by specific sets with states aroused by general drive D, as Easterbrook has done, is open to serious criticism. General drive D, such as anxiety and deprivation, thus seems to improve intentional learning, and at the same time, due to its indiscriminate intensification of all reaction tendencies, would strengthen the relatively weaker reaction tendencies or habit strengths in the high drive group, thus bringing its response potential to a point comparable to that in the low drive group where habit strength is stronger but drive level is weaker. Hence the groups would not differ in incidental learning. On the other hand, incentive motivation such as monetary reward, task-oriented instructions, or some other reward desired by the subject, should improve intentional learning since such incentives would elicit particular, goal-directed responses, but should impair incidental learning because the associative properties would not energize irrelevant reaction tendencies (Kausler and Trapp, 1960).

Factors other than the induced amount of either general or specific drive apparently affect incidental learning, also. One of these factors seems to be the positioning of the relevant and irrelevant cues in the material to be learned. The results obtained by Kausler et al. (1959), cited earlier, disagreed with results obtained by Silverman (1954), and Silverman and Blitz (1956). In all of these studies, the drive state used was general drive D, either induced or intrinsic anxiety. Kausler et al. did not obtain the decrease in incidental learning that Silverman and Silverman and Blitz obtained. It appears that the important differences among these studies lies in the placement of the cues. In the Kausler et al. study, the irrelevant cues were contained within the relevant cues: the colours (irrelevant cues) filled the geometrical figures (relevant cues), thus assuring close spatial and temporal proximity. In the Silverman (1954) study, the relevant cues were visual while the irrelevant cues were auditory. A third arrangement was used in the Silverman and Blitz (1956) study. Here, the irrelevant cues, two-digit numbers, occupied a different section of a memory drum opening six centimeters away from the relevant cues, nonsense syllables. Conceivably, then, there is an interaction between level of drive and cue position.

Task difficulty seems to be another important factor in incidental learning. Speilberger, Goodstein, and Dahlstrom (1958) found that the relationship between anxiety level as defined by the Taylor MAS and incidental learning of Bender - Gestalt Test designs was a function of the difficulty of the material to be learned. Easy designs requiring little concentration allowed the 44 high-drive Ss to perform at a higher level than the 44 low-anxious Ss. On the difficult designs, however, the low-anxious Ss did better than the high-anxious Ss.

Postman and Senders (1946) investigated the relationship between incidental learning and the explicitness of instructions. These authors had 50 Ss read a story under the diverse conditions of no instructions, instructions for general comprehension, for sequence of events, detail of content, detail of expression, and detail of presentation. The writers found that learning varies systematically with the explicitness of instructions. They concluded that explicit instructions lead to an explicit set to learn, but that lack of instructions can lead S to self-induce covert sets to learn. Furthermore, some compensatory effects may occur, in that instructions to learn specific detail can lead S to emphasize general comprehension. Winnick and Wasserman (1959) obtained similar results with 54 Ss.

Aborn (1953) studied the effects of experimentally induced failure with its consequent "ego threat" on intentional and incidental learning, and on retention. Two groups of 20 Ss each were instructed to memorize colour plates, one group under threat, the other not threatened with failure. Another two groups of 20 Ss each were given no instructions to memorize, one of these again with threat induced. He found that threat had no inhibitory effect on those "set to learn", but in the case of the incidental learning groups, the threatened group produced significantly depressed memory scores. The alleviation of threat resulted in some recovery. Combs and Taylor (1952) found that mild degrees of threat increased the time required for their 50 Ss to complete a simple coding task. These authors hypothesize that under threat the perceptive field of the individual becomes restricted to the area of the threat, resulting in compulsive or in non-adjustive behavior. With his perceptive field narrowed, the individual is unable to select from his perceptive field more adequate modes of behavior. The greater the degree of threat perceived, the greater the reduction in perceptual range and thus of the ability to adapt.

The rate of stimulus presentation seems to be another important variable. Neimark and Saltzman (1953) found that a list of two-digit numbers, when presented to 60 Ss with a two second time interval between stimuli presentations, did not result in any significant difference between intentional and incidental learning scores. However, when the stimuli were presented at three and six second intervals to similar groups of Ss, the scores for intentional learning were significantly higher than the incidental learning scores.

CHAPTER III

PROCEDURE

Subjects

The subjects used in this study were students taken from the introductory psychology courses of Assumption University. Students in these courses are required, as a part of the curriculum, to take part in research projects carried out by the Psychology Department. A questionnaire was circulated in the classes to determine which of the students did or did not smoke, and of those who did smoke, how long they had been smoking and how heavily they smoked. On the basis of the answers given, two groups of male students were selected for the experiment: a group who did not smoke and a second group who had been smoking for at least one year and who were then smoking at least 15 cigarettes per day. The two groups were further refined in order to achieve a degree of homogeneity in age range. Each of these groups was then randomly split in half, one half of each group being assigned to an induced failure group, the other half to a not-failed group. Consequently, there were four groups of ten subjects each:

1. Control; non-smokers who were not failed.
2. Induced anxiety; non-smokers who were failed.
3. Deprived; smokers who were deprived of cigarettes but not failed.
4. Deprived with induced anxiety; smokers both deprived of cigarettes and failed.

In order that a competition situation could be developed, and to enhance the failure conditions, the Ss were tested in pairs, one from the not-failed group being paired with one from the failed group. The pairing was determined solely on the basis of which two Ss were able to meet with the experimentor at the same hour. Appointments for testing were arranged by telephone and confirmed the evening before the test date. At that time the Ss were asked to participate in a simple experiment on perception. The smokers were asked not to smoke for two hours before the appointment hour. The importance of this was emphasized and, as far as is known, no S did smoke during the deprivation interval.

All Ss used in this study were male, with a mean age of 20 years and a range of 18 to 22 years of age, with the exception of one S who was 28 years of age. The mean number of cigarettes consumed by the smokers was 19 per day, with a range of 15 to 35 cigarettes.

Apparatus

The stimulus material consisted of two sets of geometrical figures drawn on 7½ x 11 inch white cardboard. The figures were approximately one half inch in area, were centred on the cardboard, and were drawn with standard drawing inks.

The first series of figures, the "preliminary set", was drawn in white ink on white paper. This set of ten figures consisted of: rectangle, triangle, diamond, square, circle, ellipse, parallelogram, semicircle, hexagon, and cone. These were presented to the Ss in random order.

The second series of geometrical figures, the "experimental set", was similar to the first, except that the lines were much wider and were coloured. The fourteen figures in this set consisted of seven different figures, there being two figures of each kind. There were seven different colours used in the drawing of these figures, two figures being drawn in each colour. The series contained: brown diamond, blue semicircle, violet square, blue parallelogram, green rectangle, red triangle, black semicircle, orange rectangle, violet circle, orange diamond, red parallelogram, black square, green triangle, and brown circle. This series of figures was presented to all Ss in this order without exception. The order was so arranged that two figures of the same form or two colours of the same hue did not occur in sequence.

The stimulus cards were presented to the Ss on a standard Gerbrand Tachistoscope, equipped with a timer adjustable to 1/100 sec. The exposure interval could be controlled manually or automatically. The illumination in the tachistoscope was constant and could not be altered. This factor, along with the high level of illumination in the tachistoscope, and the 1/100 sec. upper limit on the exposure interval, lead to the developement of the white figures on white paper for the preliminary set of figures. It was necessary for the experimental procedure that the Ss' perceptual thresholds be lowered.
All the experimental tests were conducted in the same testing room. The room was constantly illuminated by a ceiling light, the only light source, since the room was located on an inside wall and had no windows.

Procedure

On arrival for the test, the Ss were given the following instructions:

> As you probably know, there is a relationship between perceptual efficiency and scholastic ability. This is a rather confused area, and our task is to attempt to sort out some of the factors involved in it. In the first part of the experiment, I am going to present some geometrical figures on the tachistoscope. Your task will be to simply identify the figures. They will be presented at various exposure intervals, beginning with fast exposures and working down to slower speeds, in order to obtain a basic speed at which you can see them fairly easily.

The non-failed S was then asked to take the first part of the experiment. The figures were presented at exposure durations at which he could easily identify the figures (6/100 to 9/100 sec.). He was made to fail once or twice by decreasing the exposure duration to a sub-threshold level, in order to give an appearance of authenticity to his partner, who was to be failed on this task. The figures were presented rapidly and with a minimum of procedural elaboration. At the end of the series, E made approving comments regarding the fast speed and efficiency of S's perception.

The S assigned to the induced failure group then took his turn. The figures were presented at exposure intervals that were well below threshold (2/100 to 5/100 sec.). When S could not identify the figures, E inquired about his health, how was he feeling now, and had he any eye trouble. False norms were introduced, in that S was informed that the exposure interval was at normal length, and that he should be able to see the figure. E commented to the effect that the exposure would be lengthened even more, and asked S if he could see the figure now. Each figure was exposed several times, E pretending after each exposure to slow the interval more by manipulating the timer. Eventually, S was allowed to identify the figure. The same procedure was used for all ten figures. The time required for this procedure was much longer for the failed than for the non-failed S, and the procedure much more elaborate.

The procedure was designed to induce a sense of well-being, of confidence, in one S. He passed the test easily. The other S, however, experienced difficulty with this simple task, did not, apparently, succeed in it, and would, presumably, feel anxious because of this. His failure in the presence of a classmate and the disapproval expressed by E would presumably enhance any feelings of anxiety and loss of prestige. Failure in any event is threatening and anxiety arousing, and should be even more so for a college student, where success and status depends on one's ability to learn, and where academic ability is stressed.

The non-failed S was at this time escorted to another room to wait while the second part of the experiment was administered to the failed S.

At this point, the procedure of the second part of the experiment was outlined:

> Now I am going to show you a series of fourteen geometrical figures similar to the ones you've just seen. You are to memorize the series of figures. The first time you see them, just name them as they appear. Starting with the second trial, however, you are to name each figure before it appears. You name it, then you'll see it, and so on. Do you understand? The figures will be presented at the exposure duration that we established in the first part of the experiment. We will go through this series until you have it memorized and can predict every figure correctly. You should be able to learn this series in seven or eight trials (false norms), which is about average, we've found, for Assumption Students. Are you ready?

The figures were then presented to S at a fixed exposure duration of 1/10 sec. It was found during the pilot studies that this was the minimal exposure duration that permitted the perception of colour. As the number of trials increased, E made such comments as "you should be learning them by now, without so much guessing", "you're not doing as well as you should be", "your score is below average", "how are you doing in school", and so on. As the number of trials approached seven or eight, and passed this number, the number of the coming trial was added to E's remarks. The norms of seven or eight trials to criterion were false; actually eleven or twelve trials were required. This procedure was designed to at least maintain, if not to increase, the drive state aroused in the preliminary part of the experiment.

When the criterion of one errorless recitation was reached, S was asked to adjourn to another room. The non-failed S was brought into the testing room. Then the failed S was given final instructions. He was asked if he had noticed whether or not the figures were coloured. He was then instructed to match the figure with its proper colour, using the matrix designed for this on the scoring sheet. He was asked to wait until E returned.

The same procedure was used with the non-failed S in the second part of the experiment, except that he was given the true norms for the number of trials to criterion (eleven or twelve), and no derogatory remarks were made to him. E's attitude and comments toward this group of Ss was one of friendliness and jocularity, in contrast to the serious and critical attitude directed toward the failed Ss. The cards were exposed for the same duration of 1/10 sec. as for the failed Ss.

The deprived smokers were either failed or passed on the preliminary part of the experiment in the same way as the non-smokers. The deprived Ss received additional instructions for the second part of the experiment. After ascertaining that they had not smoked for two hours, they were told that the sooner the experiment was completed, the sooner they could have a cigarette, and that this depended on the quality of their performance. They were informed that the one who did best on the task would be rewarded with a package of cigarettes, and that they were therefore in competition with each other. Packages of cigarettes, matches, and a well-filled ash tray were conspicuous. E smoked in their presence, occasionally puffing smoke in Ss' direction, and smoking up the room. E pointed out that since this was a different task than the preliminary one, they each had an equal chance of winning the prize, and that all one had to do was to learn the series a little faster than the competitor. These additional procedures, coupled with a two hour deprivation period, would, it was hoped, induce a specific, incentive-oriented set. The reward was a cigarette which would relieve any physiological or psychological need induced by the deprivation of a gratifying habit, smoking. It was hoped that the value of the reward would be enhanced by the period of deprivation, by the sensory perception (sight and smell) of an object that was desired by S, and by the competitive situation. An increase in the psychological value of the reward should presumably lead to an increase in the drive to obtain that reward. Other than these additional instructions, the smokers underwent the same experimental procedures as the non-smokers.

When the testing session was completed, and both Ss had matched the colours with the figures on the matrix, both Ss were brought together and the true nature of the experiment, and the procedures employed, were explained. The Ss who had been failed were reassured that their failure was not real, but had been deliberately and of necessity induced by E, through false norms and the manipulation of the apparatus. Any questions asked by the Ss were answered. Finally, the Ss were thanked for their participation, and requested not to discuss the experiment with anyone.

CHAPTER IV

RESULTS

The data produced two measures of intentional learning for each S: the number of trials to criterion, T, and the total number of errors, E. Incidental learning was measured by the number of correct colour-figure matches, C, made by S. Table 1 presents the mean intentional and incidental learning scores obtained under the four experimental conditions.

TABLE 1

MEANS OF INTENTIONAL AND INCIDENTAL LEARNING SCORES FOR FAILED AND NOT-FAILED AND DEPRIVED AND NOT-DEPRIVED GROUPS

	Not Failed			Failed		
	C	T	E	C	T	E
Not Deprived	3.3	10.4	50.4	3.5	11.6	55.5
Deprived	4.1	10.6	50.3	3.7	12.7	57.9

The mean intentional and incidental learning scores presented in Table 1 indicate that experimentally induced failure and deprivation affected both intentional and incidental learning to a slight degree. Both of the failed groups show a slight increment in incidental learning and a decrement or impairment of intentional learning over the control group, the not-failed, not-deprived group. The deprived groups also show a slight increment in incidental learning, but only in the group which received both failure and deprivation was there a decrement in intentional learning in comparison to the control group. The group receiving deprivation conditions alone did not show any decrement in intentional learning, the mean number of trials and errors being the same as those for the control group. Incidental learning showed a steady increase from the control through the failed, failed-deprived, and deprived groups. Intentional learning showed a progressive impairment from the control through the deprived, failed, and failed-deprived groups. Figure 1 depicts the effects of the four experimental conditions on incidental learning, and figures 2 and 3 the effects on intentional learning, the number of trials to criterion and the total number of errors, respectively.

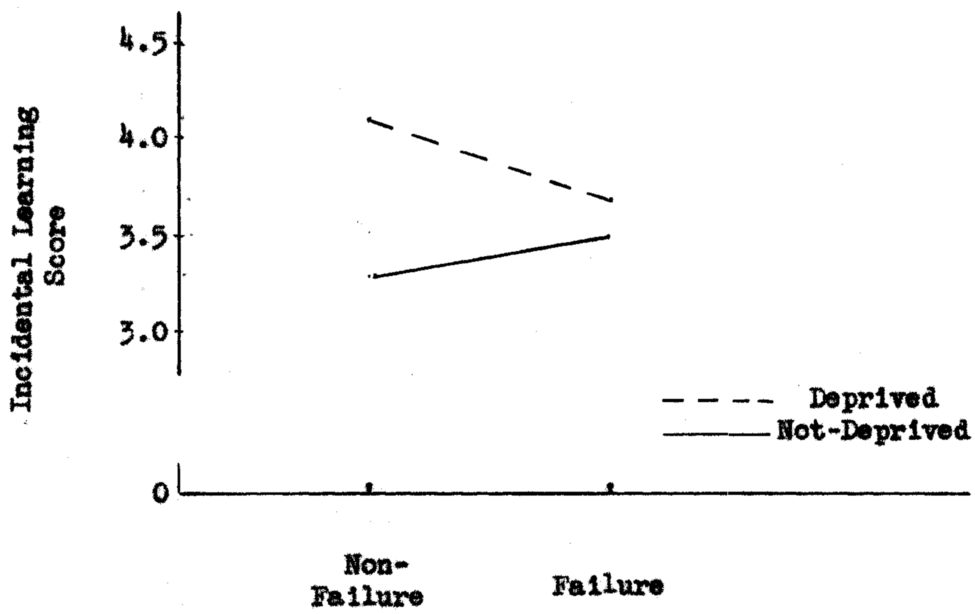

Fig. 1 The effect of deprivation and non-deprivation and failure and non-failure conditions on incidental learning.

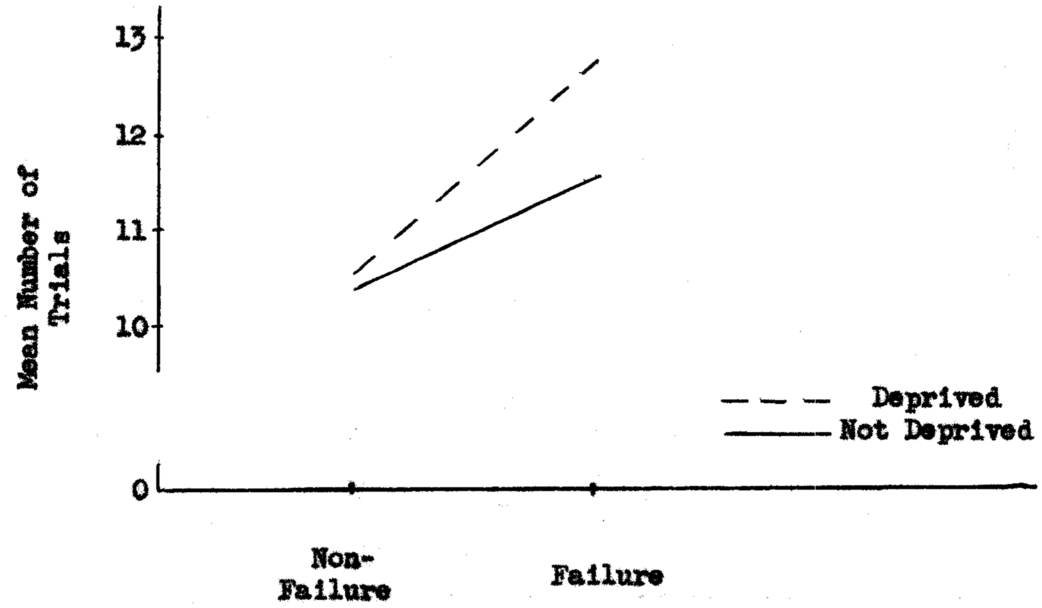

Fig. 2. The effect of deprivation and non-deprivation and of failure and non-failure on intentional learning in terms of number of trials to criterion.

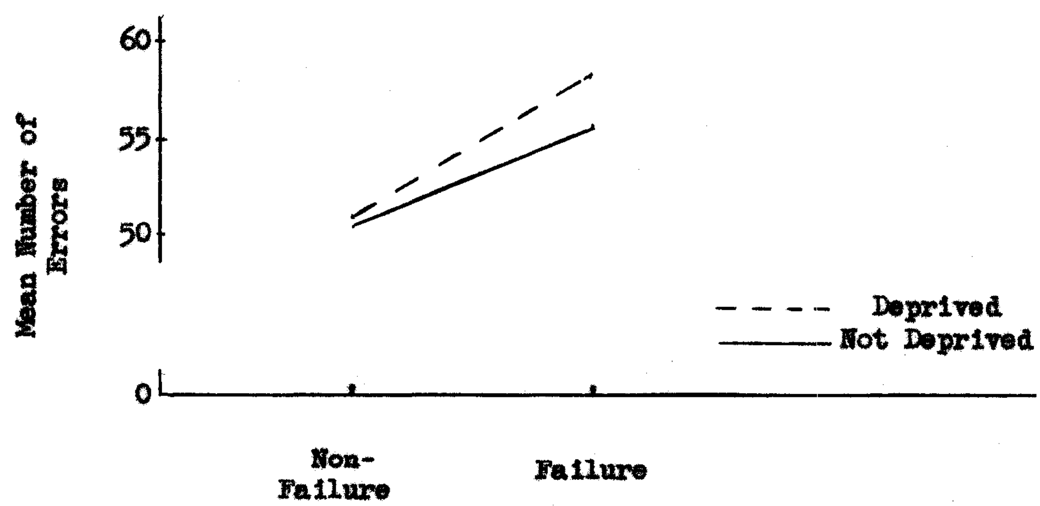

Fig. 3. The effect of deprivation and non-deprivation and of failure and non-failure on intentional learning in terms of number of errors.

In order to assess the effects of the four experimental conditions, a two by two analysis of variance was performed, and is shown in Table 2. An F of 4.08 is required for the .05 level.

TABLE 2

ANALYSIS OF VARIANCE FOR INCIDENTAL LEARNING

Source	Sum of Squares	df	F
Deprivation (D)	2.5	1	1.5105
Failure (F)	0.1	1	0.0604
D x F	0.9	1	0.5432
Within	59.6	36	
Total	63.1	39	

The analysis indicated that incidental learning was not significantly affected by any of the experimental conditions. Tables 3 and 4 present the analysis of variance for the intentional learning measures.

TABLE 3

ANALYSIS OF VARIANCE FOR INTENTIONAL LEARNING IN TERMS OF TRIALS TO CRITERION

Source	Sum of Squares	df	F
Deprivation (D)	4.225	1	0.3645
Failure (F)	27.225	1	2.3486
D x F	2.025	1	0.1747
Within	417.300	36	
Total	450.775	39	

TABLE 4

ANALYSIS OF VARIANCE FOR INTENTIONAL LEARNING IN TERMS OF NUMBER OF ERRORS

Source	Sum of Squares	df	F
Deprivation (D)	13.00	1	0.0286
Failure (F)	403.25	1	0.8254
D x F	15.80	1	0.0322
Within	17587.90	36	
Total	18019.95	39	

Neither the number of trials to criterion nor the total number of errors were affected by deprivation or failure to any significant degree.

An analysis of covariance was attempted in order to adjust for the possible effect on incidental learning of the increased number of trials required to reach criterion under the experimental conditions. The result, however, further reduced the F ratios, as seen in Table 5.

TABLE 5

ANALYSIS OF COVARIANCE FOR INCIDENTAL LEARNING ADJUSTED FOR NUMBER OF TRIALS TO CRITERION

Source	Sum of Squares	df	F
Deprivation (D)	0.0	1	0.0
Failure (F)	0.0	1	0.0
D x F	3.52	1	2.0840
Within	59.11	35	
Total	62.63	38	

Table 6 presents the analysis of covariance for incidental learning in terms of the total number of errors to criterion.

TABLE 6

ANALYSIS OF COVARIANCE FOR INCIDENTAL LEARNING ADJUSTED FOR NUMBER OF ERRORS

Source	Sum of Squares	df	F
Deprivation (D)	-0.04	1	-0.0241
Failure (F)	0.008	1	0.0048
D x F	4.212	1	2.5358
Within	58.13	35	
Total	62.31	38	

In this study, then, neither experimentally induced failure, nor the deprivation of cigarettes and the reward of cigarettes to deprived smokers, nor the combination of both of these conditions, had any significant effect on either incidental or intentional learning.

CHAPTER V

DISCUSSION

The results of this study are contrary to those expected on a theoretical basis (e.g., Brown, 1961; Easterbrook, 1959; Hull, 1943), and in terms of studies cited in earlier chapters (e.g., Bahrick, 1952; Bruner et al,, 1955; Kausler et al., 1959). It was predicted on the basis of the results obtained by Kausler et al. (1959) that incidental learning would become impaired as the range of cue perception narrowed or shrank under the deprivation-reward conditions, but would not be significantly impaired by the general drive conditions aroused by threat of failure. Intentional learning, again on the basis of Kausler et al. (1959), would be improved by both an increase in general drive and by incentives. The results are also contrary to those hypothesized by Easterbrook (1959), in which general drive D could either impair or facilitate intentional learning, but which would always impair incidental learning.

While none of the results are significant, it may be worth while to examine the mean incidental and intentional learning scores presented in Table 1 (page 30).

The mean number of trials required to reach criterion for the control and for the deprived groups are identical (10.4 and 10.6 trials), as are the error scores (50.4 and 50.3), indicating that the deprivation and reward condition by itself apparently did not affect intentional learning to any extent. According to reinforcement theory, and on the basis of previous studies, deprivation and reward should have led to improvement on the intentional task through an increase in the level of drive D, or had the task been complex, to disorganization and decrease of intentional learning. Consequently, it appears that deprivation of cigarettes for a period of two hours, and the reward of a smoke and package of cigarettes for good performance did not act either as a drive D arousing or as an incentive-motivating condition.

On the other hand, for these same two groups, control and deprived, the incidental learning scores are 3.3 and 4.1, respectively, indicating that the deprivation and reward condition permitted an increase in the range of cue utilization. If drive D or incentive motivation had been increased, then incidental learning should, on the basis of theory and previous studies, have shown a decrease. The deprivation-reward condition may have aroused very slight increases in D which, by the tendency of D indiscriminately to increase all reaction tendencies, could have led to an increase in the use of colour to learn the series of figures. In this case, D would not have increased to the extent that correct and incorrect response tendencies would compete enough to impair intentional learning. It is also possible that the Ss induced in themselves sets to learn colours. Postman and Senders (1946) and Winnick and Wasserman (1959) found that learning varies systematically with the explicitness of the instructions given the Ss, and that no instructions or vague instructions lead to self-induced instructions by S, or to other covert sets to learn.

Considering the two groups of Ss who were failed, Table 1 reveals that for the failure condition alone, there was impairment of intentional learning, in that more trials were required to reach criterion, and more errors were made, than in the control group. Again, it was expected that an increase in general drive D, through anxiety induced by failure, would facilitate intentional learning on this task and impair incidental learning (Easterbrook, 1959), or would result in no change in incidental learning (Kausler et al., 1960). In this case, failure seems to have aroused some general drive D by which competing response tendencies were strengthened to the extent that they could impair the intentional task. That is, incorrect response tendencies would be strengthened as well as the correct ones (memorizing the series of shapes), which would necessarily be weak to begin with if the incorrect tendencies were to compete to a disruptive extent. A more likely probability is that the task was of such a nature as to induce S to use colour as an aid in learning the series. Learning the series of colours as well as the series of shapes would likely impair intentional learning, since much more information would have to be assimilated. If such was the case, then the intentional task would become much more complex, and there should be an impairment of intentional learning according to Easterbrook's hypothesis. Colour and shape were both randomly arranged, making, in effect, two series to learn instead of one. The slight increase in incidental learning may be a function of a self-induced set by S to use colour, or of the increased number of trials required to learn the series as a result of the use of colour. This possibility finds some support from comments by some of the Ss to the effect that they were trying to find the key to the relationship between colour and shape.

Under the condition of failure combined with deprivation-reward, intentional learning shows greatest impairment, indicating that these two conditions combined or summated in some way, and leading to the suspicion that both of these variables are operating as general drive, D. Hull (1943) clearly states that he considers deprivation a general drive arousing agent, drive level being a function of the deprivation period. If deprivation has acted in such a way as to arouse general drive D instead of an incentive-oriented set as expected, there should have been impairment of intentional learning under deprivation alone, unless the D it aroused was very weak, as seems to be the case, since there was only a very slight increase in the number of trials under the deprivation and failure conditions combined, compared to the failure condition alone. Once again, under these combined conditions, incidental learning improvement can probably be attributed to the increased number of trials to criterion.

Lindsley's (1951) activation theory may provide another reason for our unexpected results. According to this theory, the continuum extending from deep sleep at the low activation end to "excited states" at the high activation end is largely a function of cortical bombardment by the ascending reticular activating system (ARAS), such that the greater the cortical bombardment the higher the activation. Further, the relation between activation and behavioral efficiency (e.g., cue function or level of performance) is described by an inverted U curve. That is, from low activation up to a point that is optimal for a given function, level of performance rises monotonically with increasing activation, but beyond this optimal point the relation becomes non-monotonic: further increase in activation beyond this point produces a fall in performance level, this fall being directly related to the amount of the increase in level of activation (Malmo, 1959). This theory may apply to the failure and to the failure-deprivation conditions if we could assume that the Ss involved were already highly motivated to begin with. The instructions given all Ss stated that the purpose of the experiment was to investigate the relationship between scholastic ability and perceptual efficiency. Further, the deprived Ss were urged to compete against one another for the reward, one half of these Ss being failed in addition, and one half of the not-deprived Ss also being failed. Such procedures, when combined with university students who most likely are by the nature of their work and experience already highly motivated to learn, and who are very likely quite sensitive to threats or depreciatory remarks about their scholastic ability, might very well have pushed activation beyond the optimal level. In this respect, it is important to note that the Ss who were deprived but not failed did not show impairment of intentional learning, but did show a relatively large improvement in incidental learning, indicating that perhaps the motivational conditions permitted or encouraged the use of a wider range of cues.

Spence (1960) states that individual differences in emotional reactivity are important, in that they affect drive indirectly via the elicitation of an emotional response. Just as important is incentive motivation K, which combines additively with drive and is a function of magnitude of reward, length of the response chain, and, perhaps, of the time between the initiation of the response and the receipt of the incentive. In the present experiment, the emotional reactivity of the Ss was not controlled. Kausler et al. (1959), Silverman et al. (1956), and Speilberger et al. (1958), all found the results expected, but these authors restricted the Ss used to those who had achieved extreme scores on the Taylor MAS, that is, to either intrinsically high- or low-anxious Ss. The Ss used in the present study were not screened for level of intrinsic anxiety, and consequently might have varied quite widely in range of anxiety level, The effect of failure on a highly anxious person would be much more severe than on a low-anxious S; in the former, the increase in D might become disruptive, whereas in the latter it might become motivating or organizing. It is possible that positive results might have been obtained had the Ss been selected on the basis of achieving approximately the same scores on some measure of anxiety, such as the Taylor MAS.

Another important variable seems to be the rate of presentation of the stimulus material. A study by Neimark and Saltzman (1953) showed that with a two second time interval between stimuli, intentional learning was not more efficient than incidental learning, but that with a three second interval, intentional learning without an orienting task was significantly more efficient than incidental learning. A six second interval allowed significant improvement in intentional learning both with and without an orienting task (circling the stimulus numbers) over incidental learning. The time interval between stimuli in the present study was subject-determined, in that the next stimulus was not presented until S had made the anticipatory response. The shortest interval possible was approximately 2.5 seconds, the time required for the timing mechanism on the tachistoscope to make one complete revolution and this interval varied upward to about one minute. It is thus possible that the wide variation in the time interval between stimuli affected the incidental and intentional learning scores in this experiment.

Another important factor seems to be the individual learning abilities of the Ss. In all groups there was a wide variability in the number of trials required to reach criterion. Possibly, if the Ss had been selected on the basis of intelligence test scores, the ranges of trials would have been narrowed. Threat of failure would likely be much more meaningful to a student who is not academically strong, and therefore, probably a lot more disruptive through a larger increase in anxiety, than it would be to the student who has confidence in his learning ability and who is doing well scholastically. Another method of control for this variable would be to increase the number of Ss, and then to select only those individuals whose intentional learning scores fell within one standard deviation of the mean for their group. A complementary method could possibly make use of buffer lists of similar material to establish a rate of learning for each S, and then to select only those Ss who had achieved a roughly similar rate of learning to the others in his group. While it may be argued that college students are all of a similar intelligence range, within the college population there is a wide variation in intellectual ability, as indicated by the range of academic marks. Subjects with roughly similar levels of scholastic achievement should demonstrate roughly similar learning scores in these experimental tasks.

In summary, several factors may have influenced the results. The deprivation period may have been too brief and the reward offered too small to permit the arousal of a sufficiently strong D or incentive. Further, had the rate of stimulus presentation, the number of presentations of the stimulus material been more rigidly controlled, and the selection of Ss been made on the basis of certain criteria such as learning ability, or level of intrinsic anxiety, more significant results may have been obtained. The small number of Ss in each group may have been another factor. The wide variability in the scores for each group makes significant results impossible to achieve with such a small number of Ss.

Such suggested controls as these, however, are impossible to apply at this university at the present time, and still retain a sufficient number of homogenous Ss for the experiment. There were only 25 or 30 Ss of the 250 or more students in the introductory psychology classes who have been smoking for at least one year, and who smoke at least 15 cigarettes per day, and who are of approximately the same age range, and of the same sex, and who, finally, are in the preliminary or first year Arts courses.

CHAPTER VI

CONCLUSION

Four experimental groups of ten Ss each were tested for intentional and incidental learning under control, experimentally induced failure, two hour deprivation of cigarettes and reward of cigarettes, and the combination of both failure and deprivation. One half of the Ss were non-smokers, the other half had been smoking for at least one year, and smoked 15 or more cigarettes per day. Twenty Ss were failed on a preliminary figure identification task through the use of false norms and derogatory comments by E, ten of these Ss being smokers, ten non-smokers. Another ten smokers and ten non-smokers were allowed to pass the preliminary task with ease. The 40 Ss were taken in pairs, one of whom was passed and the other failed.

The Ss were then instructed to learn the shapes of a series of 14 geometrical figures, drawn in outline in various colours, by the anticipation method. The deprived smokers were given additional instructions designed to arouse an incentive-oriented set. They were offered a reward of a package of cigarettes for the best performance in a competitive situation, and each was urged to do his best.

When the criterion of one correct anticipatory recital of the series of figures was attained, the Ss were tested for incidental learning by matching the shape and colour of the figures on a matrix. They were then informed of the true nature of the experiment, and the procedures were explained.

Analysis of variance revealed no significant effect of deprivation or induced failure, nor the combination of these two conditions, on either intentional or incidental learning. An analysis of covariance to determine the effect on incidental learning of the number of trials was attempted, but resulted in further reductions in significance. The results were discussed in terms of the reinforcement theory of learning, and in terms of certain variables that require refinements in control.

APPENDIX

THE INCIDENTAL AND INTENTIONAL LEARNING SCORES OBTAINED BY THE FOUR GROUPS IN TERMS OF CORRECT COLOUR RECOGNITIONS (C), THE NUMBER OF TRIALS TO CRITERION (T), AND THE TOTAL NUMBER OF ERRORS (E)

	Control			Failed			Deprived			Failed-Deprived		
	C	T	E	C	T	E	C	T	E	C	T	E
	4	11	56	5	9	58	3	7	79	3	13	63
	1	9	30	4	9	36	3	9	38	4	12	50
	5	12	67	4	11	60	3	9	40	5	14	52
	4	9	32	3	11	44	5	7	27	3	8	43
	2	4	17	5	19	105	2	11	46	4	8	30
	3	7	37	1	16	75	6	10	37	4	9	39
	2	10	42	2	8	36	5	12	80	4	14	72
	3	15	92	4	10	54	4	13	69	3	21	109
	5	10	51	5	14	57	6	12	54	5	12	45
	4	17	80	2	9	30	4	10	33	2	16	76
Total	33	104	504	35	116	555	41	106	503	37	127	579
Mean	3.3	10.4	50.4	3.5	11.6	55.5	4.1	10.6	50.3	3.7	12.7	57.9
SD	1.3	3.53	22.4	1.4	3.41	20.9	1.3	1.85	18.3	0.9	4.03	21.8

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