RAPPORT NR 6 - 1981

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THE INFLUENCE OF DIFFERENT INSTRUCTIONS UPON THE SOLUTION OF TWO- AND FOUR-CHOICE CONCEPT IDENTIFICATION TASKS

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M A G N E   N Y B O R G

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An experimental evaluation of some theoretical constructs

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FOREWORD

The data presented in this report have been collected through several years, in the period from 1975 to 1977; in part this has been made possible only due to the financial support offered by the Norwegian Research Council for Science and the Humanities and by Oslo University (via annuum contributed to the Institute of Educational Research). For these kinds of support I owe thanks.

Ing. Retteråsen and Ståle Skogstad have made important contributions by providing the many details of a learning panel and stimulus presentation, and T. Lyngstad and T. Hansen have assisted in performing the experiments.

I INTRODUCTION: INSTRUCTION IN TEACHING.

The word teaching has repeatedly been replaced by the word instruction (e.g. BRUNER, 1966), which is central in the title of the present work. Instruction, as used within the field of learning psychology and other fields of experimental psychology, has been used to denote the preparing of subjects for solving a task on his own. That is, by some kind of independenly performed "discovery" or "induction".

This meaning of the word is, of course, included among the different "methods" of teaching. Teaching also includes explanations, which usually intend to replace the student's own problem solving, however. Thus instructions often have the function of creating, in student or learning person, a set (an instructional set) for solving the task. They also intend to explain the experimental procedure, etc.

In all the possible meanings of the word instruction, one aspect seems to be of crucial importance: that is, the student's or subject's understanding of the instruction. It has frequently been assumed, in experiments, that instructions create equal conditions in students for solving tasks or learning by explanations. This, of course, depends entirely upon how completely an instruction has become understood by each person instructed.

In selected and homogeneous groups like advanced or graduate students, an assumption of equality can probably be defended in many cases. In a primary or secondary school class, in which no selection has yet been performed, a heterogeneity in individual preparedness for understanding instructions must be presumed. This can be said to be a documented fact.

If only parts of an instruction (or explanation) are understood by the learner or student, he will be in an unfavorable learning condition, as compared with those who have entirely understood the instruction. This, of course, applies only when the instruction is intelligible - to be understood.

But if the instruction can be agreed upon as being of "high quality" in this sense, the reader's or listener's degree of preparedness (learned readiness) for understanding it will be a critical determiner for learning a task or solving a problem.

In the experiment to be presented in following sections, an analogy of two extreme "understanding" conditions has been created by omitting, in one experimental condition, a presumedly important part of the instruction. The omitted part is presumed to simulate a not-understanding condition; that is, as if this part of the instruction had been really read for a person who was not prepared - through earlier learning - to understand it.

When really read to another group of subjects, this experimental condition can be coordinated with the ordinary assumptions made concerning students; that is, that they are wholly capable of understanding instructions.

The omitted part of the actual instruction was not necessary for solving the task. It could be supposed to facilitate the task solution, however, by supporting a theoretically defined S-analysis (stimulus-analysis) process. This process will be more extensively described in later sections. In outline S-analysis can be described, however, as a multiple abstracting or coding of stimulus "features", by the learner, in order to detect and select those which are relevant for a correct task solution. That is, in order to 1) be able to selectively generalize a response to an entire class of stimuli and 2) be able to selectively discriminate between members of two coordinated classes.

Thus it has been expected that the hearing an instructional description of such stimulus features - or values along stimulus-variables - would facilitate the learning person's stimulus-analysis, while the process of selecting the relevant stimulus-variable should remain uninfluenced by the instruction.

Since the combined stimulus-analytic and -selective process has been assumed to be reflected in the not-learned part of two-state larning curves (BOWER & TRABASSO, 1964), differences in the length of this part of the learning curve should be expected as a result of two distinct instructional conditions, therefore.

Thus, the possible impacts on concept identifications of being adequately or inadequately prepared for understanding instructions, is of main interest in this experiment. That is, degrees of preparedness in terms of preceding learning and storage. An evaluation of degrees of task difficulties, regardless of the student's preparedness, is another main concern.

Both topics are supposed to be of importance for the teacher, whose main task is to plan and arrange optimal conditions for learning in students.

II LEARNING TASKS AND PRESUMED PERFORMANCE DURING LEARNING

Concept Learning (CL-) tasks

The tasks to be described in succeeding paragraphs should be denoted concept learning (CL-) tasks because the learning persons are expected to order the set of 32 dissimilar (and partially similar) discriminative [1] stimuli into two subsets or classes (conditions 1.1 and 1.2) or into four subsets (conditions 2.1 and 2.2), each of which should be identified by a common label or response (NYBORG, 1973, 1978, chapt. II.1).

Concept identification tasks

When solved by advanced students of education,[2] the tasks should, in addition, be considered concept identification or concept utilization tasks; that is, a sub-class of CL-tasks.

The latter notion is based upon the assumption that the concepts and class names, necessary to understand an instruction that would convey an immediate solution, have been learned and many times overlearned by the subjects (H:H. KENDLER, 1964; NYBORG, 1978, p. 60).

II.1. The first experiment

Discriminative stimuli: S^D

The entire set of discriminative stimuli, common to all task conditions, is displayed in figure 1, page 2. They were presented to small groups of subjects, one at the time and repeatedly in the indicated fixed order during the learning period.

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1) Stimuli preceding and constituing occasions for "emitting" instrumental responsed.

2) Or other persons on a higher level of development.

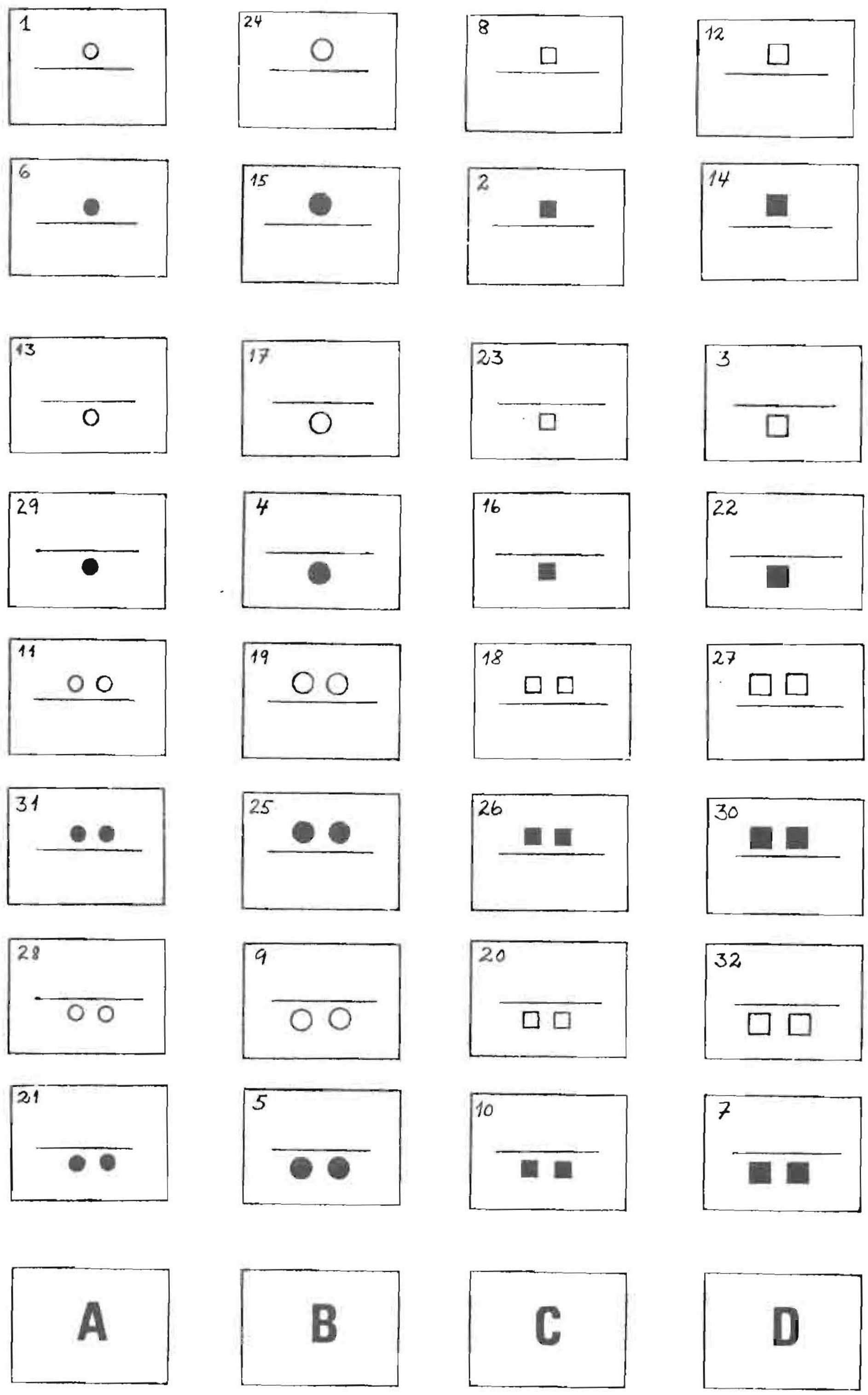

Figure 1

Set of discriminative stimuli (S^D: 1-32), set of consequent stimuli (S^C: letters A and B, or A,B, C and D, presented after the writing response), and order of presentation of all series, used in the experimental tasks.

The stimulus set may be condsidered a set of artificial, pictured objects; artificial objects were used, because natural objects would provide too easy tasks for the actual subjects.

The "objects" can be ordered into subsets (classes, categories) according to two values along each of five stimulus variables; i.e., according to similarity and dissimilarity in shape, colour, size, location, and number (NYBORG, 1978, chapt. II.2).

Responses

The subjects were instructed to identify the class membership of each stimulus by writing a letter in a response sheet, that is, in a rectangle marked by the same number as S^D. The response sheets were assembled to booklets according to the number of series (1-32) used in an experiment.

Condition 1

In one experimental condition (the two-choice task), the letters A and B should be used to "name" classes or indicate class membership.

Condition 2

In another condition (the four-choice task), letters A, B, C and D should be used for the same purpose.

Response sheets

An example of each of the conditions 1 and 2 response sheets are given in the appendix. The numbers correspond to the numbers used to mark S^D.

"Feedback" stimuli: S^C

In the lower part of fig. 1 a set of "feedback" stimuli (letters A, B, C and D) is presented.

Following the presentation of each S^D and the subject's response to it, a letter was presented in order (1) to feed back the correct class "name" to the subject, and (2) to provide an opportunity for him to judge whether his choice was correct or incorrect.

A feedback indicating to the subject that his choice of "name" was correct, is assumed to be a wanted consequence of his act. That is, it has been presumed an approximately equal motivation in all experimental groups to obtain corrects, avoid incorrects.

Emotional disturbance of task solution

Stronger emotional reactions to frustrations connected with incorrect choices, should probably reduce the subject's momentary capacity for solving the task.

Emotional reactivity, as a subject variable, probably differed among the individuals participating in the experiment. But there is no reason to believe that emotional reactivity has been unevenly distributed among axperimental groups.

However, if one task condition is more difficult than another, in the sense of providing a higher probability of being incorrect, it is reasonable to assume that task solution is more difficult to reach by the mere fact that emotional interference in the person is more likely to occur.

This additional task difficulty should probably be seen as an inevitable source of between-group variance when task difficulty per se differs significantly.

The tasks used have been labeled two-choice and four-choice tasks, indicating a choice between two or four class labels (letters) or responses, respectively.

Condition 1: The two-choice task

A correct solution of the two-choice task could be reached by "naming" all the "large" objects A, all of the "small" objects B (fig. 1, p. 2).

In other words, size had been made the relevant stimulus variable; colour, shape, location, and number had all been made irrelevant for task solution. Thus, the proportion of the relevant S-variable to all S-variables is 1/5. The same proportion (1/5) has been used by BOWER in a concept identification task which later will be referred to (BOWER & TRABASSO, 1964).

An important part of the subject's task, therefore, would be to selectively attend to similarity and difference in size, in order to be able to classify and name S^D correctly.

Condition 2: The four-choice task

A correct solution of the four-choice task could be obtained by giving the label A to all "large" and white objects, the label B to all small and white objects, the label C to all "large" and black objects, and the label D to all small and black objects.

Thus, two stimulus variables (size and colour) had been made relevant for task solution, while three variables (i.e. shape, location, and number) remained irrelevant.

That is, the amount of relevant similarity within each sub-set and the amount of relevant difference between sub-classes had been increased conjunctively, compared to condition 1; irrelevant similarities and differences had been reduced accordingly.

When this fact is seen in isolation, it should give a prediction of easier of faster task solution, in condition 2 (BOURNE & HAYGOOD, 1959).

However, the number of sub-classes and the corresponding number of response alternatives are doubled, in the condition 2 task.

This doubling could have been performed by increasing the number of values along one relevant stimulus variable, e.g., by using four size values instead of two.

In that case, the subject's task should still include the selection of size from a sample of five stimulus variables. The correct pairing of four different size values with a corresponding number of different letters should be a more time-consuming or more difficult problem than combining two sub-classes with two different responses, however (BOWER & TRABASSO, 1964).

In addition, the present four-choice task can be effectively solved only by selecting one combination of two stimulus variables (i.e., colour and size) from a sample of ten possible combinations.

Recently it has been presumed that increasing relevant similarity and difference should reduce the four-choice task difficulty. It is now reasonable to offer an opposite prediction, which seems by far stronger: that the four-choice task is considerably more difficult than the two-choice task.

That is, the combined prediction of facilitation and delay, summarize to the prediction of a significant delay of condition 2 task solution.

All-or-none performance

Condition 1.

Based upon earlier investigations and mathematical formulations (e.g. BOWER & TRABASSO, 1964; NYBORG, 1970 and 1971), we should expect that the two-choice task be solved in an all-or-none manner.

That is, the learning person should for a relatively long period remain in an unlearned or -none state, operationally defined by a consistent chance level of performance (probability of being correct (or wrong) not significantly different from .5).

After that period he should quickly enter a learned state.

Instructions

In concept identification experiments, the instruction given to subjects preceding task presentation and learning, usually includes a description of the nature of a concept identification task, a definition of the stimulus set in terms of stimulus variables and values along stimulus variables, the response set to be used, and the consequences to be fed back to the subject after each response.

Such instructions were given to subjects in the present experiment, as well (see appeneix).

The crucial experimental variable, however, was the distinction between two levels of instructions.

Conditions 1.1 and 2.1

In one condition (.1) the stimulus set was defined in terms of values along five stimulus variables; that is, <u>shape</u> - squares, circles; <u>colour</u> - black, white; <u>location</u> - above or beneath a horizontal line; <u>number</u> - one or two objects; and <u>size</u> - "large" or small.

Conditions 1.2 and 2.2

In another condition (.2) this part of the instruction was omitted, leaving to the subject himself to detect which similarities and dissimilarities could be used for classification.

In all other respects the instructions for conditions 1.1 and 1.2, for conditions 2.1 and 2.2, were identical.

Condition 1 and 2 instructions differed according to task differences (i.e. number of classes and choices), but were otherwise alike.

In summary,

advanced students of education have been committed to three experimental CL conditions, combined into a 2x2 factorial design.

One experimental variable includes the distinction between a two-choice and a four-choice task.

Another experimental variable includes two levels of instruction, one of which was expected to shorten a stimulus analyzing process.[1] (1.1 and 2.1 vs. 1.2 and 2.2).

II.2 A replication, performed under somewhat changed conditions.

In the experiment just described, S^D and S^C were presented by means of a recorded TV-program to subgroups of advanced students of education.

The subject's responses consisted of writing the letters A or B (or C or D) on response sheets, exemplified in the Appendix. This procedure allowed for cheating by writing responses after S^C had occurred occurred (the correct response, functioning either as S^C+ or S^C-.) Such cheating was actually detected - in terms of extreme discrepancies - in the responses of those persons who were committed to the most difficult conditions of learning (cond. 2.1 and 2.2). For these reasons, the data on learning in conditions 2.1 and 2.2 will not be reported in Chapter III.

A replication was later performed, in which subjects learned individually, while sitting by a learning panel (Fig. 2) designed, except in the many technical details[2], by the present writer.

S^D could be projected from the upper of the slides projectors, located behind the panel, to screen no.

1) See chapt. III, p. 20.

2) The many technical problems were solved by the engineers RETTERÅSEN and SKOGSTAD:

1. Immediately after such a presentation (of 3-4 sec. duration), the two actual response alternatives (A and B) were presented by means of a lower projector to screen no. 2, allowing for a total presentation of seven pictures. Subjects had been instructed to press one of two press buttons, located beneath the letters A and B (Fig. 2). When the choice was correct, a green lamp would be lit; correspondingly, when an incorrect press had been performed, the red lamp was lit.

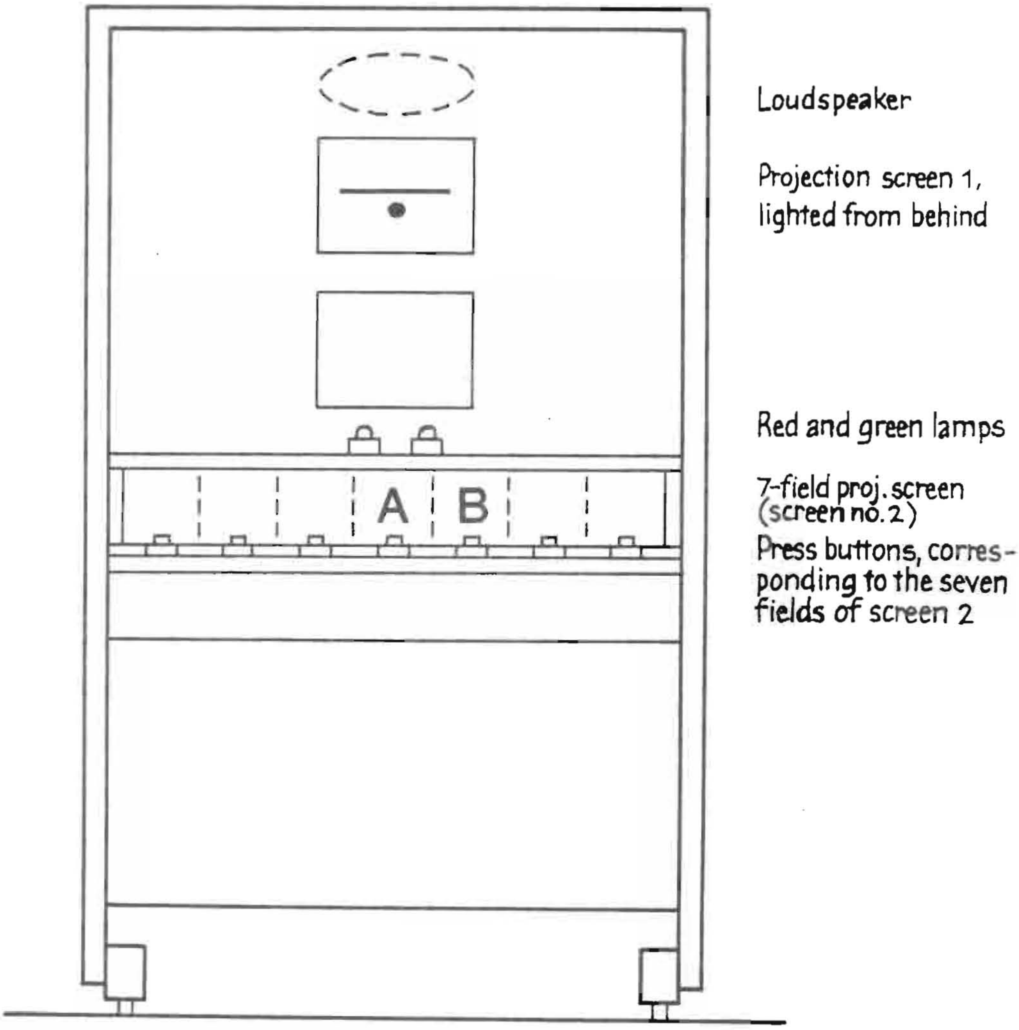

Figure 2.

Learning panel as seen from the front side, operated by the subjects.

The time interval between stimulus presentation and response "emission" (the latency interval) was measured by a time-unit counter.

The subjects were first-year students in a teaching training college. This change in sampling of subjects can hardly explain all of the greater difficulty in learning manifested in the results from experiment 2. It may rather be interpreted to mean that the new conditions of learning produced states within some of the persons which interfered with favorable solutions.

Thus, the condition of being alone with the experimenter and his assistant, being requested to follow a strictly programmed routine, etc., seemed to produce emotional insecurity in Ss belonging to both of the experimental groups; and this state seemed to become reinforced by experiencing the signals of incorrect. In subsequent interviews, therefore, it was reported by some subjects belonging to both groups that they had not completely analyzed stimuli. Those who reported the relevant S-variable (size) and the correct solution, had usually solved the task when sitting at the learning panel.

Again it should be emphasized, therefore, that an interpretation of experimental results must allow also for an explanation in terms of possible emotionally conditioned disorganizations and even breakdown in morale. In school this problem is well known, especially in those who <u>need</u> to cheat; i.e., those who have not adequately learned what may be required in order to solve tasks independently.

A more complete description of the learning panel, sheets of response recording and instructions are available in the Appendix.

III. TASK SOLUTIONS THEORETICALLY INTERPRETED IN TERMS OF STRUCTURES, FUNCTIONS, AND PROCESSES IN THE LEARNING PERSON. PREDICTIONS.

III.1 Task solutions theoretically interpreted.

Introduction

It has been suggested that a consistently correct task solution can be reached by subjects when they first have selectively attended to size (the two-choice task) or the correct combinations of size and colour (the four-choice task).

Beyond that, the subject must selectively associate the correct letters to the corresponding, relevant values, selectively discriminate between relevant values, and selectively generalize along the relevant stimulus variable (or variables) and values.

The preceding conclusions are based upon a thorough task analysis (NYBORG, 1978, chapt. III).

Based upon earlier experiments with similar tasks and comparable subjects, it can be predicted that the subjects' performance during learning should follow an all-or-none pattern, as formerly described (p.6; BOWER & TRABASSO, 1964; NYBORG, 1971).

Condition 2 subjects, however, should be expected to start on a lower probability of being correct on each trial, and the all-or-none performance should not be clear-cut for these subjects.

Finally, it has been suggested that the -none or unlearned state should last longer (take more trials) in subjects committed to experimental condition 2 than in subjects committed to condition 1.

Further and more precise predictions will be offered in a later section (chapt. III.2).

In succeeding paragraphs a theoretical model will be advanced in order to explain and give coherence to the conclusions and predictions given.

The model is more completely described and validated elsewhere (NYBORG, 1978, chapt. IV), and will only be outlined in the present paper.

Within this context, we shall more thoroughly examine two constructs used by the present writer to explain concept learning; that is, two processes labeled stimulus analysis and selection.

These constructs will be related to by far the most timeconsuming and operationally defined unlearned (or guessing) state of performance.

That is, these processes should confidently be considered the more difficult processes in concept identification (- or the transfer of earlier learned concepts and conceptual systems into the solution of a relatively new, present problem).

Before we continue this analysis, the theoretical model of a learner and the inferred learning processes should be presented in outlines.

The model

The model of a learning situation (fig. 3, p. 16) includes a set of components which can be observed and operationally defined by the experimenter; that is, ORs, S^D, R, S^C, S^F, all of which are located on the lefthand side of fig. 3.

The learning person, symbolized on the right-hand side of fig. 3 by a large rectangle, has - of course - a set of receptor organs and a set of effector organs which have not been "modelled" in detail.

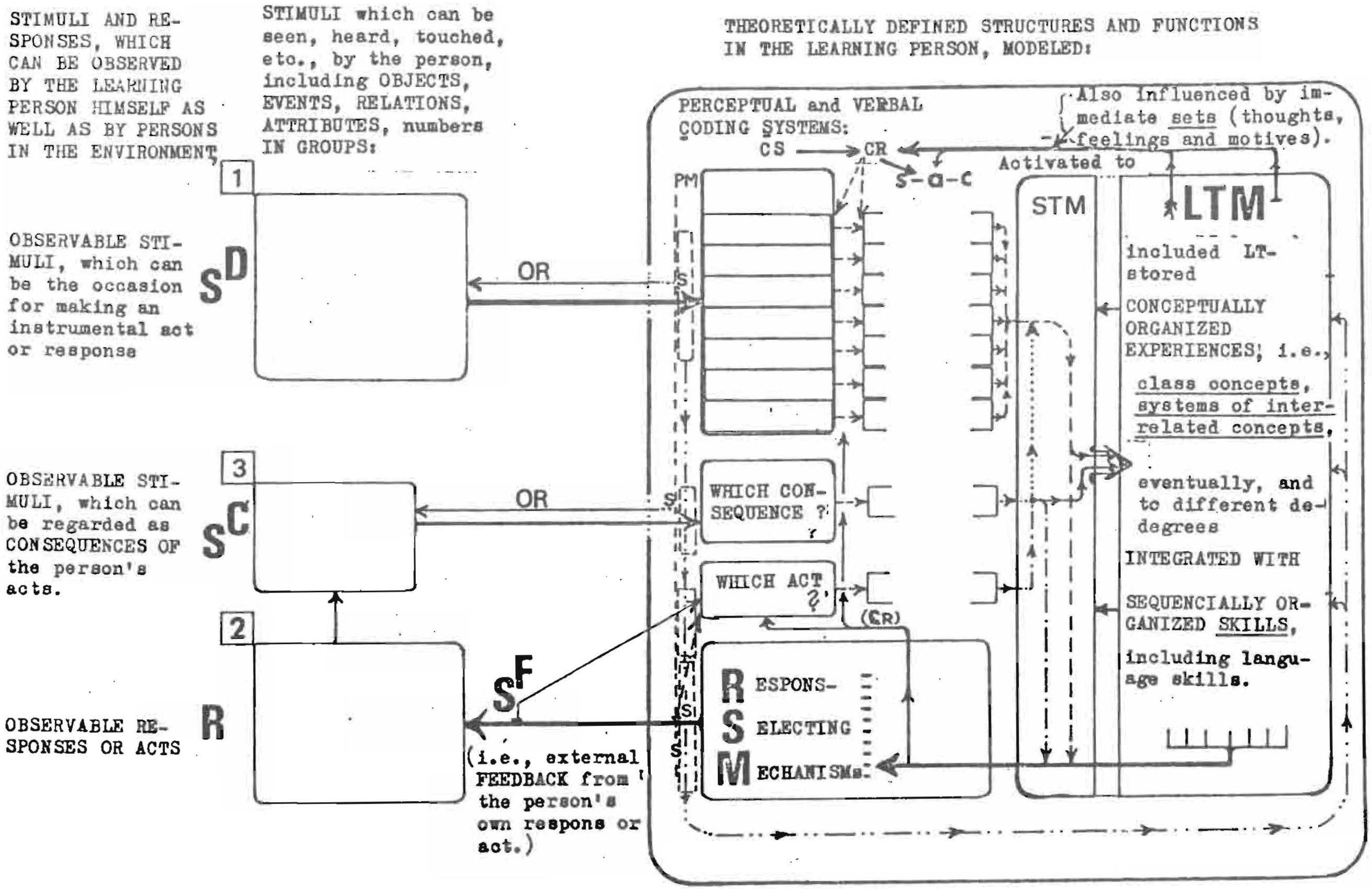

Figure 3.

General model of a learning situation, including external and observable components and inferred components in the learning person. See text for an explanation of abbreviations.

The reader's attention is drawn to the learner's posession of a

1) a perceptual system, i.e., long-term stored experiences and different kinds of sets activated to coding systems (CS) and coding responses (CR),
2) a set of memory or storage systems, that is, Primary Memory (PM), Short Term Memory (STM), and Long Term Memory (LTM), and
3) a Response Selecting System (RSM),

all of which are essential parts of a person's learning system.

The emotional and motivational systems which constitute parts of a human learning system, are supposed to be tied mainly to perceptual and storage systems.

That is, we do not include an observation of emotional responses, and will not make assumptions concerning their originally reflexive connections to specific classes of "eliciting" stimuli.

Neither do we include assumptions about primary or unlearned motivational systems.

The perceptual system, represented in the upper and left-hand part of the symbolized person, must by necessity be tied to the function of sense organs as well as to the memory systems.

OR

The person can obtain sensory contact with surrounding stimuli (including feedback stimuli (S^F) from his own responses) by means of instrumental observing or orienting responses (OR, e.g., turn head, fixate eyes, manipulate, etc.).

These responses constitute essential parts, though only one component of attention.

A complete perceptual act, of course, includes an orientation towards, focussing upon, and sensation of stimuli; but a greater emphasis is placed, in the present model, upon how the person interprets or codes stimuli in terms of earlier experiences, stored in long-term memory (LTM); and in terms of the flow of events (emotions, motives, sets, and thoughts), presently taking place in the person.

Memory systems in the service of perception PM

A "perceptual" or physiological memory (PM) of stimuli has been shown to exist for some time without being thus coded (SPERLING, 1960), provided that it is not interfered with by new sensory experiences (AVERBACH & CORIELL, 1961).

LT-stored experiences activated

Such uncoded memory "images", which can be established during even extremely brief stimulus presentations (SPERLING, 1960), may be assumed to activate differentially organized experiences, stored in LTM (arrow from PM to LTM).

Thus, activated long-term stored experiences can be utilized for the purpose of coding stimuli (arrows from LTM to different components of the perceptual stystem).

s-a-c

The final chain or component of perception has been labeled stimulus-as-coded (s-a-c) in the model (a term used by LAWRENCE, 1963).

CS and CR

It is conceived of as the consequence of coding responses [1] (CR) generated within the frame of one or several coding systems (CS).

Comparisons by means of STM

A flow of perceptions can be conceptualized as a sequence of s-a-c's (or s-a-c's in parallel), re-

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1) Coding response is used, because the event is assumed to produce a consequence in the person, i.e., s-a-c. However, CR is considered a perceptual act, frequently based upon motor acts, verbal-motor acts, etc.

tained and eventually compared by means of a short-term memory (STM).

Memory span denotes the quantitative limits of STM, assumed by MILLER (1956) to be within 7 ± 2 "chunks" or memory units.

Beyond these quantitative limits, the size of and coherence within the memory unit can be assumed to decide the amount of information which can be kept in STM at the same time and eventually be rehearsed successively by the person.

Determinants of CSs and CRs

What will constitute coding systems and coding responses in each case, depends, in part, upon the nature of the actual task; and in part upon the nature of and the condition in the organism solving the task.

In a healthy and normal person, they should always be intimately related to task stimuli; but we should be safe in concluding that they also relate to what is already activated in the person prior to task stimulation and to which kinds of LT-stored experiences are activated by stimuli in the learning person.

The model applied to the present task and Ss

In the actual persons and learning conditions, it should further be safe to assume that conceptual organizations and language skills constitute important LTM-bases for coding stimuli, as well as for responding to them.

RSM

By receiving and accepting an instruction (instructional set), the person's response set had been restricted to the choice between writing A and B, or A, B, C and D, in the two-choice and the four-choice condition, respectively.

The response selecting system (RSM) as well as the coding systems or the total perceptual system, are assumed to be tied to LTM-organizations, as a structural base; the former system must - by necessity - also be tied to effector organs (e.g., in throat, mouth, hands, arms, etc., and the corresponding psycho-motor areas in the central nervous system).

Language skills are supposed to serve response selecting as well as perceptual coding systems.

Stimulus Analysis common to two- and four-choice tasks

In order for the person to perform a complete <u>analysis</u> of S^D in terms of similarities and dissimilarities in shape, colour, location, size, and number, the corresponding conceptual systems must be stored in LTM and activated by stimuli to perceptual and verbal coding systems (figures 4 and 5, pages 15 and 16).

The process of stimulus analysis, therefore, is conceived to be a utilization of coding systems and the corresponding coding responses in order to detect or code which stimulus variables [1] and values along stimulus variables are represented in the S^D-set.

Stimulus analysis may be assumed to proceed in the person without his making observable responses.

It can sometimes be verbally reported by the person, however, if he possesses the necessary language skills (LTM-stored skills, integrated with conceptually organized experiences).

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1) The concept of stimulus variable has been discussed in a broader sense in NYBORG, 1978, chapt. II.215.

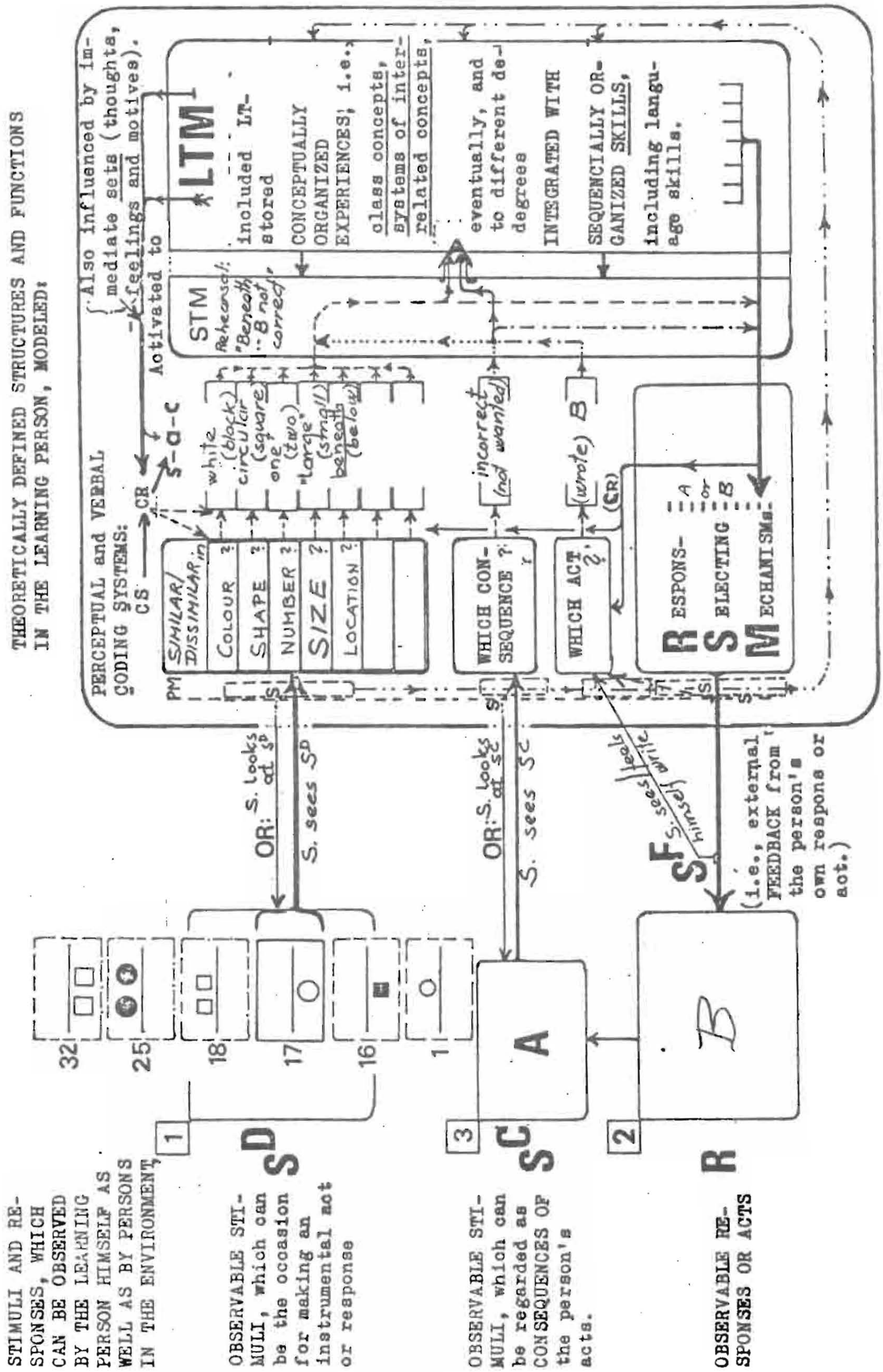

Figure 4

One cycle of the two-choice task-solution pictured in terms of operationally and theoretically defined events.
The person (P) has selected location (beneath..) as a base for writing B, which, in turn is coded and eventually rehearsed (STM) as incorrect. P must reselect.

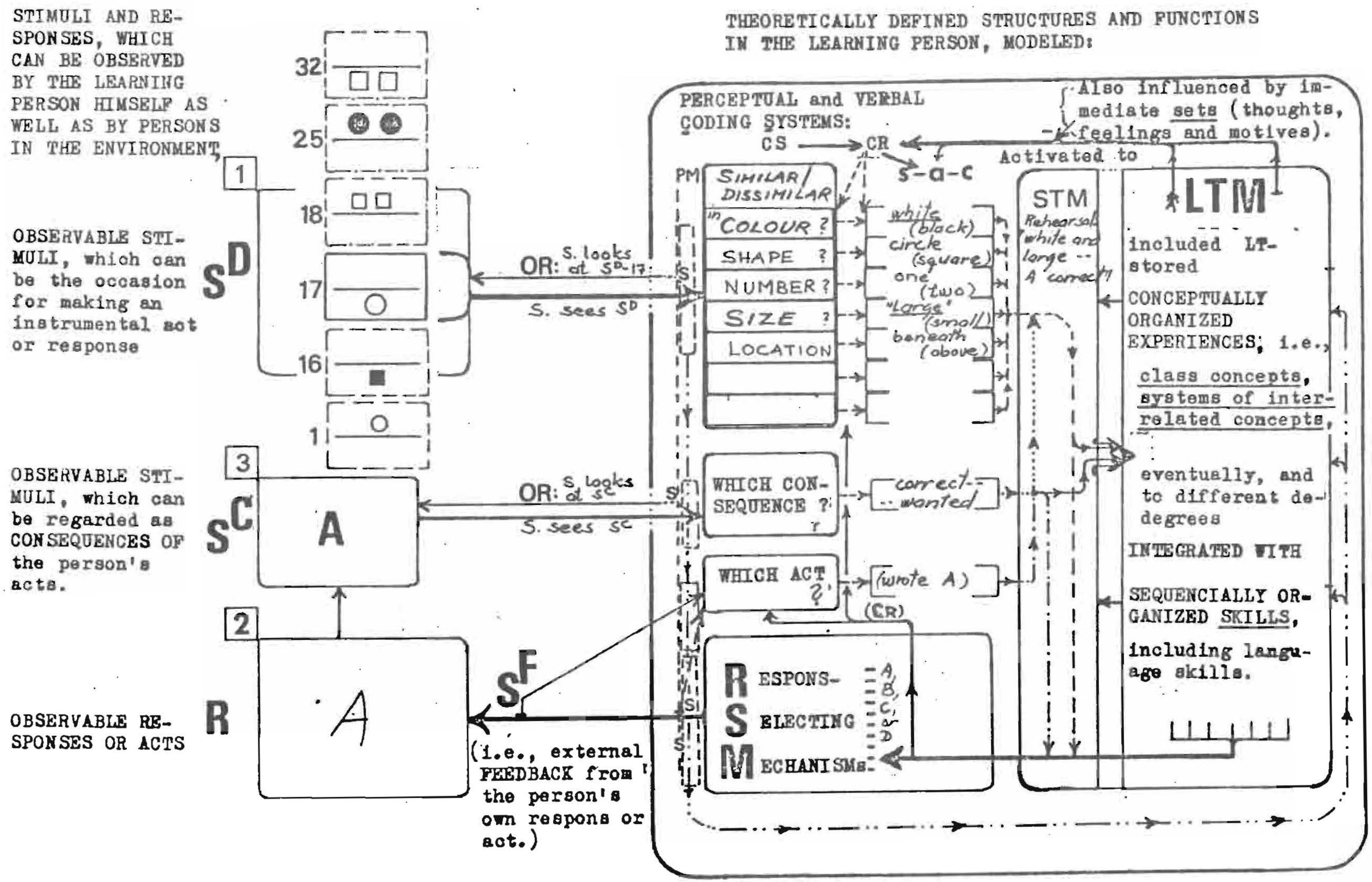

Figure 5

One cycle of the four-choice task-solution pictured in terms of operationally and theoretically defined events.
P has selected colour (white) and size ("large") as a base for writing A, which is coded and rehearsed as correct.

Stimulus analyses, peculiar to conditions .1 and .2.

A verbal instruction, including a definition of stimulus variables (and values), given prior to task presentation, (cond. 1.1 and 2.1), should be expected to shorten the stimulus analyzing process, provided that the instruction conveys the necessary conceptual meanings to the learning person.

The latter notion is regarded an important one for classroom learning and teaching (see a later discussion, in chapt. V).

The process of Stimulus Selection

When stimuli have been partly or completely analyzed by the person, a successive testing of coding systems in order to detect the relevant stimulus variable or variables can start in the person.

This is usually possible only when stimuli are responded to and feedback stimuli are coded by the learning person in terms of correct and incorrect (presumed to be wanted and not wanted consequences, respectively).

The successive testing of coding systems and responses against a schedule of coded feedback stimuli and consequences in order to select the task-relevant [1)] coding system, will be labeled a stimulus selection process, in the present paper.

While stimulus analysis is assumed to depend mainly upon the activation of LTM-stored experiences, stimulus selection also involves a comparison of sequences of events by means of STM, in order to detect task-relevant relationships between them.

Stimulus Selection and STM

That is, sets of events, including cycles of coded S^D, R, and S^C, must be remembered and compared within limited time intervals in order for the person to

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1) i.e., the coding system which, when used as a base for responding, gives the maximum number of corrects.

detect which combinations of S^D - s-a-c's and responses produce a consistent pattern of corrects.

The number of succeeding s-a-c's quickly surmounts the limits of 7 ± 2, suggested by MILLER. The limitations of STM, therefore, provide heavy restrictions upon the comparisons necessary in order for the person to select the task-relevant coding system or relevant coding systems. However,

Learning, including integrations, organizations, and storing of s-a-c's, can occur when the task-relevant CS or CSs are selected, and the corresponding S^D - s-a-c's are correctly paired or integrated with S^F - s-a-c's.

As has been previously mentioned, the task of performing a complete stimulus analysis should be equal for subjects in conditions 1.1 and 2.1, and equal for conditions 1.2 and 2.2, since the same set of S^Ds is used.

Conditions .1 and .2 are assumed to differ according to the levels of instruction applied, however.

The selection of one relevant coding system among five possible (condition 1, fig. 4) should be easier to obtain than the selection of one combination of two coding systems among ten possible combinations (condition 2, fig. 5).

Further, the integration of two S^D - s-a-c's within one coding system with two response-alternatives, should take shorter time (or fewer trials) than the integration of four dual s-a-c's within a combination of two coding systems with the corresponding four response alternatives (figures 4 and 5).

While translated into behavioral predictions, the chance level performance as well as the transition from unlearned to learned state of performance, should take longer time or more trials in condition 2 than in condition 1 subjects.

On the other hand, the chance level performance should be shortened by an instructional set (cond. 1.1 and 2.1), by means of which the subject can anticipate the kinds of stimulus variables and values represented in the S^D-set.

If the latter statement is translated into theoretical terms, it can be assumed that the process of analyzing discriminative stimuli is made considerably shorter by means of a verbal instruction, in subjects belonging to experimental groups 1.1 and 2.1.

That is, we presume that they from the very beginning can start a systematic stimulus selection, since they have already had activated the full repertoire of coding systems necessary for analyzing stimuli.

Emotional complications

Since condition 1.2 and 2.2 subjects are expected to stay for a longer time on a chance level, and because all condition 2 subjects are expected to perform initially and for relatively long time on a low probability of being correct, it is assumed that these subject groups are more subject to emotional interferences with effective task solutionl.

III.2 Predictions, summarized

Our predictions can be derived from what has been discussed in chapters II.1 and III.1, and from the experimental results obtained by ZEAMAN & HOUSE (1963), BOWER & TRABASSO (1964), and NYBORG (1971, chapt. V).

Some important aspects expected to become reflected in the data of learning conditions 1.1 and 1.2 are represented in Figure 6, taken from NYBORG (1978).

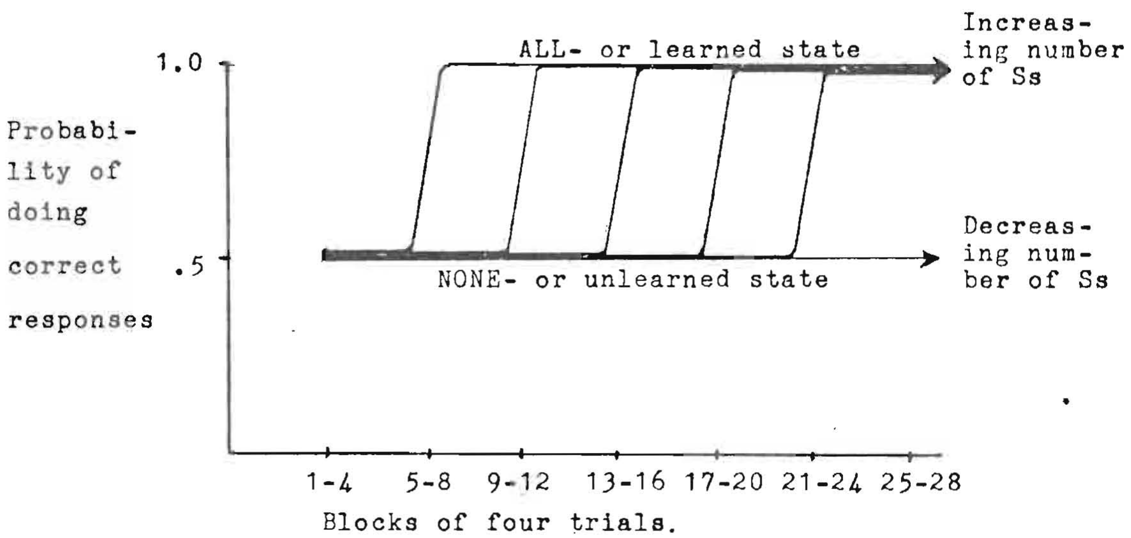


Figure 6

Transition from none- or unlearned to all- or learned state of performance in a two-choice concept identification task.

III.21 All-or-none performance

The horizontal line at the probability of .5 in Figure 6 represents a chance or guessing probability of being correct in a two-choice task. In a four-choice task, a less clearcut two-level performance (.5 or 1.0, respectively) should be expected. The latter statement is based upon the discussion just referred to (in Chapter II.1), and upon data presented by NYBORG (1971, Chapter V) on the solution of three-choice tasks.

Prediction 1.1 The performance observed in two-choice concept identification tasks can be represented by a two-level, all-or-none learning curve like that presented in Figure 6; that is, when blocks of trials rather than singel trial choices are plotted in terms of 1 and 0 for correct and incorrect responses, respectively.

Prediction 1.2 When four alternative choices, corresponding with four combinations of two binary S-variables are involved, the two-level performance will be less clear, in similar concept identification.

III.22 Length of the none-line

The length of the "none"-line, representing the chance (.5) probability in a two-choice concept-identification task, can be assumed to reflect one of or a combination of the two following main factors:

1) The length of this line (the none-state) is a manifestation of task difficulty. The longer the line, the more difficult the task. This statement may be based upon comparisons of task difficulty as related to the ratio of relevant to irrelevant stimulus variables (BOURNE & HAYGGOD, 1959). In the present two-choice task, this ratio is held constant (R/I=1/4). Based upon data obtained by BOURNE & HAYGOOD (1959), the four-choice task should prove to be more difficult than the two-choice task, however. Conditions 1.2 and 2.2, involving an omission of analysis-supporting parts of the instruction, should similarly be expected to increase task difficulty.

2) The length of the none-state can also be expected to reflect individual or group differences in preparedness for learning the task; e.g., when Ss are subgrouped according to IQ (ZEAMAN & HOUSE, 1963), or prior learning (NYBORG, 1971), emotional reactivity, etc. A subgrouping according to such variables has not been performed in the present study.

The two statements given above can be integrated into one theoretically formulated statement, which also incorporates the relations between conditions 1 and 2 (one versus two choices): The length of the none-learned state of performance reflects the difficulty of a combined stimulus-analysis and -selection process.

Since 1) a difference in experimental instructions is expected to create a difference in the analysis or multiple coding process, and 2) since analysis and selection may be thought to be more difficult in the four-choice condition, a second set of predictions can be formulated:

Prediction 2.1 The none-learned state of performance will be longer - or takes more trials - in condition 2 (four-choice) than in condition 1 (two-choice) subjects.

Prediction 2.2 The none-learned state will be longer - take more trials - in conditions 1.2 and 2.2 subjects than in conditions 1.1 and 2.1 subjects.

IV EXPERIMENTAL RESULTS

IV.1 Introduction

Not all data, necessary to evaluate the predictions presented in section III.2 have been reliably obtained (ch. II.2). Thus, only a small and probably unreliable set of data are relevant for predictions 1.2 and 2.1. Data concerning prediction 2.1 will not at all be reported, therefore. They clearly indicate that a propoer experimental test might have supported the prediction, however.

On the other hand: Sets of data concerning 1) the verbal reports given by Ss after an experimental session, and 2) the latency data have only preliminary been included in the present report.

Verbal reports

The first set of data, mentioned above, indicates that reports reflecting a more complete coding or analysis of stimuli in terms of S-variables, were most frequently given by persons who had solved the task. When reports of such analyses were incomplete in a task-solving person, the <u>relevant</u> stimulus variable was usually included among those mentioned. Data on 46 Ss have provided the basis for our report of this over-all impression.

Latency data

Data concerning latency - or delay of responses - were obtained only in the second experiment (24 Ss). They have not been thoroughly analysed yet, but they give so far no clear or systematic pattern when related to the series of correct and incorrect responses.

Thus, both a reduced and an increased delay of response could follow an <u>incorrect</u> choice. Similarly, both an increased and a reduced delay could follow a <u>correct</u> response. Within some contexts, during the experiment, a longer delay of response (e.g., beyond 2 seconds) could reasonably be interpreted to mean that a subject used the time to elaborate upon such questions as "why was this choice invorrect?" or "why was it correct?" Sometimes, however, a longer delay seemed to reflect an emotionally conditioned block or disorganization, in the subject.

Similarly a shortened delay could be interpreted to mean different "things" within different contexts; that is, as reflecting either an emotionally disorganized, cognitive state in the subject; or a security, due to a cognition of having solved the task, in other persons or states of task solution. In addition, other interpretations might of course be possible.

What can be said conclusively, at the present stage of data processing, is that latencies varied considerably, both within and between persons and experimental subgroups.

IV.2 The all-or-none performance evaluated.

Two-choice data

In figure 7 is available for inspection a typical way of plotting data when all-or-none performance is of main interest; that is, in terms of mean data for blocks of trials, rather than for single trials. The plots (+) represent only persons who have still not learned or solved the task.

The "curves" which lead from the none-state to the all-state reflect transitions of single persons or subgroups of persons from a none-learned to a learned state of performance. This happens at different points - or after different number of trials or blocks - for different persons.

The plots are based upon the performances of the 24 subjects who participated in experiment II. A similar "curve" might have been displayed for experiment I data, but has not become included in the present report.

It can be seen that the none-state of performance is represented, in figure 7, by a (mean) horizontal line at a level slightly above the chance or .5 level of performance:

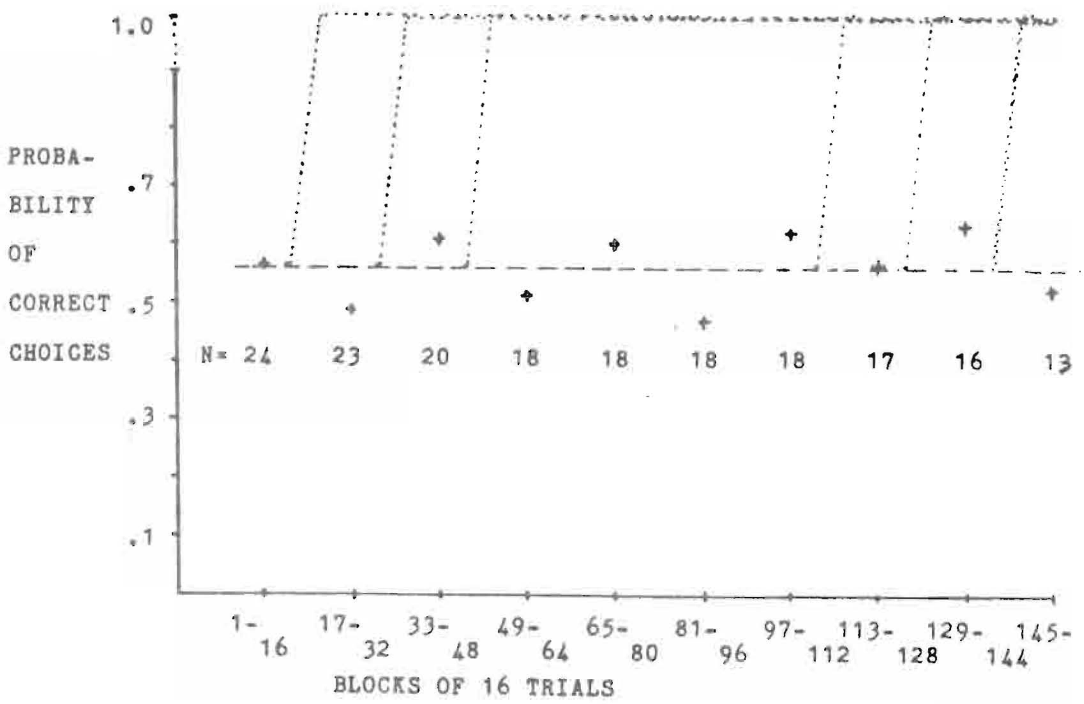


Figure 7

Probability of correct choices in a two-choice concept identification task, based upon data for initially 24 Ss, decreasing to 13 Ss after ten blocks of trials.

A large proportion, i.e., 13 of 24 persons, did not enter the learned state within the 160 trials available in this experiment. Thus, 160 trials appeared to be a too small number of trials for solving the task under the experiment II conditions. The number of 160 trials was chosen in advance, on the basis of experiences from experiment I, in which 96 trials produced a higher proportion of learners. Once the number of 160 had been chosen, it had to be maintained throughout the entire experiment, however.

Four-choice performance

Figure 8, is based upon data for four persons participating in experiment I and committed to the four-choice (2.1 and 2.2) conditions of learning. The data presented in figure 8 provide only a preliminary indication therefore, and can of course not be taken as a sufficient support for prediction 1.2.

It can be seen that the plots are more irregular, in the present figure, thus reflecting a minor sample-size. The mean probability of correct choices is approximately .30 as compared with a mean probability of .56 in the two-choice task:

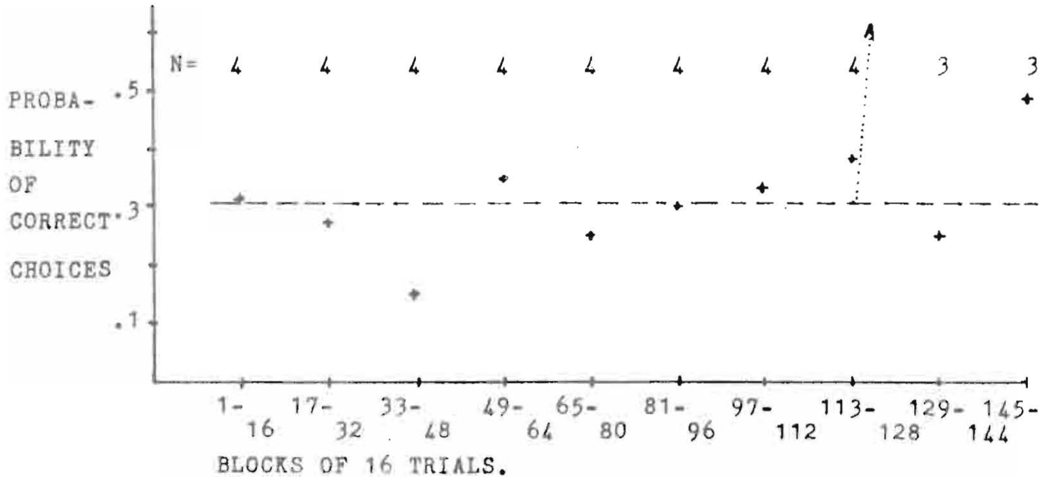


Figure 8

Probability of correct choices in a four-choice concept identification task, based upon data for initially four, later three Ss.

Though not statistically tested, a significantly lower initial probability of being correct is manifested, therefore. And a trend in the right-hand part of the "curve" indicates that the horizontal line may appear to become an in-valid description of the performance in subsequent trials.

A real test has not been performed, however; a further discussion of data on four-choice tasks should be postponed, therefore.

Table 1: Instructional conditions, subjects, scores, means, and differences between means in two 2-choice concept identification experiments:

	CONDITIONS OF INSTRUCTION, 1.1 and 1.2										$D_{\bar{X}_2\bar{X}_1}$	t	p
	Cond. 1.1: Description of S-variables and -values incluced:					Cond.1.2: Description of S-variables and -values omitted							
	N_1	L[1]	NL	X_1's	$\bar{X}_1$	N_2	L	NL	X_2's	$\bar{X}_2$			
EXPERIMENT I, performed 1975 with advanced students of education, participating in a course of learning psychology.	11	8	3	12 96+[2] 13 96+ 15 96+ 26 33 43 47 88	51.4	11	5	6	34 96+ 43 96+ 43 96+ 45 79 96+ 96+ 96+	74.5	23.1	1.71	.1>p> .05
EXPERIMENT II, performed 1977 as a replication under somewhat changed conditions with first year students in a a teacher training college.	12	6	6	32 34 45 54 111 149 160+ 160+ 160+ 160+ 160+ 160+	115.4	12	5	7	25 45 109 121 143 160+ 160+ 160+ 160+ 160+ 160+ 160+	130.3	14.9	.69	.25>p >.20
	23	14	9		84.8	23	10	13		103.6	18.8		

1: L - Learners; NL - None-Learners

2: + after a score indicates that the task had not been solved within the given number of trials. The true score should be higher, therefore.

IV.3 The length of none-learned state of performance evaluated.

Data relevant for the present problem has been presented in figure 7, page 31, and in table 1, page 33.

It can be seen, in table 1, that computations for both experiments are based, in part, upon incomplete series of trials. Thus, all figures marked by a + in table 1, indicate that at the end of either 96 trials (exp. I) or 160 trials (exp. II), the subjects referred to had yet not learned the task. This constitutes the basis for a distinction between Learners (L) and None-Learners (NL),made in the table.

The true scores for None-Learners remained unknown, therefore. It can safely be concluded, however, that they should have been higher than 96 and 160, respectively. This fact, of course, influences both the means and differences between means, and means and standard deviations involved in the computations of t-values. It clearly favours the condition 1.2 groups, since they contain most None-Learners (13 to 9). Especially the data for experiment II are of reduced reliability, because of the high proportion of None-Learners in both groups (1.1 and 1.2).

In spite of these insufficiences, due to the described problems of data collection, two experimental tests of the same hypothesis or prediction (prediction 2.2) can be said to support it.

Whether this support should be considered statistically significant, can be discussed, however. Normally, only a confidence level of .05 or higher would be accepted. When the same hypoghesis has become repeatedly supported, a lower level of confidence can be defended, however.

This, coordinated with the fact that data collections were incomplete in some respects, thus favouring the 1.2 condition, has led the present writer to tentatively reject the 0-hypothesis. The 0-hypothesis, within this context, concerns the difference between conditions 1.1 and 1.2, presumed to be caused, essentially, by the described differences in instruction.

V DISCUSSION: THE CONSTRUCTS OF ANALYSIS AND SELECTION EXPERIMENTALLY EVALUATED.

In figures 9 and 10 below, the differences represented by figures in table 1 have been graphically symbolized in terms of mean differences in length of the none-state performance of experimental groups 1.1 and 1.2, respectively.

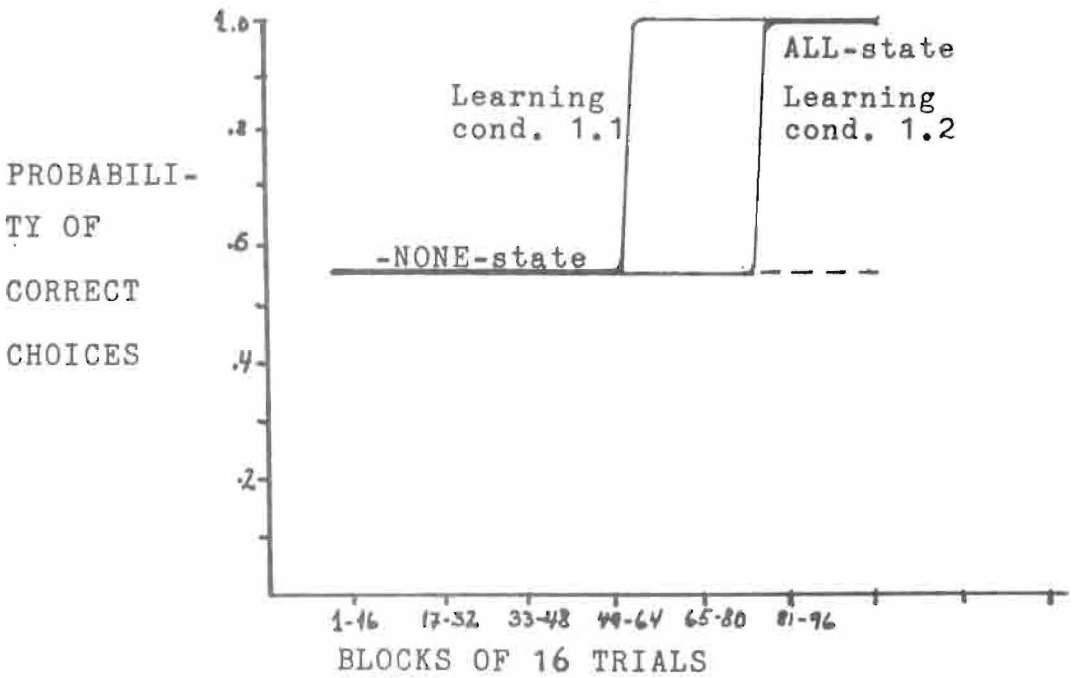


Figure 9

Mean number of trials in the none-learned state for groups 1.1 and 1.2 in experiment I.

In section IV.2, data which support the notion of an all-or-none performance in two-choice concept identification tasks, have been presented.

The none-state performance, manifested as an approximately horizontal, linear function of initial trials - and reflecting a near .5 probability of correct choices -, has been interpreted to mirror processes, in the performing person, which only can be theoretically defined. That is, defined as a multiple coding or perceptually analytic process, including also a set of <u>selections</u> of S-variables, tested out in subsequent trials.

Task solution, manifested in performance data by a transition from none-learned to a learned or all-state (fig. 9 and 10), can only be attained by a coding and selection of the task-solution-relevant stimulus-variable, however.

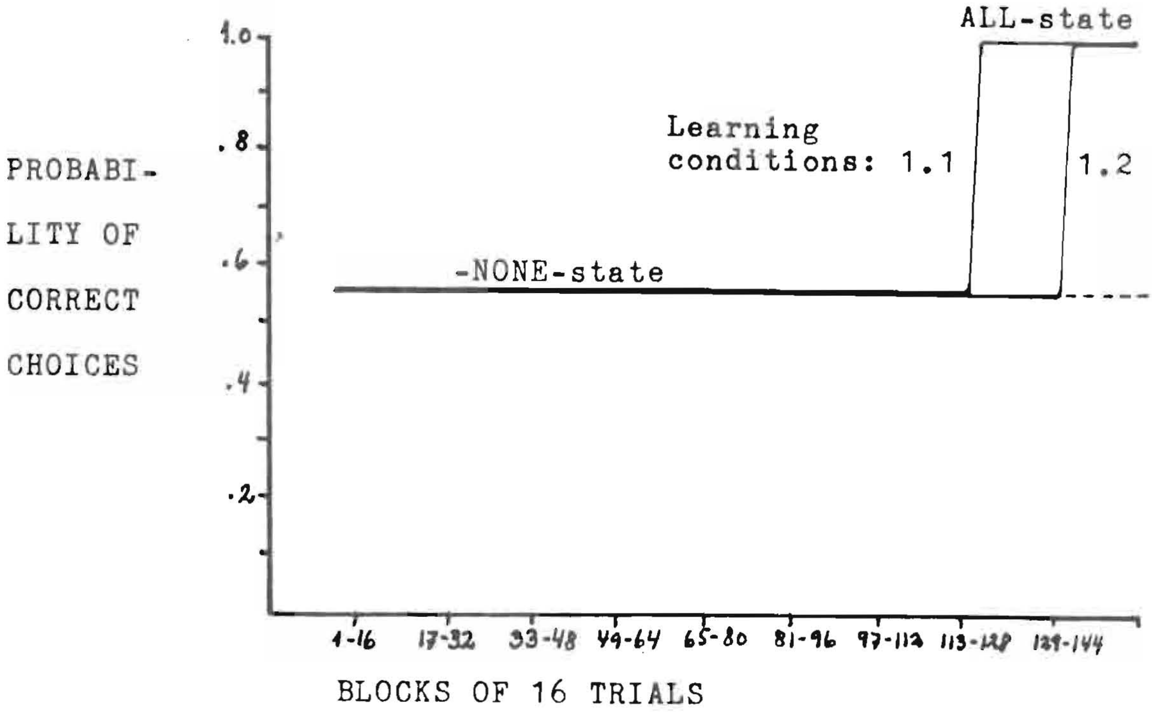


Figure 10
Mean number of trials in the none-learned state for groups 1.1 and 1.2 in experiment II.

It has been argued in chapter III that this combined stimulus analytic and selection process can be shortened by an instructed knowledge of which stimulus variable are involved in task stimuli.

The data which have been presented in chapter IV can be said to support this notion. It is the <u>stimulus-analytic</u> - or multiple coding process - that can be shortened in this way, however, rather than the selection process; this can safely be concluded, since no information was given with respect to which stimulus-variable was relevant.

The learning condition 1.2, in which the parts of instructions describing stimulus-variables was omitted, is used in this experiment to simulate persons or pupils who do - not at all or not fully - understand the words applied in describing stimulus-variation and -similarities.

If this analogy can be accepted as valid, a delayed task solution should be expected in such learning persons. Or, in other words: Their insufficiently learned and transferred readiness for solving the task, can be presumed to postpone task solution. This should be interpreted, also, in terms of negative emotions, possibly aroused by an increased amount of failures.

Since similarities and differences in shape, size, colour, place, and number, all of which are represented in the present tasks, are involved in many tasks "presented" in daily life, (including those of learning to read and write graphemes and digits, learning object-class concepts, etc.), the validity of our experimental results is not confined to the present task, but is probably of far greater generality (NYBORG, 1978,1 and 2; NYBORG & al., 1980).

R E F E R E N C E S

Averbach, E. & Coriell, A.S.: Short term memory in vision. Bell System Technical Journal, 1961, 40, 309-328.

Bourne, L.E. & Haygood, R.C.: The role of stimulus redundancy in concept identification. Journal of Experimental Psychology, 1959, 58, 232-238.

Bower, G.H. & Trabasso, T.R.: Concept identification. In Atkinson, R.C. (Ed.): Studies in mathematical psychology. Stanford, California: Stanford University Press, 1964, 32-94.

Bruner, J.S.: Toward a theory of instruction. Cambridge, Massachusetts: Harvard University Press, 1966.

Kendler, H.H.: The concept of the concept. In Melton, A.W. (Ed.): Categories of human learning. New York: Academic Press, 1964, 211-236.

Lawrence, D.H.: The nature of a stimulus: Some relationships between learning and perception. In Koch, S. (Ed.): Psychology a study of a science, Vol. 5. New York: McGraw-Hill, 1963.

Miller, G.A.: The magical number seven, plus or minus two: Some limits on our capacity for processing information. Pshchological Review, 1956, 63, 81-97.

Nyborg, M.: Begrepslæring: Analyse av definisjoner, oppgavetyper, delprosesser og teorier. (Concept learning: Analysis of definitions, categories of tasks, component processes and theories.) Oslo: Universitetsforlaget, 1970.

Nyborg, M.: Læring, begrepslæring, begrepsundervisning. (Learning, concept learning, concept teaching). Institute for Educational Research, University of Oslo, Oslo (1973-) 1978 a.

Nyborg, M.: Summary of a special educational research project with mild and borderline cases of mentally retarded children. Report No. 3, 1978 from the Institute for Educational Research, University of Oslo, Oslo 1978 b.

Nyborg, M. & al.: Individualized teaching - for communicative social participation and for language-mediated transfer: Teaching speach-mediated "fundamental" conceptual systems as an LTM-basis for analytic and selective perception in Lower-MA children. Paper delivered to the Trondheim seminar on individualized teaching for Nordic educational researchers, June 1980. Institute for Educational Research, University of Oslo, Oslo 1980.

Sperling, G.: The information available in brief visual presentations. Psychological Monographs, 1960, 74, No. 498.

Zeaman, D. & House, B.J.: The role of attention in retardate discrimination learning. In Ellis, N.R. (Ed.): Handbook of mental deficiency: Psychological theory and research. New York: McGraw-Hill, 1963, 159-223.

A P P E N D I X

INSTRUKSJON, gruppe 1

På bordet foran deg ligger det et svarhefte, dekket av et blankt ark, samt en blyant; disse tingene skal du foreløbig la ligge i ro.

Som dere har fått vite tidligere, dreier oppgaven seg om et begrepsproblem.

Oppgaven vil bli presentert i form av bilder eller stimuli som blir fremvist på disse TV-skjermene.

Ialt dreier det seg om 32 forskjellige bilder. De samme 32 bildene kan imidlertid fremvises flere ganger, slik at den serien som skal vises, omfatter flere enn 32 bilder.

Bildene fremstiller ikke vanlige ting, men fremstiller kunstige objekter. Disse kunstige objektene har imidlertid egenskaper som også naturlige ting kan ha.

På hvert bilde er det - i tillegg til objektet - påført et tall. Tallene korresponderer med den tallrekken som er påført svar-arkene. Fjern nå det blanke arket som ligger over svar-heftet, men se bare på den første siden av heftet.

Tallene på arket viser hvilken rute du til enhver tid skal skrive i. Rutens tall skal bestandig være det samme som bildets.

Gr. 1+2 De 32 forskjellige bildene er laget slik at de bl.a. kan grupperes i to undergrupper á 16 bilder, som du kan kalle A og B (skriver).

Objektene kan grupperes etter fem forskjellige egenskaper eller kriterier. Oppgaven består i å finne

Gr. 1+2 hvilken egenskap av fem forskjellige som kan tjene
Gr. 3+4 til å gruppere dem riktig i denne sammenhengen.

Hver gang et bilde blir fremvist, skal du derfor
Gr. 1+2 skrive enten A eller B i ruten ved siden av det
Gr. 3+4 tallet som du så på bildet.

Kort etter at du har skrevet den valgte bokstaven, blir den riktige bokstaven fremvist, slik at du kan vite om du valgte rett eller feil.

Det er fullt mulig å få riktige svar ved å skrive av bokstavene når de vises frem på skjermen. Det vil i så fall være avskrift, og ingen god problemløsning.

En slik måte å løse problemet på, vil gjøre eksperimentet fullstendig verdiløst.

Dersom du skulle synes at oppgaven er vanskelig, har jeg tillit til at du likevel velger å skrive en bokstav mens du ser bildet før den rette bokstaven vises.

Det hører også med til oppgaveløsningen at det ikke er tillatt å skrive eller tegne noe annet enn den ene bokstaven som du skal skrive hver gang du ser et bilde.

Bare gruppene 1 og 3:

Jeg skal nå beskrive oppgavebildene nøyere, slik at du vet mer om hva du går til:

Objektene som skal vises, er både like og ulike på fem forskjellige måter, nemlig:

- i FORM, enten kvadratisk eller sirkel-formet
- i PLASSERING, enten over eller under en vannrett linje
- i FARGE, enten hvit eller svart
- i STØRRELSE, enten større eller mindre objekter
- i ANTALL, enten en eller to figurer.

Jeg gjentar det som nettopp er sagt, men nå i motsatt rekkefølge: Objektene.....

Det gjelder om å finne frem til

Gr. 1 — den egenskap som definerer de to undergruppene, A og B,

Alle gruppene — Jeg skal nå, før vi begynner, kort summere opp det viktigste av det du får å gjøre:

Hver gang et bilde vises, skal du skrive <u>en</u>, men bare <u>en</u> av bokstavene

Gr. 1+2 — A eller B i ei åpen rute på svar-arket,

Gr. 3+4

Rutene er merket med et tall foran, f.eks. slik [32], og rutens tall skal til enhver tid korrespondere med det tallet som er påført bildet.

Kort etter at du har skrevet den valgte bokstav, vises den <u>riktige</u> bokstaven på skjermen, slik at du kan vite om du valgte rett eller galt.

Vent enda litt med å røre svar-arket:

Når du er ferdig med forsøk 32, dvs., det bildet som er påført tallet 32, skal arket brettes over - slik (demonstrerer).

XXXXXXX

Nå er eksperimentet ferdig. Vil dere være vennlige å følge min assistent som om et øyeblikk kommer bort til dere til et lite intervju om oppgaveløsningen. Ta med svarheftet, og lever det til intervjueren når dere kommer til intervju-rommet.

TAKK for hjelpen.

DISKRIMINASJONSLÆRINGS-PANEL

tegnet i hovedskisse av Magne Nyborg, men utarbeidet i samarbeid med ingeniør RETTERÅSEN og STÅLE SKOGSTAD.

A Teknisk beskrivelse (følger senere).

B Komponenter i lærings-situasjonen som kan varieres og registreres (følger senere).

C Hoved-komponenter, funksjoner og sekvenser, slik de
MN: kan registreres også av forsøkspersonen:

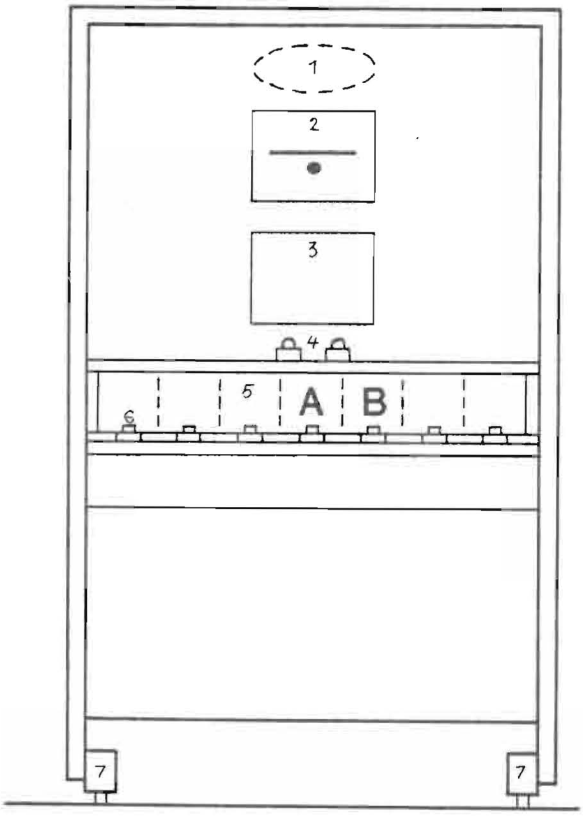
0 Hovedskisse av DL-panelet.
1 Suksessiv diskriminasjonslæring (DL)
2 Samtidig diskriminasjonslæring
3 Matching-to-sample DL: Samtidig
4 Utsatt.
5 Generelt om respons-systemer....
6 "Bestillings-ark" for S-materiell.

D Anvendelse og eksempler på anvendelse: (følger senere)
MN:

1 Par-assosiasjons-læring (PAL)
2 Diskriminasjons-læring (DL), tre hovedtyper.
3 Begrepslæring (BL)
4 Verbale og nonverbale komponenter i ulike kombinasjoner.

OVERSIKTS-SKISSE (ikke riktig dimensjonert)
<u>av lærings-panelet, sett fra forsøkspersonens side</u>.

For nærmere forklaringer, se side 46.



1 Høyttaler (fra bånd-opptaker/avspiller).

2 Skjerm, belyst bakfra (billed-fremviser). Tids-regulert billed-fremvisning.

3 Dør som kan trekkes til side og derved avdekker objekter el. objekt-modeller.

4 Rød og grønn lampe.

5 Skjerm, belyst bakfra.

6 Sju respons-knapper, dvs., i et antall som motsvarer mulig antall små-bilder i billed-felt 2.

NB Tids-intervallet mellom S-presentasjon og valg-reaksjon kan måles ved hjelp av en tid-teller. (Latens).

7 Jekker, som kan brukes til å heve eller senke lærings-panelet etter forsøks-personens størrelse.

<u>Merknader</u>:

i) Dersom både billedfelt 1 og 2 benyttes, kan tids-intervallet mellom dem reguleres, fra samtidighet til større tids-avstand (Utsatt matching-to-sample DL).

ii) <u>Grønn</u> lampe (punkt 4, over) signaliserer <u>riktig</u> valghandling, <u>rød</u> lampe signaliserer feil-valg.

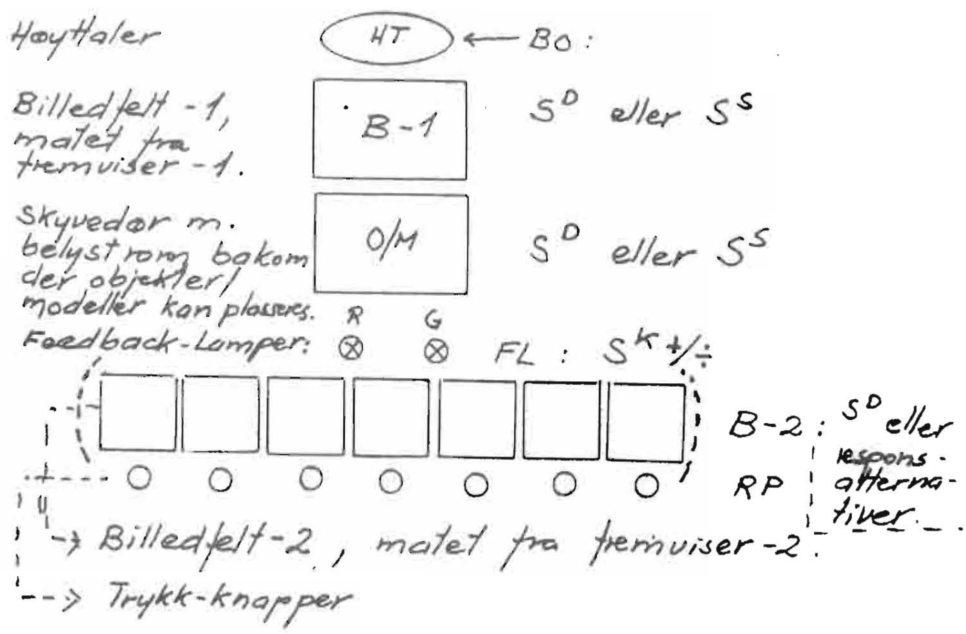
iii) Også billedfremvisning i billedfelt 2 kan tids-reguleres. Opptil 7 forskjellige bilder kan her vises samtidig, som grunnlag for bare diskriminasjon, eller som grunnlag for kombinert diskriminasjon og generalisering, i så fall innlagt i begreps-læring.

Apparatet tenkes knyttet til SV-fakultetets EDB-anlegg, men dette må utstå noe, inntil panelet er utprøvet mer manuelt. Programrutiner kan imidlertid påbegynnes (Midler bevilget av NAVF for 1976).

I SUKSESSIV DISKRIMINASJONSLÆRING (DL)

Komponenter		Forkortn.
	1 Båndopptager for avspilling av instruksjon m.m.	BO
	2 Øverste billedfelt (B-1), alternativt objekter/modeller, avdekket av skyvefør (O/M)	B-1 O/M
	(3) Eventuelt nederste billedfelt med plass til max. 7 småbilder, til presentasjon av respons-alternativer, dvs., bilder, tall, bokstaver, ord, etc.	B-2
	4 Respons-panel, med opp til 7 knapper i bruk	RP
	5 Feedback-lamper, altern. rød/grønn, gitt henholdsvis signalverdiene feil/riktig	FL

KOMPONENTENE billedmessig fremstilt i forhold til hverandre



KOMPONENTER, FUNKSJONER og SEKVENS

1 Instruksjon, lagt inn på bånd, skal kunne kobles inn og ut. Utkoblingen skal starte en sekvens av hendelser:

2 Diskriminativt stimulus presenteres: SD

Alternativt:

2.1 Bilde føres inn i B-1
2.2 Objekt/Modell avdekkes (O/M)
2.3. Lyd/tale presenteres (BO).

(Ev. føres bilder inn i B-2 som presentasjon av responsalternativer; samtidig med B-1).

3 Fremvisningstid styres; dvs. bilde fjernes eller objekt tildekkes

3.1 etter en bestemt og styrt tid.
3.2. når personen trykker på en knapp, dvs. den riktige av flere alternative. Alternativt når P trykker på første knapp, feil eller riktig.
3.3 etter en viss tid, eller før den tid når fp. trykker på riktig knapp/første knapp.

4 Måling av tiden mellom S^D-start (B-1) og personens reaksjon/reaksjoner.

5 Registrering av personens reaksjon eller reaksjoner, både feilvalg og riktige reaksjoner.

Dersom reaksjonen f.eks. består i å si et ord, i stedet for å trykke på en knapp, skal

5.1 forsøksleder kunne registrere tidspunktet for R, f.eks. ved å trykke inn en knapp, og
5.2 R kunne tas opp på lydbånd.

6 Personens R skal utløse feedbacklampe, rød eller grønn. Rød/grønn må være programmert i forhold

6.1 Til bilde/objekt i en sekvens, og
6.2 til knapper i responspanel

Ad 5.1 Forsøksleders registrering skal kunne slå inn rød eller grønn lampe.

7 Styring av tidsforløp fra reaksjon /feedback til neste sejvebs av 2-6 startes.

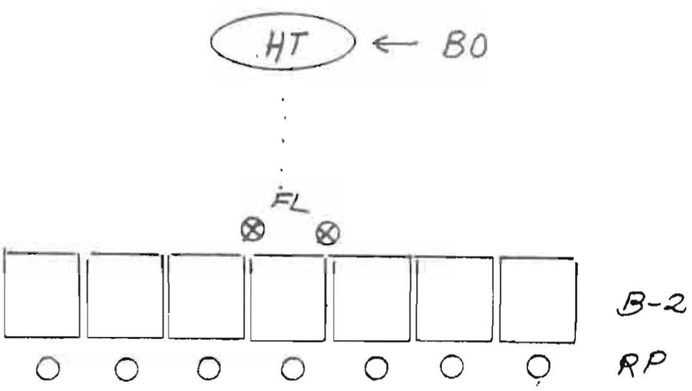
----

8 Billedsekvens programmeres ved innlegg av bilder i magasin. Rødt/grønt signal i forhold til bilde og knapp programmeres i maskin.

II SAMTIDIG DL.

Komponenter	1	Båndopptager/forsterker	BO
	2	Nederste billedfelt (B-2) med plass til max. 7 bilder	B-2
	3	Responspanel (max. 7 knapper i bruk)	RP
	4	Feedback-lamper,rød/grønn	FL

Billedmessig



Komponenter i funksjon og sekvens

1 Som i suksessiv Dl.

2 Presentasjon av fra 2 til 7 forskjellige bilder i nederste billed-felt (B-2) S^D

3 Som i forbindelse med Suksessiv DL

4 - " -

5 Registrering av personens reaksjon eller reaksjoner, både feilvalg og riktige reak- på RP.

6 Som i forbindelse med suksessiv DL, unntatt tillegg (ad. 5.1.).

7 Som ved suksessiv DL.

III Matching-to-sample DL: Samtidig M-T-S.

Komponenter

1 Båndopptager/forsterker.

2 Øverste billedfelt (B-1)

3 Nederste billefelt (B-2)

4 Responspanel

5 Feedback-lamper

Billedmessig — Se side 45.

Komponenter i funksjon og sekvens

1 Som i forbindelse med suksessive Dl

2 Sample stimulus (S^S) presenteres i samme tre alternativer som i forbindelse med suksessiv DL, punkt 2. Blir stående mens

3 Diskriminative stimuli (S^D) føres inn i B-2 like etter. Både S^D og S^S varer

4 Til personen reagerer til ett eller flere av bildene i B-2 ved å trykke p korresponderende knapp/knapper

Det videre forløp vil være som i forbindelse med suksessiv Dl, punktene 4 - 7.

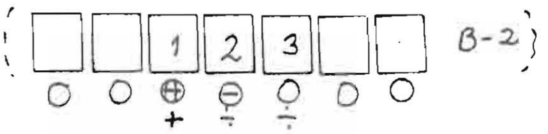
IV MATCHING - TO-SAMPLE DL: UTSATT matching.

Det samme som i forbindelse med samtidig m-t-s, (III), bare med ett unntak:

Sample stimulus fjernes før S^D i B-2 føres inn, og et regulerbart tidsintervall skytes inn mellom de to hendelsene.

V GENERELT OM RESPONS-SYSTEMER OG FREMFØRING TIL NESTE SEKVENS.

Eks. 1. Ett bilde (B-1), objekt (O/M), eller ett lydstimulus (BO) presenteres som S^D; tre respons-alternativer, eventuelt kombinert med tre bilder i B-2, hvorav bare ett alternativ er riktig.



\+ riktig knapp, dvs. gir grønt lys

\- feil knapp (rødt lys)

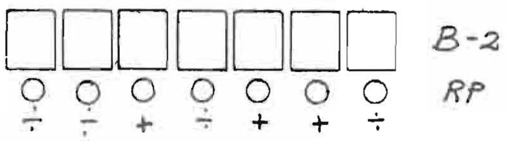
Alternativ 1:

Hvilket som helst <u>første</u> trykk, riktig (+) eller feil (-), fører, etter et nærmere bestemt delay-intervall videre til neste sekvens. Trykk-posisjon registreres.

Alternativ 2:

Bare trykk på +-knapp fører videre til neste sekvens. Trykk-posisjon registreres. Delay-intervall. Trykk på feil knapper før riktig, tenner rød lampe og registreres i den rekkefølge de gjøres, men fører ikke videre til neste sekvens.

Eks. 2 7 bilder presenteres samtidig i B-2. Det er riktig å reagere til tre av dem (+++):



1 Alle trykk registreres i den rekkefølge som de gjøres og med tidsangivelse for hvert av, dvs. fra S-start til trykk (Dette gjelder også eksemplet ovenfor).

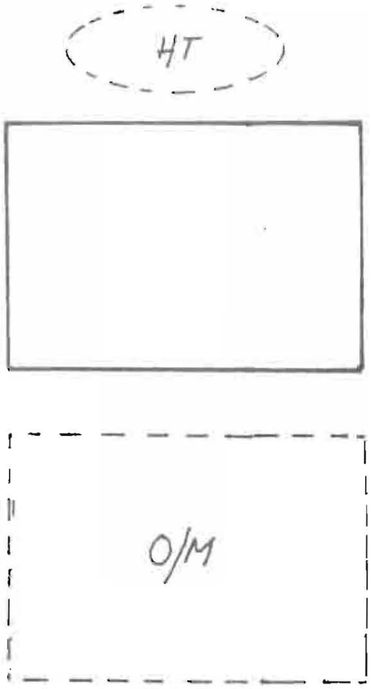
2 +-trykk tenner grønn lampe,
--trykk tenner rød lampe.

3 Først når alle +knapper er trykket, føres en ny sekvens inn, dvs., etter et styrt delay-intervall.

M. Nyborg
Nr.

(Bestillings-ark, brukt i forbindelse med konstruksjon av stimulus- eller oppgave-bilder.)

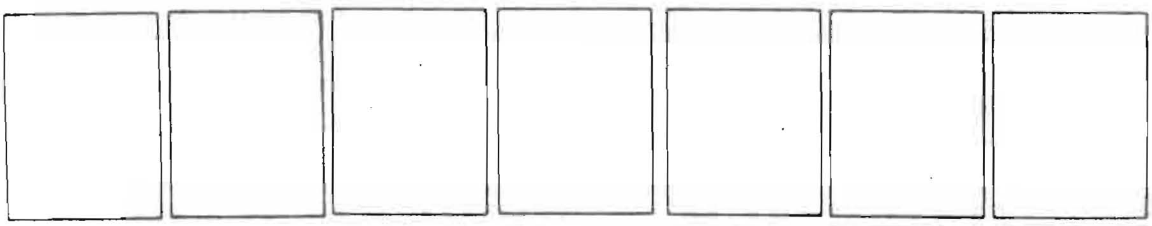
B-1



BESKRIVELSE:

M. Nyborg
Nr.

B-2



(Innfelt i ett bilde)

BESKRIVELSE:

BL-EKSPERIMENT.

2- og 4-valg begreps-identifikasjon (BL-2, BL-4);
To forskjellige instruksjons-betingelser: BL-2.1; BL-2.2
Bl-4.1; BL-4.2.

Læringsbetingelse: 2c.1.

FORKLARING; MOTIVERING:

Du finner det kanskje rart at jeg avspiller et lydbånd-opptak i stedet for å lese opp eller la deg selv lese instruksjonen.

Grunnen til dette er følgende:

Hvis jeg selv leste instruksjonen for hver ny person ville jeg ikke ha kontroll over at jeg leste med samme stemmeleie, fart, betoning og pauser for alle deltagende personer.

Hvis jeg overlot til hver person selv å lese instruksjonen, ville jeg ikke vite hvor fort forskjellige personer leste, hvor grundig de gjorde det, hvor mange repetisjoner av viktige avsnitt ble gjort, o.l.

Begge deler ville kunne medføre feilkilder som er uønskelige i et lærings-eksperiment av denne art.

Jeg vet ikke om du vil finne lærings-oppgaven lett eller vanskelig.

Uansett hvordan du opplever den, lett eller vanskelig, vil jeg be deg løse den så raskt og hensiktsmessig som mulig.

Du bidrar på den måten til å belyse viktige sider ved begreps- og språk-læring.

Overdreven frykt eller engstelse er det ingen grunn til å ha. Forsøk heller å være avslappet, men med våken oppmerksomhet, når du går inn i lærings-situasjonen.

ORIENTERING OG INSTRUKSJON:

Du sitter nå foran et såkalt lærings-panel, nærmere bestemt, et diskriminasjonslærings-panel.

Ved dette panelet skal du lære å knytte ulike "fellesnavn" til side-ordnede klasser av "objekter", presentert i billedform.

I så henseende ligner læringen på mye av den begreps- og språklæring som finner sted i det naturlige liv.

For at oppgaven ikke skal bli for lett, men derimot mest mulig lik for alle, har jeg fått laget bilder av såkalte geometriske figurer i stedet for vanlige objekter; og du skal navnsette dem ved bokstaver i stedet for ved vanlige ord.

Nå litt om lærings-panelet, det du får se der, og det du skal gjøre:

Som du kan se, har lærings-panelet blant annet to billed-fremvisnings-skjermer.

(Begge belyses, det nederste oppdelt i felter)

Den nederste skjermen er delt opp i felter, der hvert felt korresponderer med en av de to trykk-knappene som skal brukes. I hvert felt skal det vises en bokstav.

Ved trykk på en av de to knappene skal du senere få vise ditt valg av bokstav på nederste skjerm, etter at du har sett et bilde på den øverste skjermen.

Endelig, over den nederste skjermen er plassert to lamper, en grønn og en rød. Hvis den røde lampen lyser når du trykker, viser den at du har valgt riktig bokstav. Hvis den grønne lampen lyser når du

2 Valget av bokstav-navn skal du vise ved å trykke på den knappen som har plass nærmest den valgte bokstav.

Men du skal ikke trykke noen knapp før bokstavene vises på nederste skjerm. Dette er viktig: Ikke trykk før bokstavene vises på nederste billed-skjerm.

Når bokstavene vises, skal du så snart som mulig trykke ved den valgte bokstav.

3 Idet du trykker på knappene, finner to hendelser sted:

For det første: Den røde eller grønne lampen signaliserer at du har valgt henholdsvis riktig eller feil bokstav-navn. Jeg gjentar: Rødt lys bestyr riktig valg; .. grønt lys betyr feil valg. Dersom valget av bokstav er feil, skal du trykke også den andre knappen, som da må være riktig.

For det annet: Bokstavene fjernes fra nederste billedskjerm når du trykker ved riktig bokstav.

1 Etter en stund vises et nytt bilde på øverste skjerm. Dermed starter den samme serien av hendelser som nettopp er beskrevet,og slik fortsetter det inntil 5 serier á 32 bilder er presentert og navnsatt av deg.

Nå er vi klare til å begynne.

BL-EKSPERIMENT,

2- og 4-valg begreps-identifikasjon (BL-2; BL-4);
To forskjellige instruksjonsbetingelser: BL-2.1; BL-2.2
BL-4.1; BL-4.2

Lærings-betingelse: 2c.2

ORIENTERING OG INSTRUKSJON:

Du sitter nå foran et såkalt lærings-panel, nærmere bestemt, et diskriminasjonslærings-panel.

Ved dette panelet skal du lære å knytte ulike "fellesnavn" til side-ordnede klasser av "objekter", presentert i billedform.

I så henseende ligner læringen på mye av den begreps- og språklæring som finner sted i det naturlige liv.

Forat oppgaven ikke skal bli for lett, men derimit mest mulig lik for alle, har jeg fått laget bilder av såkalte geometriske figurer i stedet for av vanlige objekter; og du skal navnsette dem ved bokstaver i stedet for ved vanlige ord.

Nå litt om lærings-panelet, det du får se der, og det du skal gjøre:

Som du kan se, har lærings-panelet blant annet to billedfremvisnings-skjermer.

(Begge belyses, det nederste oppdelt i felter).

Den nederste skjermen er delt opp i felter, der hvert felt korresponderer med en av de to trykk-knappene som skal brukes. I hvert felt skal det vises en bokstav.

Ved trykk på en av de to knappene skal du senere få vise ditt valg av bokstav på nederste skjerm, etter at du har sett et bilde på den øverste skjermen.

Endelig, over den nederste skjermen er plassert to lamper, en grønn og en rød. Hvis den grønne lampen lyser når du trykker, viser den at du har valgt riktig bokstav. Hvis den røde lampen lyser når du trykker, viser den at du har valgt feil bokstav.

Det som kommer til å skje, er følgende:

1 Først vises et bilde på øverste skjerm. Det vises i ca. 4 sekunder.

2 Så blir det en kort pause før bokstavene vises på nederste skjerm. I den pausen må du ikke trykke på knappene.

3 Etter pausen vises bokstavene A og B på nederste skjerm.

4 Da, men først da skal du trykke på <u>en</u> av de to knappene som korresponderer med bokstavene. Ved å trykke ved en bokstav, viser du hvilket bokstav-navn du har satt på bildet som du så på øverste skjermen.

Trykk så hurtig som mulig etter at bokstavene er kommet frem på skjermen; idet du trykker, viser lampene ved grønt eller rødt lys om du har valgt oppgaveriktig eller feil bokstav. Ved at du trykker på en av knappene, blir bokstavene fjernet.

Kort tid etter vises

1 et nytt bilde på øverste billed-skjerm.

Slik fortsetter det om og om igjen, inntil <u>en</u> og samme serie av bilder er vist <u>5</u> ganger.

XXXXX

Ialt er det 32 forskjellige bilder i den serien av bilder som skal vises på øverste billed-skjerm. De kommer som nevnt til å bli vist flere ganger, med en liten pause mellom hver serie på 32 bilder.

Pausen er lagt inn av tekniske grunner; hele tiden er det samme oppgave som skal løses.

Jeg sa nylig at alle de 32 bildene er <u>forskjellige</u> på en eller flere måter. De kan også være <u>like</u> på en eller flere måter.

Likhetene og forskjellene kan beskrives ved <u>fem</u> hoved-kriterier.

(Din oppgave består blant annet i å finne ut)

2.1 og <u>hvilket</u> av <u>fem mulige hoved-kriterier</u> som kan gi

2.2 grunnlag for å klassifisere bildene i de to under- gruppene, A og B, som er valgt for denne løsningen.

Hver av undergruppene A og B omfatter 16 bilder.
Jeg gjentar:

Til slutt en oppsummering av det som kommer til å skje:

1 Et bilde presenteres på øverste billed-skjerm.

2 Ett av fem forskjellige hovedkriterier kan da gi deg grunnlag for å velge enten A eller B som navn på det som er avbildet.

2 Valget av bokstav-navn skal du vise ved å trykke på den knappen som har plass nærmest den valgte bokstav.

Men du skal ikke trykke noen knapp før bokstavene vises på nederste skjerm. Dette er viktig: Ikke trykk før bokstavene vises på nederste billed-skjerm.

Når bokstavene vises, skal du så snart som mulig trykke ved den valgte bokstav.

3 Idet du trykker på en knapp, finner to hendelser sted omtrent samtidig:

For det første: Den grønne eller røde lampen signaliserer at du har valgt henholdsvis riktig eller feil bokstav-navn. Jeg gjentar: grønt lys betyr riktig valg;.. rødt lys betyr feil valg.

For det annet: Bokstavene fjernes fra nederste billed- skjerm.

1 Etter en stund vises et nytt bilde på øverste skjerm. Dermed starter den samme serien av hendelser som nettopp er beskrevet, og slik fortsetter det inntil 5 serier á 32 bilder er presentert og navnsatt av deg.

Nå er vi klare til å begynne.

P __

CL - Learn. cond. 2c. Subject code: ________

SERIES no. ___								SERIES no. ___															
S.no	R	Sc.	Lat.	S.no	R	Sc.	LAT.	S.no	R	Sc.	Lat.	S.no.	R	Sc.	Lat.	S.no.	R	Sc.	Lat.	S.no.	R	Sc.	Lat.
1	A B			17	A B			1	A B			17	A B			1	A B			17	A B		
2	A B			18	A B			2	A B			18	A B			2	A B			18	A B		
3	A B			19	A B			3	A B			19	A B			3	A B			19	A B		
4	A B			20	A B			4	A B			20	A B			4	A B			20	A B		
5	A B			21	A B			5	A B			21	A B			5	A B			21	A B		
6	A B			22	A B			6	A B			22	A B			6	A B			22	A B		
7	A B			23	A B			7	A B			23	A B			7	A B			23	A B		
8	A B			24	A B			8	A B			24	A B			8	A B			24	A B		
9	A B			25	A B			9	A B			25	A B			9	A B			25	A B		
10	A B			26	A B			10	A B			26	A B			10	A B			26	A B		
11	A B			27	A B			11	A B			27	A B			11	A B			27	A B		
12	A B			28	A B			12	A B			28	A B			12	A B			28	A B		
13	A B			29	A B			13	A B			29	A B			13	A B			29	A B		
14	A B			30	A B			14	A B			30	A B			14	A B			30	A B		
15	A B			31	A B			15	A B			31	A B			15	A B			31	A B		
16	A B			32	A B			16	A B			32	A B			16	A B			32	A B		