

*EFFECTS OF REINFORCEMENT AND GUIDANCE
PROCEDURES ON INSTRUCTION-FOLLOWING
BEHAVIOR OF SEVERELY RETARDED CHILDREN¹*

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Positive reinforcement, physical guidance, and fading procedures were used to teach two severely retarded children motor responses to a variety of verbal instructions. Subjects' responses to one set of instructions provided the focus for the training procedures. Their responses to a second set of instructions were used to assess the generalized effects of training. The frequency of responses to both sets of instructions was evaluated during Baseline 1, Training 1, Baseline 2, and Training 2 periods. During the training periods, this evaluation was made after the daily training sessions when no training procedures were in effect. Results indicated that the subjects showed pronounced increases in instruction-following behaviors (both trained and untrained) during training periods with decreases in such behavior occurring during the Baseline 2 period. The general findings demonstrate the applicability of the training procedures for producing and maintaining instruction-following behaviors in severely retarded children and for facilitating appropriate responding to instructions not directly involved in training.

Numerous studies have examined the prevalence of language disorders among mentally retarded populations (Sachs, 1951; Schlanger, 1953; Schlanger and Gottsteben, 1957). As Spradlin (1963) pointed out, the results of such studies indicate that about 57 to 72% of institutionalized mentally defectives have speech defects. Because of the high frequency of speech problems, there have been many attempts to modify the verbal behavior of this population (*e.g.*, Schneider and Vallon, 1955; Mechan, 1955; Johnson, Capobianco, and Miller, 1960). Such studies have typically attempted to increase the frequency of specific types of verbalizations and/or to improve articulation.

Although equally important, there has been less emphasis on another aspect of language training, which concerns language as a stimulus rather than a response. That is, not only does the human organism have to learn to produce language responses but it is also critical that his motor responses come under the control of verbal stimuli. Within this context, a verbal stimulus, like any other physical stim-

ulus, presumably acquires discriminative properties by means of a reinforcement process. While many studies have pointed out the importance of verbal stimuli (instructions) for establishing and maintaining human operant behavior (*e.g.*, Ayllon and Azrin, 1964, Baron, Kaufman, and Stauber, 1969) few studies have attempted to develop verbal stimulus control of such behavior when it is initially absent. The task of a trainer becomes one of insuring that an organism makes a specific response in the presence of a specific verbal stimulus. Results by Bowman (1960) suggest that a verbal reinforcement technique can be used to teach retarded children a motor response to a verbal request. The subjects in this study were required to respond to a group of verbal requests (*e.g.*, "Which is the back of the dress?") by pointing. Zimmerman, Zimmerman, and Russell (1969) using a token reinforcement procedure administered on a group basis also successfully generated and maintained high frequencies of "instruction-following" behavior in moderately and mildly retarded subjects.

In shaping the motor responses of severely retarded children, a special problem may be presented in that the response to be reinforced, or an approximation of it, may never occur. In such instances, physical guidance procedures such as those described by Baer, Peterson, and Sherman (1967) and Whitman, Ca-

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ponigri, and Mercurio (1971) have been used initially to insure that a target response occurs. For example, in the Baer *et al.*, (1967) study, a child was verbally instructed to raise her hand. When the child failed to respond appropriately the experimenter reached out and raised the subject's hand and then immediately reinforced the child's guided response. As guidance was gradually withdrawn, the response occurred without the use of such a procedure. In a similar fashion, Whitman *et al.*, (1971) taught a severely retarded and hyperactive child to sit down for periods up to 30 min.

The present study was designed to assess the utility of a physical guidance procedure used in conjunction with a reinforcement procedure for producing appropriate motor responses to a variety of verbal instructions in severely retarded children. Moreover, the extent to which generalization to other instructional stimuli occurred was closely examined.

METHOD

Subjects

Two children enrolled at Logan School for the Mentally Retarded, South Bend, Indiana served as subjects. The first subject, Roger, was 4.5 yr old. He was diagnosed as having cerebral angiomas (Struge-Weber-Dimitri Disease). The condition, which is very rare, is identified by a port-wine stain formed of blood vessels on the face and is associated with vascular malformations in the cerebral cortex. Behaviorally, Roger could walk and feed himself but could not dress himself and would not cooperate with toilet training procedures. According to the Communicative Evaluation Chart (a language assessment test) he was estimated as having the verbal skills of a 1 yr old. Although he had no words in his verbal repertoire he occasionally produced syllables such as "da", "la", and "ba". The subject could, however, respond appropriately to some verbal commands but generally ignored such commands given to him by his teacher. When demands of any kind were made upon him he was prone to tantrum behavior: screaming, kicking, and at times engaging in head banging and hand biting. Because he was uncooperative in test situations his level of retardation could not be more completely assessed. On the basis of the behavioral strengths and

deficiencies cited here, Roger was estimated to fall within the severe range of mental retardation.

The second subject, Mary, was 7 yr old. At the age of three months she developed petit mal seizures which have continued to the present and are only partially controlled by anticonvulsants and diet. The subject was toilet trained, could feed herself, and partially dress herself. On the Vineland Social Maturity Scale she obtained a SQ of 37. According to the Communicative Evaluation Chart her language level was assessed as being between a 2 and 3 yr old level. Although her vocabulary was estimated to be around 200 words there was no evidence of phrases or sentences in her speech. The subject's teacher described her as a friendly, hyperactive child who virtually was unable or unwilling to make appropriate responses to any verbal commands but who rather "sat" in her own little world.

Procedure

Roger. In order to assess Roger's ability to follow instructions, a list of 22 common instructions was prepared (see Table 1). These were instructions to which his teacher felt he was capable of responding appropriately. The subject's initial operant response level to this set of instructions was established over a five-day baseline period. During each baseline session, the entire set of instructions was presented twice to the subject with a short rest period being given between the two presentations. Each instruction was given slowly, with 15 sec being allowed for the child to produce the appropriate response. All baseline sessions were conducted in an 8 by 10 ft room that contained a table and two chairs. Within reach of Roger on the table were the objects mentioned in the instructions.

After the subject's initial operant response level had been determined, training extending over 20 consecutive school days was initiated. Training sessions were conducted once a day with each session lasting approximately 30 min. The same room and objects used to establish a baseline performance was also used during the training period. The 22 verbal instructions given to the subject during the baseline period were divided into two sets of 11 instructions. The subject's responses to the first set of instructions (Training) provided the focus for the training procedure. The second

Table 1
Instructions Given to Roger and Mary

	Roger	Mary
<i>Training Set T</i>	1. Sit down	1. Look at me
	2. Stand up	2. Point to the window
	3. Look at me	3. Pick up the pencil
	4. Point to your nose	4. Give me the pencil
	5. Pick up the cup	5. Put the pencil in the box
	6. Give me the pencil	6. Put the pencil next to the box
	7. Put the pencil in front of the box	7. Pick up the cup
	8. Clap your hands	8. Give me the cup
	9. Put your hands under the table	9. Touch your arm
	10. Point to your eye	10. Go to the door
	11. Pick up the jacket	
<i>Generalization Set G</i>	1. Come here	1. Pick up the block
	2. Hold my hand	2. Give me the block
	3. Put your hands on the table	3. Put the block in the box
	4. Point to your ear	4. Put the block next to the box
	5. Point to your mouth	5. Look at the lamp
	6. Point to your arm	6. Touch your leg
	7. Give me the cup	7. Pick up the toy
	8. Give me the jacket	8. Give me the toy
	9. Pick up the pencil	9. Point to the door
	10. Put the pencil in the box	10. Go to the window
	11. Put the pencil behind the box	

set of instructions (Generalization) was never administered during the training session. The subject's motor responses to this latter set of instructions provided, however, a test for the ongoing generalization effects of the training procedure (See Table 1). In order to establish a firm response basis for initiating the reinforcement procedure, the two instructions, "sit down" and "stand up", to which Roger most frequently responded during the baseline period were placed in the training set. The instruction "look at me" was also placed in this set so that the subject would learn to have eye contact with the experimenter and enable the experimenter better to maintain the subject's attention during training. The other instructions were assigned insofar as was possible on a matched basis to the training and generalization sets by taking into consideration the specific verbs (*e.g.*, put or point) involved in the instructions.

Training involved the application of positive reinforcement, physical guidance, and fading procedures. Physical and social reinforcers were used in conjunction with each other and administered on a continuous schedule. The physical reinforcers were sweet cereal (Fruit

Loops) and chocolate bits. Social reinforcement consisted of the experimenter praising Roger by saying "good" or "good boy" after each correct response. In order to get the subject initially to respond to an instruction, a physical guidance prompting procedure was frequently used. For example, if the experimenter introduced the instruction "pick up the cup" and Roger did not respond, the experimenter would proceed to take his hand, place it around the cup, and then lift his hand up. In administering the reinforcement, a fading procedure was used with reinforcement initially being given for a response, even though it was completely guided by the experimenter. The experimenter then reduced his participation in such a response by gradually withdrawing his physical guidance and immediately reinforcing Roger's increased autonomy in responding to the command. Physical guidance was first withdrawn from those physical movements associated with the completion of a given response and then it was progressively removed from other movements in the total response sequence in a reverse fashion until Roger finally initiated the response himself. For example, with regard to the instruction

"pick up the cup", the experimenter reduced the extent of his physical guidance from complete assistance merely to guiding the subject's hand to the cup to complete withdrawal of such physical assistance.

During training, each session began with the experimenter working with an instruction to which Roger had already consistently and correctly responded. After he responded correctly four out of five times to a given instruction, a different instruction from the training set was given. The order of introduction of new instructions is presented in Table 1. However, if Roger continually failed in his attempt to respond to one of the instructions, the experimenter discontinued the instruction and moved on to the next one. No specific criteria was established for terminating the subject when he was failing. The experimenter made such a decision on the basis of whether or not he felt Roger was showing some progress. If the subject failed to respond correctly to three successive instructions, the experimenter reinitiated a successful reinforcement experience by returning to an instruction Roger was already capable of successfully completing. During the 20-day training period, all of the instructions in the training set were extensively worked with by the experimenter.

After each training session, a new operant level was established according to the same procedure outlined for the baseline period. The experimenter presented the entire list of 22 instructions (training and generalization sets) to the subject twice without any type of physical or social reinforcement, physical guidance, or fading procedure being administered. The instructions were presented in the order listed in Table 1 with the training instructions preceding the generalization instructions.

After the 20-day training period ended, the operant level of the subject's response to social commands was again assessed during a second five-day baseline period according to the procedure outlined for the initial baseline evaluation. After this second baseline period was completed, training, along with daily measurement of the operant response level, was reinstated for a 15-day period.

Mary. Except for deviations discussed here, the procedure followed for Mary was identical to that used for Roger. Because the types of instructions that her teacher felt that she could

respond to were somewhat different, the list of 20 instructions was changed (see Table 1). The subject's initial operant response levels to the instructions were established over a five-day baseline period with the entire list being administered twice daily. After the baseline was taken, training sessions extending over a period of 35 consecutive school days were initiated. The instructions given to the subject were broken into two sets of 10. The training and generalization were again generally parallel with regard to the types of instructions. The subject's responses to instructions in the training set again provided the focus for the reinforcement and guidance procedure. The subject's responses to the other set of instructions were used to assess generalization effects of the training procedure. Two instructions, "sit down" and "stand up", were selected as preliminary commands that were worked with first to acquaint the subject with the training procedure. In training the subject to make appropriate motor responses to the instructions, reinforcement (physical and social), physical guidance, and fading procedures were used, essentially in the same way as with Roger. Because Mary was on a kilogenic (high fat-low sugar) diet, artificially sweetened soda was initially administered as the reinforcer. The soda was squirted into her mouth by means of a hypodermic-like syringe. However, later in the study Mary was taken off her special diet and cereal (Fruit Loops) was used as a reinforcer. As with Roger, after each training session the entire list of instructions was given twice to the subject according to the procedure used during the initial baseline period. After the training period was terminated, a 15-day baseline period was conducted with the entire list of commands again being given twice daily. This second baseline period was followed by a 10-day period during which training was reinitiated.

RESULTS

Two checks were made during each of the baseline and training periods in order to assess the reliability with which two observers rated the appropriateness (correctness) of the subjects' responses to the various instructions. In all instances, the percentage of agreement between independent ratings made by the observers exceeded 95%.

Figures 1 and 2 present the average daily frequency of correct motor responses per five-day period made by Roger and Mary to the training and generalization instructions during the baseline and training sessions. The response data recorded during the training period represent non-reinforced generalized responses observed during the testing periods immediately following the daily training sessions. Responses to the training instructions were directly reinforced during the training sessions; the generalization instructions were never presented during this period.

As shown in Figures 1 and 2, both Roger and Mary's average response frequencies to the training and generalization instructions during the baseline period were quite low. In the first training period, both subjects showed a marked increase in responding to those two sets of instruction, with Roger showing a more substantial increment than Mary. During the last five days of this period, Roger's average response frequencies to the training and generalization instructions were 15.8 and 12.6 respectively, while Mary's were 7.8 and 6.2. During the second baseline (Post Training) period,

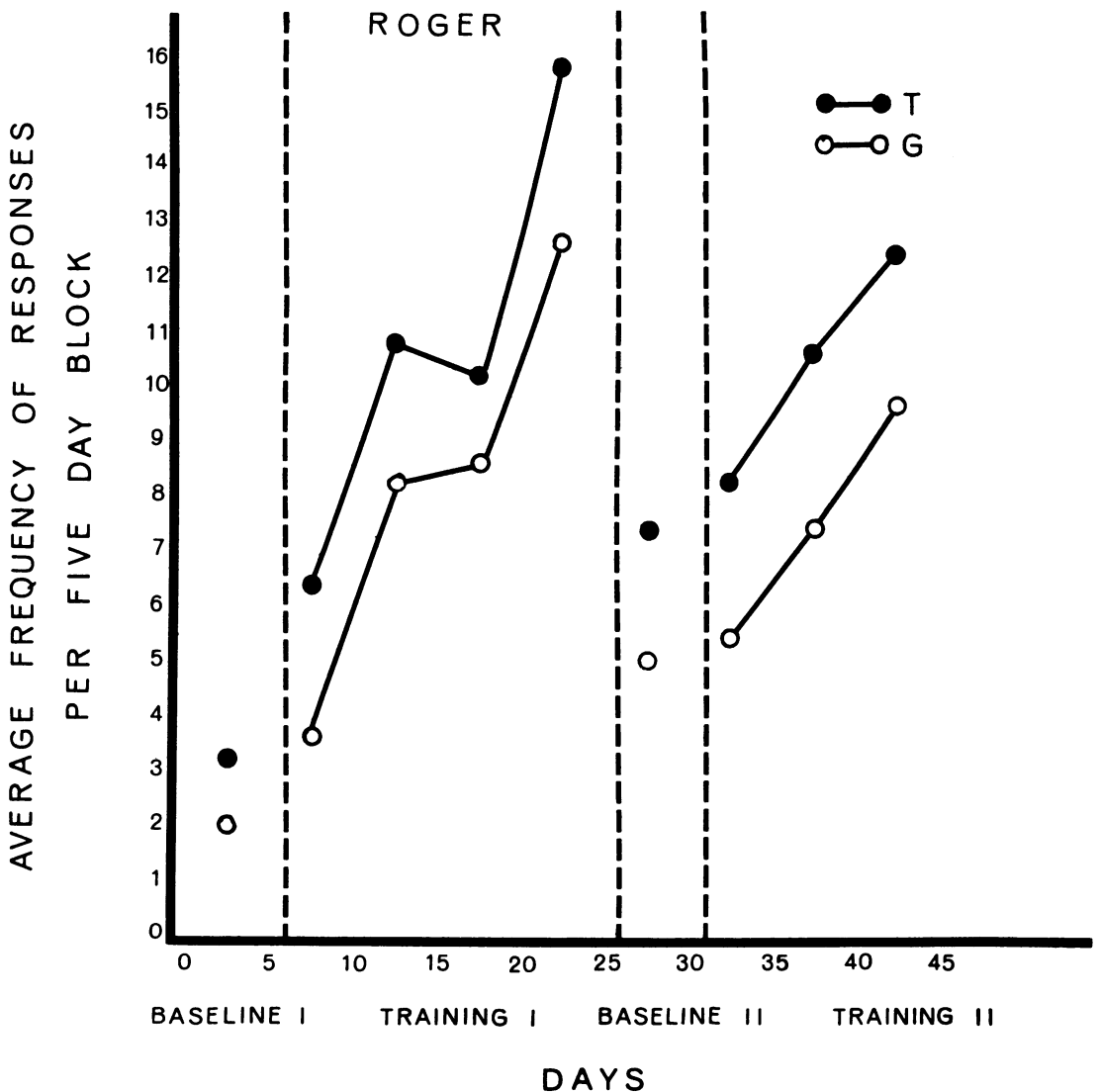


Fig. 1. Average daily frequency of correct motor responses per five-day block made by Roger during baseline and training periods to training (T) and generalization (G) instructions.

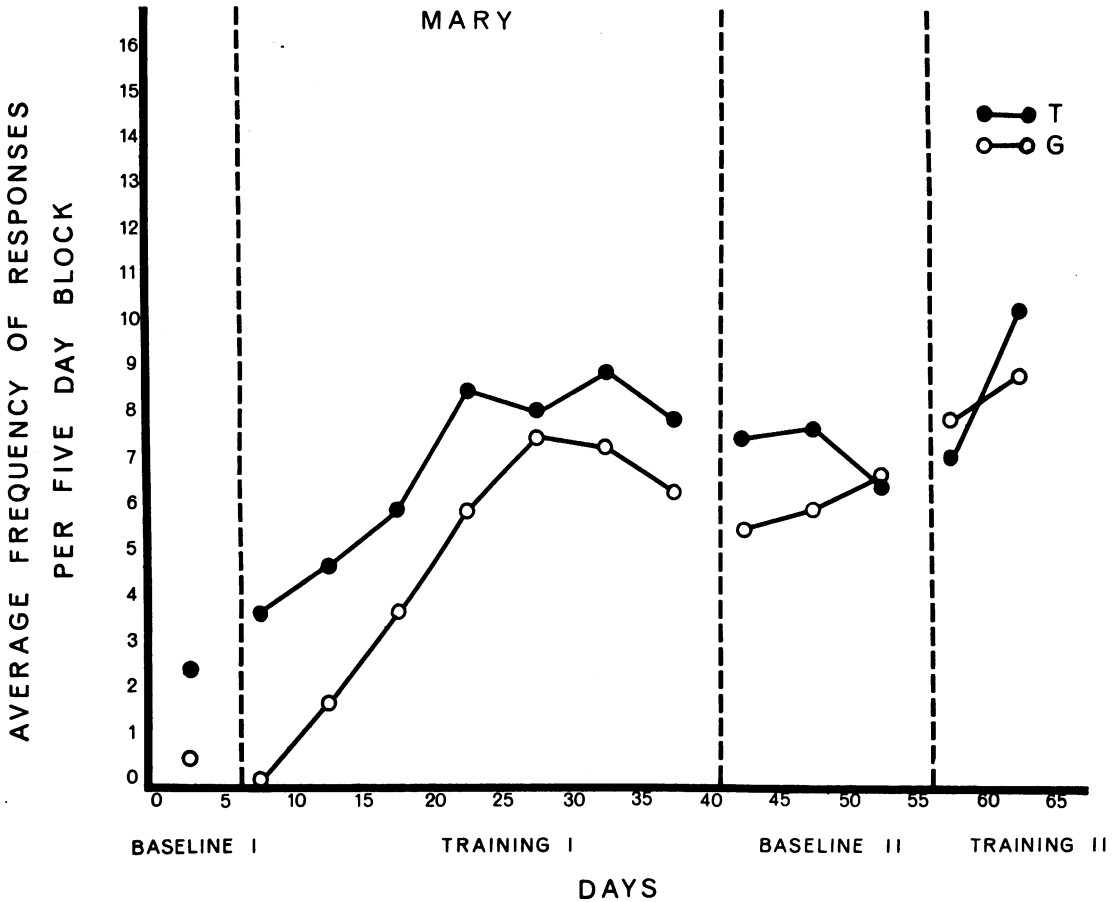


Fig. 2. Average daily frequency of correct motor responses per five-day block made by Mary during baseline and training periods to training (T) and generalization (G) instructions.

Roger showed a precipitous decline in responding to the two sets of instructions, while Mary showed only a slight decrement. In the second training period, both subjects displayed subsequent increments in responding to the training and generalization instructions. During the last five days of this period, Roger's average response frequencies to the instructional sets were, however, lower than his level of responding during the last five days of the first training period, while Mary's conversely were higher.

DISCUSSION

The performance of the two subjects suggests that functional relationships were developed between a majority of the specific motor responses and the corresponding training instructions given by the experimenter. For both

Roger and Mary there was a pronounced increase in the frequency of correct responses during the first training period, followed by a decrease during the second baseline period, and again a subsequent increase during the second training period. Contrasting the performance of the two subjects, Roger showed a greater increase in responding during the first training period, a greater decrease in responding during the second baseline period, and less response recovery during the second training period than Mary. Although there was some decrement in responding during the second baseline period, it is important to note that both subjects continued to respond correctly to many of the instructions.

Considering the subjects' responses to the generalization instructions it is evident that an extensive generalization effect occurred. Although responses to these instructions were

never reinforced, both subjects showed a marked increase in the number of such responses during the training periods. That responses to these generalization instructions were brought under control of the reinforcing stimulus is also suggested by the fact that the trend of response increments during the first training period, response decrements during the second baseline period, and subsequent response increments during the second training period were quite similar to the trend of responses to the training instructions during these same periods. When the structure of the training and generalization instructions is examined, this type of generalization effect is striking. While the type of motor response referred to in the two sets of instructions was often identical (*e.g.*, point to or put) the stimulus involved in the particular responses (nose, block) was not the same.

It may well be that more was involved in training than the subjects learning a specific motor response and/or learning to make such a response in the presence of a specific stimulus. It is possible that the subjects were capable of responding more appropriately to the instructions before training than was indicated by their performance during the initial baseline period, but that they merely failed to respond for motivational reasons. The reinforcement administered to responses during training thus may not have influenced learning but rather increased the probability of the subject utilizing responses already in his behavioral repertoire. This contention is supported by the fact that in the majority of instances where a subject frequently responded in an appropriate manner during training to a specific instruction he also responded appropriately at least once to this same instruction during the initial baseline period.

For both subjects, the general trend of increments in correct responding during the training period and decrements during the baseline periods were by and large reflected in the frequencies of correct responses that they made to individual instructions. However, there were several instructions to which the subjects seldom or never responded correctly. In general, these were either instructions that were longer and more complex (*e.g.*, put the pencil next to the box) or instructions that contained words that the subjects did not respond to (know) in other verbal contexts as

well (determined via informal testing procedures).

This finding suggests that it might be important to examine carefully and evaluate the format and words used in designing an adequate instructional training procedure. Considering the format of the instruction, it would seem more efficient before training a subject to respond to a complex command (*e.g.*, pick up the pencil and put it in the box) to first insure that he has mastered the separate component responses to the two simple instructions within such a complex command. Moreover, it might also be advisable to use a word in a simple or complex instruction only if the subject already "knew" its empirical referent. Although a child can and probably does learn the "meaning" of a word in the process of learning an appropriate motor response to an instruction involving that word, it might be more efficient first to teach the child the verbal label for a stimulus object before incorporating it into an instruction.

Whether or not this latter suggestion is advisable, however, is an empirical question. Expressive training has been shown to generalize to receptive discriminations (Dickerson, Girardeau, and Spradlin, 1964; Hamilton, 1966), but results by Guess (1969) suggest that receptive comprehension may be functionally independent of expressive speech. In his study, however, only the effect of receptive training on expressive speech was examined. The question of what effect expressive speech training has on receptive comprehension was not evaluated by Guess and needs to be examined further.

In summary, this study suggests that reinforcement, guidance, and fading procedures can be used effectively to produce and maintain instructional control of behavior in severely retarded children where such control is virtually absent to begin with. Moreover, it is particularly important to note that the two children in this study developed instruction-following behaviors even though they were almost completely deficient in expressive speech. There was also a strong indication that such procedures will also concomitantly facilitate appropriate responding to instructions not directly involved in the training program. In developing reinforcement procedures for use with retarded children, it seems imperative that such a generalization effect occur if such techniques are to be of real use to special edu-

cation teachers. Unfortunately, there has been too little emphasis on the development and evaluation of behavior modification techniques that promote generalization to responses beyond those immediately involved with the training procedure.

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Received 16 November 1970.

(Revised 4 June 1971.)