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Schedule Sensitivity of Instructed Human Operant Behaviour: Effects of Warning and of Social Stimuli with Elaborate and Minimal Instructions

© Christine-Shawn Boisvert

University of Ottawa

Ph.D. Thesis in Psychology

Abstract

Schedule insensitivity of behaviours that are established through elaborate instructions is a frequently reported finding in the behavioural literature. This insensitivity usually takes one of two forms: (a) behaviour pattern that is not appropriate to the schedule in effect or (b) failure of the behaviour pattern to adjust once a new unannounced schedule is put in effect. However, a number of methodological flaws in previously published studies hinder a clear interpretation of these findings. The current series of studies attempted to rectify these problems by including sufficiently large groups of subjects (n = 14 or 15) to allow for acceptable levels of power. In addition, the same experimental task was used throughout to provide continuity. This task involved first establishing steady-state responding on a multiple DRL6s/FR18 schedule, and then changing the parameters of the schedule, without alerting subjects to this change. Experiment 1 attempted to replicate the previous findings that indicated that elaborate instructions induced schedule insensitivity when the multiple schedule was changed to EXT/EXT. Experiment 2 investigated the generalisability of the findings of Experiment 1 by examining the effect of a change in contingency to FR18/FR18. Experiments 3 and 4 investigated whether the findings of the first two studies were due to the effect of a "social variable" (the salience of the social stimuli). Experiments 1, 2, and 3 also investigated the effect of a "warning" that conditions may change at any time. Overall, the results suggest that the warning decreases the schedule insensitivity engendered by the elaborate instructions. The results also suggest that the salience of the social stimuli is an important factor in producing the "insensitivity effect," and may be responsible for some of the more dramatic results in the literature. Further, the findings raise the question of whether instructions do, in fact, engender schedule insensitivity.

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Schedule Sensitivity of Instructed Human Operant Behaviour:

Effects of Warning and of Social Stimuli with Elaborate and Minimal Instructions

Organisms can learn to perform new tasks a number of different ways, including trial-and-error learning and shaping. Trial-and-error learning is the process by which it gradually takes an organism less and less time to perform a task (Catania, 1984). This occurs because the behaviours emitted by an organism can impact on and change the environment. These environmental changes affect the likelihood that the behaviour that caused these changes will reoccur in the future. For example, when a food-deprived rat is placed in a box in which food can be delivered by depressing a lever, the rat will initially engage in various exploratory behaviours, such as sniffing and walking around the box. Eventually, one of these behaviours will result in the rat pressing on the lever, which will occasion the delivery of food. Subsequently, it will take the rat less and less time to begin pressing the lever to receive food each time it is placed in the box. The consequence (food delivery) of the behaviour (pressing the lever) increases the likelihood that lever-pressing will reoccur again in the future. In behavioural terms, this procedure is called reinforcement. Reinforcement occurs when (a) an action (e.g., lever-pressing) leads to a consequence (e.g., food delivery), (b) the action then occurs more frequently, and (c) this increased frequency occurs because the consequences follow the action (Branch & Hackenberg, 1998). In this case, the food delivery is said to reinforce lever-pressing, and the food itself is called a reinforcer. If the food delivery were to decrease the probability of pressing the lever again in the future, the effect of food delivery would be to 'punish' lever-pressing.

Although trial-and-error learning is an effective method of establishing behaviours, it may take a significant amount of time before the rat even ventures close enough to the lever to press it. Behavioural research has shown that one can speed up the acquisition of new behaviours

if one "shapes" the behaviour. Shaping the behaviour one wishes to establish involves reinforcing closer and closer approximations of the desired behaviour (Kazdin, 1994). To continue with the 'rat' example, one could begin by delivering food (i.e., reinforcement) when the rat moves in the direction of the lever; then, once the rat is consistently moving in the direction of the lever, reinforcement would be delivered only when the rat is in close proximity to the lever; then, in the final phase of the shaping, reinforcement would be delivered only when the rat actually presses the lever.

In humans, both trial-and-error learning and shaping can be used to establish new behaviours. But, there is also an additional method that cannot be used with animals: instructions. Instructions are verbal descriptions that indicate the manner in which to perform a task, and state or imply the consequences (Skinner, 1976). For example, instead of providing reinforcement for successive approximations for lever-pressing, one could quickly establish this behaviour in humans by saying, "press the lever to receive food." One would expect that establishing behaviours through the use of instructions would be advantageous in terms of rapidity and ease of acquisition, particularly in the case of complex tasks. For example, it would likely take a very long time for a person to learn to drive a car exclusively through trial-and-error learning. One could presumably speed-up the acquisition process through shaping by selectively reinforcing behaviours that approximate proper driving. However, this would surely be a very lengthy, not to mention dangerous, endeavour. It would be much more expedient, and safer, to instruct the person to "press lightly on the right pedal to accelerate," etc...

In everyday life, instructions are an important and frequently used method of teaching a variety of behaviours (Skinner, 1976). From a very early age, parents instruct their children to emit, or stop emitting, various behaviours. This form of teaching continues in the classrooms of

grade school and graduate school. Instructions are also a component of various therapies, and are an integral part of experiments in the behavioural laboratory (Skinner, 1963), in which subjects are instructed to perform specific behaviours (e.g., pressing a button to receive points). Given that instructions are so pervasive, it would be useful to study their effects to determine how, and under what conditions, instructions affect behaviour. And, although not a traditional focus of radical behavioural research, Skinner suggests a framework within which to study instructions.

Instructions and Radical Behaviourism

From a radical behavioural perspective the study of instructions falls within the realm of 'verbal behaviour.' The term 'verbal behaviour' was coined by Skinner (1957) to define behaviour that is effective only through the mediation of other people. Skinner used this term instead of more commonplace terms such as 'language' or 'speech' because 'verbal behaviour' was free of any unintended meaning that everyday words had acquired. For example, Skinner noted that 'language' and 'linguistic' are too broad in their conceptualisation and refer to the practices of people in general and not to the behaviour of any one person. Skinner (1976) also noted that 'language' has the "character of a thing, something a person acquires and possesses" (p. 98), as in "acquiring language." Skinner (1957) suggested that the term 'verbal behaviour' is more appropriate because it emphasises the behaviour of an individual, rather than referring to an abstract concept regarding the behaviour of people in general. He further suggested that 'verbal behaviour' is a more specific term and implies only that 'verbal behaviour' is behaviour. Skinner reasoned that verbal behaviour is different from other behaviours only in that its effects do not impact directly on the physical world. Rather, the effects of verbal behaviour are mediated through other people. Non-verbal behaviours, on the other hand, act directly on the physical world, and are directly reinforced or punished by their effects on that world. For example,

finding food inside the refrigerator reinforces the non-verbal behaviour of opening the refrigerator door. No amount of verbal behaviour, however, will open that refrigerator door directly. For verbal behaviour to have an effect on the physical world it must do so through another person. The verbal behaviour "please open the refrigerator door" will be reinforced only if the person to whom this request is directed opens the door.

Skinner's (1957) analysis of verbal behaviour suggests that verbal behaviour is acquired and maintained in the same manner as is any other behaviour: through reinforcement and punishment. The one significant difference compared to non-verbal behaviours is that the reinforcement and punishment of verbal behaviour occurs in relation to other people. Verbal behaviour is acquired within a social context in which reinforcement and punishment for emitting verbal behaviours are delivered by other people. One also learns to respond to verbal behaviour by being reinforced and punished for responding appropriately to verbal behaviour.

Within this behavioural framework, instructions are considered to be a specific class of verbal behaviour, which Skinner (1969) termed "contingency-specifying stimuli." In behavioural terms, a contingency refers to (a) the probability that a certain consequence will follow from a specific behaviour and (b) the probability that this consequence will occur in the absence of that behaviour (Domjan & Burkhard, 1986). In terms of the 'rat' example, the contingency that exists between lever-pressing and food-delivery is the probability that lever-pressing will occasion food-delivery, and the probability that food-delivery will occur without the lever being pressed. Skinner suggested that instructions "specify" a contingency by describing relations between actions and consequences (Hineline & Wanchisen, 1989). In everyday language, an instruction is a verbal stimulus that tells us (a) what to do, (b) when to do it, and (c) what will happen when we do it (Hayes & Hayes, 1989). For example, the instruction "press the lever slowly when you hear

the bell in order to receive food" specifies (a) what to do (press the lever), (b) when to do it (when you hear the bell), and (c) what will happen when we do it (receive food). It is noteworthy that Skinner actually used the term 'rule' to refer to contingency-specifying stimuli. A review of the literature indicates that most authors use the terms 'rules' and 'instructions' interchangeably (e.g., Catania, Matthews, & Shimoff, 1982; Hayes, Brownstein, Haas, & Greenway, 1986; Hayes, Brownstein, Zettle, Rosenfarb, & Korn, 1986; Rosenfarb, Newland, Brannon, & Howey, 1992; Schmitt, 1998). Hayes & Hayes (1989) point out that the term 'rule' has been used by many psychological theorists and has different meanings for each. Schmitt (1998) notes that the generic term 'rule' has been widely used to refer to such words as "...instructions, rules, advice, commands, orders, directives, adages, and proverbs" (p. 1). Further, Reese (1989) indicates that the term 'rule' has multiple everyday meanings. For example, Hayes and Hayes (1989) note that 'rule' "...originally meant a straight stick, and then a straight stick used for measuring" (p. 153). Other meanings of the word 'rule' include consistency, regularity, and 'to govern.' Hayes and Hayes (1989) further note that it is this latter meaning that is referred to in behaviour analysis. Behaviour can be 'rule governed,' that is, under the control of rules. Despite the widespread use of the term 'rule' within the behavioural literature, it was decided, for the purposes of this thesis, that the term instruction (as defined above) will be used throughout in order to avoid confusion and possibly imbuing the term 'rule' with unintended meaning.

Skinner (1976) suggested that establishing behaviour through instructions would be both advantageous and disadvantageous in comparison to establishing behaviour through exposure to the natural contingencies (trial-and-error learning). He suggested that one advantage would be that behaviours could be acquired more rapidly when instructed than when merely exposed to the natural contingencies. However, Skinner also speculated that a disadvantage would be that

behaviours established by instructions would be different from those behaviours acquired through direct experience with a natural contingency. This would be so because instructions can never capture all of the subtleties of a natural contingency; instructions cannot specify, or describe, every nuance of the actual contingency. Rather, instructions are a simplified version of the contingency, and therefore behaviours established through instructions will also be simplified. For example, the execution of a golf swing will topographically differ depending on whether one is solely following instructions or whether one has had extensive practice with hitting golf balls. In the latter situation, one's golf swing will have come under control of the direct consequences of hitting the ball; the myriad subtle consequences of hitting the ball in various ways cannot be fully captured by instructions.

Skinner (1976) also suggested that behaviours established through instructions would not, in the long term, remain different from those established by exposure to the natural contingencies. Rather, with extensive exposure to the natural contingencies, instructions would become less important in determining behaviour, and the non-verbal contingencies would eventually take over in the control of behaviour. Skinner's analysis therefore suggests that there could initially be some topographical differences between behaviours established through instructions and those established through non-verbal consequences. However, behaviours established through instructions should eventually come under control of the natural contingencies, and thus become equivalent to those behaviours that were initially established through these contingencies. This would occur because behaviours continue to be sensitive to their consequences, and therefore will eventually be shaped by the effects of the natural contingencies.

A few studies have investigated the effect of instructions on non-verbal behaviour from a

radical behavioural perspective. Unfortunately, research in this field has not progressed in a linear manner, and it is at times difficult to determine a common thread across the studies. In order to make sense of these studies, they will be reviewed within the context of Skinner's predictions about the effects of instructions on non-verbal behaviour. First, the findings related to the effect of instructions on the acquisition of behaviour will be reviewed. Second, findings regarding the topographical differences between instructed and non-instructed behaviours will be presented. This will be followed by the findings regarding the long-term effects of instructions on behaviour.

Two important points should be noted about the research that is reviewed below. First, the methodological shortcomings of these studies suggest caution in the interpretation of the results. Most of the studies have very low levels of power due to the small number of subjects in each experimental group, and due to the apparently large degree of within-group variability. In addition, many of the studies reviewed below used different methodologies and different criteria to determine schedule sensitivity. A second point to be noted is that there is little recently published research that is directly related to the content area of this thesis. Only two of the studies reviewed were published in the 1990s. A literature search revealed that although there are a number of investigators evaluating the role of instructions (e.g., Dixon & Hayes, 1998; Taylor & O'Reilly, 1997), more recent studies have a different focus that is only tangentially related to the main theme of this thesis, and will therefore not be reviewed.

Review of the Behavioural Research on Instructions

Instructions and the Acquisition of Behaviour

A review of the research in this area supports Skinner's prediction regarding the advantage of instructions on the acquisition of behaviour: People acquire behaviour more quickly

when they are provided with instructions compared to when they are only exposed to the natural contingencies. For example, in one early study investigating the effect of instructions on behaviour (Ayllon & Azrin, 1964), appropriate responding rarely occurred until specific instructions were provided to subjects. In this study, which was conducted in a psychiatric hospital, less than 10% of the 18 subjects studied picked up all of their cutlery (a knife, a fork, and a spoon) at any one meal during the 10-meal baseline period. Following the baseline, a contingency was implemented in which patients received extra items such as cigarettes and candy for picking up their cutlery. This contingency was initially put in place without any specific instructions provided to patients. However, after 20 meals, the behaviour of patients had still not come under control of the contingency (i.e., there was no discernible change in the proportion of patients who picked up all of their cutlery at mealtime compared to the proportion of patients who had done so during the baseline period). When the procedure was changed to include the instructions to patients indicating that they would receive various items in return for picking up their cutlery, almost half of the patients immediately began responding appropriately. By the fifth meal, 67% (12/18) of the patients were responding appropriately.

The fact that instructions facilitate the acquisition of behaviour has also been supported by a number of laboratory studies that used various reinforcement schedules to investigate the effect of instructions on non-verbal responding. Reinforcement schedules are programs that determine "how and when the occurrence of a response will be followed by a reinforcer" (Domjan & Burkhard, 1986, p.129). In a study conducted by Baron, Kaufman, & Stauber (1969), a Fixed Interval reinforcement schedule was used to investigate the influence of instructions on non-verbal responding. An Interval schedule of reinforcement is a schedule in which a certain amount of time has to elapse since the last delivery of a reinforcer before a response will

occasion a reinforcement (Domjan & Burkhard, 1986). On a Fixed Interval (FI) schedule, an equal amount of time elapses after the delivery of a reinforcer before a response can occasion reinforcement. Responses emitted during this fixed interval of time (known as the inter-reinforcement interval) have no effect on the delivery of the reinforcer. Only a response that occurs at or after the passage of a specific amount of time will produce reinforcement. For example, on an FI4s schedule, the first response to occur after 4 seconds have elapsed since a reinforcer was delivered will occasion reinforcement. The typical pattern of responding observed in non-human animals on an FI schedule is known as a "scalloped" pattern, in which there is a pause in responding at the beginning of each interreinforcement interval, followed by gradually accelerating responding until the reinforcer is delivered (Buskist, Bennett, & Miller, 1981). This pattern of responding on FI schedules has been shown to be quite robust across various non-human animal species (Domjan & Burkhard, 1986). Different patterns of responding have been found to be characteristic of non-human animal responding on various other reinforcement schedules, as will be described later.

In Baron et al.'s (1969) study, subjects responded by pressing a button according to an FI schedule that had the following 5 different components: FI10s, FI30s, FI90s, FI270s, and Extinction (i.e., the programmed contingency provides no reinforcement, regardless of the rate or pattern of responding). This type of schedule is called a "multiple schedule" because it is composed of more than one schedule. In this study, all subjects were trained for 20 50-minute sessions during which each component of the multiple schedule was presented for 10 minutes, and was paired with a specific coloured light to indicate which component was in effect. A total of 14 subjects was randomly assigned to one of 4 instruction groups: One group ($n = 4$) was given elaborate instructions that indicated the manner in which to respond to each component of

the multiple schedule in order to receive reinforcement. This group of subjects was also provided feedback regarding their responding (points were added to a counter when responding met the criteria for the component schedule in effect). A second group (n = 4) was given the same elaborate instructions as the first group, but these subjects were not provided with feedback regarding the accuracy of their performance. A third group (n = 4) was given only minimal instructions that related the purpose of the experiment and indicated that they had to press the button to receive reinforcement. The minimal instructions provided no information about the rate at which the subjects were to press the button to occasion reinforcement. This group was also provided with feedback about their performance. The fourth group (n = 2) was provided with only minimal instructions and no feedback.

The results of Baron et al.'s (1969) study indicated that elaborate instructions facilitated the acquisition of schedule-appropriate responding. By the end of the fifth session of training, 63% (5/8) of the subjects provided with elaborate instructions were responding consistently with the programmed contingency (i.e., their responding showed scalloping, and their response rates were markedly different across the 5 components of the multiple schedule). In contrast, 0% (0/6) of the subjects provided with only minimal instructions were responding according to the multiple schedule by the end of the fifth session of training. The results also indicated that this advantage of instructions persisted until the end of the training (i.e., 20 sessions). By session 20, 88% (7/8) of the subjects given elaborate instructions were showing both differentiation in their response rates across the 5 components of the multiple schedule, as well as non-human animal-like responding on the multiple schedule (i.e., scalloping). In contrast, 0% (0/2) of the subjects given minimal instructions and no feedback, and 75% (3/4) of the subjects given minimal instructions with feedback, showed differentiation in their responding across the different

components of the multiple schedule. In addition, Baron et al. (1969) noted that marked scalloping was more often and reliably seen in those subjects who were given elaborate instructions (feedback and no feedback) compared to those subjects who were given minimal instructions with feedback. Those subjects who were given minimal instructions and no feedback showed no evidence of scalloping or of differentiation in their response rates across the 5 components of the multiple schedule. This latter result is not surprising because in the absence of feedback, subjects would not come into contact with the consequences of their behaviour on the environment. That is, without feedback it would be impossible to be sensitive to the consequences of one's actions because one would never enter into contact with these consequences.

Another study that used an FI schedule also found that instructions facilitated the acquisition of schedule appropriate responding. In their study, Lippman & Meyer (1967) required volunteer college students to perform a task in which they had to press a button according to an FI20s contingency schedule in order to obtain reinforcement (points on a counter). One group of subjects (n = 10) was given minimal instructions that explained the purpose of the experiment, described the apparatus, and indicated to subjects that they had to push the button to obtain points. These minimal instructions provided no information about the reinforcement schedule in effect. A second group of subjects (n = 3) was provided with elaborate instructions in addition to the minimal instructions. The elaborate instructions accurately explained that reinforcement was contingent on "...pressing the button after a certain amount of elapsed time (...) [which] will vary somewhat from point to point" (p.135). Subjects were exposed to the FI20s schedule until they had accumulated a total of 50 points. The results showed that 100% (3/3) of participants given elaborate instructions began responding in a

manner consistent with an FI schedule and showed the characteristic scalloped pattern of interval responding very early on in the training (within 1 to 3 reinforcements). In contrast, only 20% (2/10) of participants given only minimal instructions began responding according to the FI schedule as quickly. The results also showed that without specific elaborate instructions, a number of subjects never responded appropriately. By the end of training (i.e., after having accumulated 50 reinforcements), 40% (4/10) of subjects who were provided with only minimal instructions were still not responding according to the FI schedule.

Two studies by Hayes and his colleagues also demonstrated that elaborate instructions facilitated the acquisition of schedule-appropriate responding. These studies will not be reviewed in detail here because the main focus of these experiments was on other properties of instructions, which will be discussed in later sections (pp. 34-39 and pp. 44-47). Only an overview of the findings is presented here. In a study by Hayes, Brownstein, Zettle, et al. (1986), one group of subjects (n = 4) was given only minimal instructions that explained the purpose of the experiment, described the experimental apparatus, and indicated to subjects that they had to press the buttons to receive points. These minimal instructions provided no information about the reinforcement schedule in effect. A second group of subjects (n = 4) received both minimal instructions and elaborate instructions that explained the rate at which they were to respond in order to receive reinforcements. All subjects were exposed to the contingency for a total of 48 minutes. The results indicated that subjects given elaborate instructions began responding according to the programmed contingency more quickly than did subjects who received only minimal instructions. Within the first 4 minutes of training, 100% (4/4) of the subjects given elaborate instructions responded in a manner that was consistent with the programmed schedule, whereas 0% (0/4) of the subjects provided with minimal instructions only responded similarly.

Further, this difference continued until the end of the training period. Even after 48 minutes of exposure to the schedule, only 25% (1/4) of the subjects who had received only minimal instructions were responding appropriately. Similar results were found by Hayes, Brownstein, Haas, et al. (1986), in a study that used the same instructions and a similar task as those used in Hayes, Brownstein, Zettle et al. (1986). This study does not report when during the 64 minutes of training that subjects began responding according to the programmed schedule, but only reports the number of subjects responding appropriately by the end of the training. The results indicated that 94% (15/16) of the subjects given elaborate instructions responded according to the programmed contingency by the end of training, whereas only 32% (6/19) of the subjects who were given only minimal instructions were responding similarly.

Finally, a study by Rosenfarb et al. (1992) also demonstrated that elaborate instructions facilitated the acquisition of schedule-appropriate responding. This study will not be reviewed in detail here because the main focus of the experiment was on other properties of instructions, which will be discussed in a later section (pp. 47-49). Only an overview of the findings is presented here. In this study, one group of subjects (n = 10) was given only minimal instructions that explained the purpose of the experiment, described the experimental apparatus, and indicated to subjects that they had to press the buttons to receive points. These minimal instructions provided no information about the reinforcement schedule in effect. A second group of subjects (n = 10) received both minimal instructions and elaborate instructions that explained the rate at which they were to respond in order to receive reinforcements. All subjects were exposed to the contingency for a total of 52 minutes. The results indicated that subjects given elaborate instructions began responding according to the programmed contingency more quickly than did subjects who received only minimal instructions. After an initial 40 minutes of training,

60% (6/10) of the subjects given elaborate instructions responded in a manner that was consistent with the programmed schedule, whereas only 10% (1/10) of the subjects provided with minimal instructions only responded similarly. Further, this difference continued until the end of the training period. After an additional 12 minutes of exposure to the schedule (i.e., after a total of 52 minutes), 70% (7/10) of the subjects who had received elaborate instructions were responding appropriately, compared to 50% (5/10) of the subjects who had received only minimal instructions.

The research findings clearly support Skinner's first prediction that subjects acquire behaviours more quickly when they are given specific instructions as to how to respond. When subjects are only given minimal instructions that provide no information regarding the contingency in effect or regarding the specific manner in which to respond, subjects acquire behaviours much more slowly. In addition, the findings indicate that without elaborate instructions, many subjects never acquire the new behaviour.

Topographical Differences Between Instructed and Non-Instructed Behaviours

Skinner's second prediction about the effects of instructions posited that instructed behaviours would be topographically different from behaviours established solely through exposure to the natural contingencies. This difference would arise because instructions cannot specify all of the subtleties of contingencies, and instructed behaviours would therefore be simplified versions of behaviours established through the natural contingencies. That is, non-instructed behaviours would be under the control of the natural contingencies, whereas instructed behaviours, at least initially, would not be completely under the control of the natural contingencies. With non-human animal subjects, researchers consider that behaviour has come under the control of the reinforcement schedule once the subject begins to emit characteristic

patterns of responding (Domjan & Burkhard, 1986). As indicated previously, research has found consistent patterns of responding on various schedules of reinforcement across different species of non-human animals. Because behavioural theory holds that the principles identified with non-human animals should also apply to humans (Hayes, Zettle, & Rosenfarb, 1989), the patterns of responding of humans on various reinforcement schedules should resemble the patterns of responding of non-human animals on similar schedules, once behaviour has come under control of the reinforcement schedule. Thus, based on Skinner's second prediction, one would expect that non-instructed behaviours would resemble the responding of non-human animals on similar schedules, whereas instructed behaviours would differ from the responding of non-human animals.

A review of the studies presented above does not support this prediction because there do not appear to be any topographical differences between the responding of humans subjects who were provided with elaborate instructions, and the responding of non-human animal subjects on similar schedules of reinforcement. The studies of Baron et al. (1969), Hayes, Brownstein, Haas, et al. (1986), Hayes, Brownstein, Zettle et al. (1986), Lippman & Meyer (1967), and Rosenfarb et al. (1992) all showed schedule appropriate responding for the majority of subjects provided with elaborate instructions. A lack of schedule control (as evidenced by responding that does not correspond to the behaviour of non-human animals on similar schedules) was seen much more frequently in subjects who were only exposed to the programmed contingencies and not provided with elaborate instructions. For example, as indicated previously, Baron et al. (1969) found that marked scalloping, which is considered to be indicative of schedule control, was seen more often and more reliably in those subjects who were given elaborate instructions. Further, a number of studies that examined the response patterns of non-instructed human subjects on various

reinforcement schedules also found that responding often did not correspond to the responding of non-human animals on similar schedules (e.g., Schmitt, 1974; Striefel, 1972; Weiner, 1962, 1964, 1965, 1969, 1970a, 1970b). These findings therefore suggest that it is non-instructed human responding, and not instructed responding, that fails to be controlled by the contingencies in effect.

Despite the apparent evidence to the contrary, Matthews, Shimoff, Catania, & Sagvolden (1977) asserted that instructed responding is topographically different from non-instructed responding that is under the control of the contingency. They supported this claim by proposing that the behaviours that had been considered to be non-instructed were, in fact, instructed. They indicated that it is erroneous to consider that the responding of subjects in the studies reported above was 'non-instructed,' because subjects were provided with instructions to initiate responding. That is, subjects were told what behaviour to emit (e.g., "press the lever") in order to receive reinforcement. Matthews et al. pointed out that animal studies establish responding (for example, lever-pressing in rats) through shaping. With human subjects, however, responding is typically established through instructing subjects on the desired response (i.e., that the task involves 'pressing the lever'). Matthews et al. posited that instructing subjects on the response required to operate the experimental apparatus does constitute providing subjects with instructions, and may be responsible for the differences between human and non-human animal responding on reinforcement schedules. They speculated that humans have a history of being instructed to emit high rates of responding. Therefore, merely being instructed to "press the button" may, as a result of this history, result in high-rate responding.

Matthews et al.'s (1977) speculations therefore suggest that in order to properly investigate the topographical differences between instructed and non-instructed behaviours, one

would have to include an experimental group that received no instructions whatsoever (i.e., not even any minimal instructions). Thus, following this line of reasoning, Matthews et al. examined the response rates of subjects whose responding was established through shaping rather than through minimal instructions to determine whether shaping would reliably produce animal-like responding. Their study involved a number of procedural variations, and only relevant portions will be presented here. In this study, only "very minimal" instructions were provided to all subjects. These "very minimal" instructions related the purpose of the experiment (to earn points to be exchanged for money), and indicated when the experimental apparatus was functional (when the green "session on" light was on) and when the experimental apparatus was not functional (when the yellow "wait" light was on). These "very minimal" instructions did not provide any information to subjects regarding the response necessary to operate the apparatus. Rather, the required presses on a telegraph key were established by shaping successively closer approximations of key pressing. Once pressing of the telegraph key was successfully established, the schedule of reinforcement was put in effect. For a few subjects, responding was established through demonstration rather than through shaping. In this case, the experimenter entered the room and "demonstrated" key pressing by depressing the telegraph key once. This single demonstration was sufficient to initiate key pressing. In order to determine whether the behaviour of subjects had come under control of the reinforcement schedule, the responding of subjects was compared to the responding of non-human animal subjects on the same schedules of reinforcement, as published in the literature (e.g., Ferster & Skinner, 1957).

In one portion of the study, a total of 38 subjects was randomly grouped into 'yoked' pairs (i.e., 19 pairs). The first member of each pair received reinforcement according to a Variable Ratio (VR) contingency schedule. Ratio schedules are schedules in which a certain

number of responses have to be emitted in order for reinforcement to occur (Domjan & Burkhard, 1986). A VR schedule is a ratio schedule in which the number of responses required for reinforcement varies from one delivery of reinforcement to the next. For example on a VR10 schedule, the specific number of responses required to occasion reinforcement will vary, but, on average, reinforcement will be delivered after the subject has emitted 10 responses. The typical pattern of responding observed in non-human animals on a VR schedule is a high, constant rate of responding. Matthews, et al. (1977) have noted that ratio contingencies typically maintain higher rates of responding than do interval contingencies. The second member of the yoked pair received reinforcement whenever the responding of the first member of the pair occasioned reinforcement. That is, when the first subject received a reinforcement for having pressed the telegraph key a certain number of times, the second subject was reinforced for his/her next response. Reinforcements for the second subject were not contingent on the number of responses emitted, but rather were delivered after the passage of varying amounts of time (depending on how long it would take the first subject to press the telegraph key the required number of times). The second subject was therefore responding on a Variable Interval schedule. A Variable Interval (VI) schedule is similar to the FI schedule described above, except that a varying amount of time elapses after the delivery of each reinforcer before a response can occasion reinforcement. As was the case for the FI schedule, responses emitted during this interval of time have no effect on the delivery of the reinforcer. Only a response that occurs at or after the passage of a specific amount of time (which will vary from reinforcer to reinforcer) will produce reinforcement. Studies with non-human animals have shown that the typical pattern of responding on this schedule is roughly constant responding (Catania, 1984). The reinforcements for each pair of subjects were delivered at approximately the same time. Subjects were 'yoked'

in this manner in order to ensure that it was the actual contingency (i.e., the relationship between responses and their consequences), and not the number of reinforcements that was responsible for the patterns of responding.

The VR schedule for the first member of each pair increased gradually across the duration of the experiment, from VR5 to VR25. Following the accumulation of 50 reinforcement points, there was a brief break in the experiment, and then a VR30 schedule was instituted for 64 minutes for 11 pairs of subjects. Based on non-human animal research, it was expected that subjects on the VR schedule would show much higher response rates than would subjects on the VI schedule, and Matthews et al.'s (1977) results supported this expectation. By the end of the experiment, all first members of each pair (11/11) on the VR schedule were responding at higher rates than were subjects on the yoked VI schedule. One of the procedural variations of interest involved reversing the contingency schedules for both members of three pairs during the final 64 minutes of the experiment (i.e., VR becomes VI, and vice versa). For two of these pairs, the behaviour of one member had been established through demonstration rather through shaping. The results indicated that the effect of the schedule reversals varied from subject to subject. For all four subjects for whom behaviour was established through shaping, appropriate schedule reversals were obtained. However, appropriate reversals were obtained for only one of the two subjects whose behaviour was initially established through demonstration. Matthews et al. (1977) interpreted their findings as indicating that when behaviour is established through shaping rather than through instructions, the patterns of responding on VR and VI schedules of reinforcement are similar to the patterns one would expect to observe in non-human animals on similar schedules. However, this study did not include a group whose behaviour had been

established through instructions, and it is therefore not possible to directly compare shaping to instructions.

A second study by Matthews et al. (1977) investigated whether humans would exhibit the typical "FI scallop" response pattern when responding was established through shaping rather than through instructions. In this study, responding (presses on a telegraph key) was established through shaping for all 10 subjects, and the apparatus used was identical to that used in Matthews et al.'s (1977) first study described above. Once the response of pressing on the telegraph key was successfully shaped, 6 subjects were placed on a VR schedule in which the ratio was gradually increased from VR5 to VR25. Once subjects had obtained 50 reinforcers, the schedule was changed to FI60s. For the other 4 subjects, an FI schedule that was gradually increased to an FI50s was instituted after pressing on the telegraph key was successfully shaped. The results of this study showed that the FI schedule produced animal-like low response rates in all subjects, and that a scalloping pattern was evident for a number of subjects. Further, they found that the experience of responding on the VR schedule prior to the FI schedule did not subsequently affect responding on the FI schedule. Thus, these two studies by Matthews et al. (1977) suggested that shaping the initial response produced behaviour that was sensitive to the programmed contingencies. That is, they found that human responding on schedules of reinforcement was topographically similar to the responding of non-human animals on similar schedules. Unfortunately, Matthews et al.'s (1977) hypothesis that establishing responding using even minimal instructions results in responding that is topographically different from the responding of non-human animals on similar schedules has not been investigated in any subsequent studies. Only one study (Shimoff, Catania, & Matthews, 1981) made use of the shaping comparison condition to establish responding, but this study compared shaping to

elaborate instructions, and it is therefore not possible to determine whether establishing responding through shaping produces response patterns that differ from those of responding established through minimal instructions.

In summary, the findings in this area do not support Skinner's second prediction regarding the difference between behaviours established through instructions, and behaviours established through exposure to the natural contingencies. Although Matthews et al.'s (1977) studies suggest the possibility that minimal instructions may result in responding that is topographically different from responding that is established without any instructions, this possibility has not, as is indicated above, been directly assessed. Thus, there is insufficient evidence to support the claim that minimal instructions result in behaviours that are different from behaviours that were established only through exposure to the reinforcement contingencies. In the case of elaborate instructions, the above-reviewed findings have not demonstrated any topographical differences between responding established through elaborate instructions and the responding of non-human animals on similar schedules of reinforcement, which is contrary to Skinner's prediction. However, the veracity of Skinner's second prediction is difficult to determine on the basis of the laboratory studies reviewed above given the relative simplicity of the experimental tasks. In the case of more complex tasks, such as a golf swing, it seems much more likely that instructions would be unable to specify all of the subtleties of the natural contingency. Thus although the findings do not support the prediction that instructed behaviours would differ from contingency-shaped behaviours in terms of their topography, it is possible that this hypothesis would be supported if more complex tasks were used.

Long-Term Effects of Instructions

Skinner's third prediction regarding the effect of instructions was that instructed behaviours would eventually come under the control of the natural contingencies. That is, after having been exposed to the natural contingencies for a period of time, instructed behaviours would eventually resemble non-instructed behaviours. Given that the above-reviewed studies have not conclusively shown that instructed behaviours differ topographically from non-instructed behaviour, it would seem that it would be unnecessary to examine this prediction for the relatively simplistic studies presented. However, simply looking at the topographical differences between behaviours that have been instructed and behaviours that have not been instructed is not the only way to determine the veracity of Skinner's third prediction. Skinner based this prediction on the assumption that the reason that instructed behaviours would eventually come under control of the natural contingencies is because responding continues to be sensitive to its consequences, and therefore the contingencies would eventually alter the instructed behaviour. In other words, Skinner asserted that all behaviours, whether instructed or not, are sensitive to their consequences.

This issue of sensitivity is interesting because it is possible that the reason that no topographical differences are observed between instructed and non-instructed behaviour is because instructions could be establishing behaviours that "mimic" the behaviours established by the reinforcement contingencies. If this is the case, instructed behaviours could be appropriate for the reinforcement contingency in effect without actually being under the control of the contingency itself. That is, one could produce behaviours that "look like" they are under the control of the contingency by simply following the instructions provided by the experimenter.

Following instructions could therefore produce schedule-appropriate behaviours, regardless of whether these instructed behaviours are sensitive to their consequences.

The possibility that instructed behaviours can mimic the behaviours that are under the control of the contingency schedule is suggested by the results of the study by Baron et al. (1969), which was reviewed above. In this study, half of the subjects who were given elaborate instructions were provided with feedback on their responding, and the other half of subjects who were given elaborate instructions did not receive any feedback. The results showed that regardless of the feedback condition, all subjects whose responding had been established by elaborate instructions quickly began responding according to the contingency schedule in effect. Baron et al. (1969) posited that elaborate instructions, with or without feedback, were a prerequisite for behaviour to be sensitive to the programmed schedule. But this statement does not make sense. Behaviour cannot be sensitive to its consequences if no feedback is provided. This study therefore provides evidence that instructed behaviours can "mimic" schedule-sensitive behaviour, and suggests that it might be necessary to evaluate the sensitivity of instructed behaviours more thoroughly.

Two methods have been used to investigate the sensitivity of behaviour to schedules of reinforcement. One method has been to provide subjects with instructions that are inaccurate for the schedule in effect. If instructed behaviours are sensitive to the contingencies, as predicted by Skinner, the behaviour initially established by the inaccurate instructions should eventually come under the control of the contingencies. This would occur because following inaccurate instructions would result in behaviour that does not provide optimal reinforcement. Eventually, the feedback produced by responding on the reinforcement schedule will alter behaviour in accordance with the schedule in effect. If, on the other hand, instructed behaviours are not

sensitive to their consequences, one would expect that, even after a lengthy exposure to the contingencies, behaviour would continue to conform to the instructions. The second method used to determine behavioural sensitivity has been to first establish steady-state responding on a contingency schedule, and then change the contingency without alerting participants to this change. If responding is sensitive to its consequences, one would expect that the change in schedule would engender a corresponding change in responding. If, on the other hand, responding is not sensitive to its consequences, one would expect that an unannounced change in contingencies would have no effect on responding. The findings relating to the sensitivity of instructed and non-instructed behaviour will be reviewed next.

Schedule sensitivity as assessed with inaccurate instructions. In an early study by Kaufman, Baron, & Kopp (1966), subjects responded on a Variable Interval (VI) schedule for monetary reinforcement. One group of subjects was given accurate information that reinforcement would be delivered on a VI basis, and other groups of subjects were given inaccurate instructions that reinforcement would be delivered on either a Variable Ratio (VR) or a Fixed Ratio (FR) schedule. An FR schedule is similar to the VR schedule described previously, except that in the case of the FR schedule, the same number of responses is always required for reinforcement to occur. The typical response pattern observed in non-human animals on an FR schedule is a high rate of responding with pauses following reinforcement (Catania, 1984). Matthews, et al. (1977) have noted that ratio contingencies (i.e., FR and VR) typically maintain higher rates of responding than do interval contingencies (i.e., FI and VI). Kaufman et al. (1966) reported that their findings indicated that the inaccurate instructions exerted substantial control during a 3-hour period: participants responded according to the instructed schedule rather than to the programmed VI schedule. In a subsequent study, Kaufman et al. (1966) examined the effects

of inaccurate instructions when reinforcement was unavailable during a 3-hour period. The findings demonstrated that instruction-consistent responding was weakened during this period, but was not completely eliminated, therefore only partially supporting Skinner's prediction. That is, responding did eventually change, but responding did not completely come under the control of the programmed contingency, even after prolonged exposure to this contingency.

Similar results were found by Lippman & Meyer (1967). In this study, a total of 16 college students volunteered to perform a task which required them to press a button according to an FI20s contingency schedule in order to obtain points. Subjects were exposed to this task until they had accumulated a total of 50 points. The 16 subjects were randomly assigned to three groups, and all subjects were given minimal instructions regarding the experiment and the apparatus. The first group of subjects (n = 3) was given written instructions explaining that reinforcement was contingent on "...pressing the button after a certain amount of elapsed time (...) [which] will vary somewhat from point to point" (p.135) (i.e., instructions that explained a variable interval schedule); the second group of subjects (n = 3) was given written instructions explaining that reinforcement was contingent on "...pressing the button a certain number of times (...) [which] will vary somewhat from point to point" (p.135) (i.e., instructions that explained a variable ratio schedule); the third group of subjects (n = 10) was not provided with any additional instructions beyond the general minimal instructions. The results showed that 100% (3/3) of participants given variable interval instructions responded in a manner consistent with an FI schedule and showed the characteristic 'scallop' pattern of fixed interval responding after 1 to 3 reinforcements. For those participants given variable ratio instructions, 67% (2/3) demonstrated high, steady rates of responding, characteristic of variable ratio schedules. The third participant in this group initially showed the same high rate of responding, but after 14

reinforcements she shifted her responding in a manner consistent with the programmed FI schedule (i.e., scalloping). Finally, the responding of subjects who were not provided with any specific instructions as to how to perform the task varied: 40% (4/10) of participants responded in a manner consistent with a variable ratio schedule (i.e., high rates of responding), and 60% (6/10) of participants eventually responded according to the FI schedule in effect (i.e., showed scalloping), after 2 to 43 reinforcements. These results show that even after a lengthy period of exposure to the FI contingency (i.e., the accumulation of 50 reinforcers), the majority of subjects who were provided with inaccurate instructions continued to respond according to the instructions rather than to the programmed schedule. This study therefore appears to refute Skinner's third hypothesis and suggests that instructed behaviours are insensitive to the programmed contingency schedules in effect. However, two shortcomings of this study are important to note. First, the small number of subjects in each group greatly reduces the power of this study. Second, the fact that 40% of the subjects who were given only minimal instructions failed to come under schedule-control suggests that the period of time during which the subjects were exposed to the contingency may have been insufficient for subjects to receive enough feedback about their responding for the programmed contingency to gain control of behaviour. It is possible that if subjects had been exposed to the schedule for a longer period of time, the responding of all subjects would have come under the control of the contingency.

Another study that investigated schedule sensitivity was conducted by Buskist et al. (1981). The task used in this study required subjects to pull a door on a vending machine to access food reinforcement located behind the door. Subjects were exposed to the task for a minimum of eight sessions, and until their responding was stable (i.e., was showing the same pattern of responding) over four consecutive sessions. Each session consisted of the delivery of

20 reinforcers. Subjects could open the vending machine door according to an FI27s contingency schedule. That is, after 27 seconds had elapsed since the delivery of the last reinforcer, the vending machine door was unlocked, and subjects could open the door to access the reinforcer. During the 27-second intervals between reinforcements, the vending machine door was locked, and subjects were not able to access the reinforcer. Pulls on the vending machine door during this 27 second interval had no effect on the amount of time elapsed between reinforcers (i.e., pulls did not reset the timer). A total of 35 University students were randomly assigned to seven experimental groups (n = 5). All participants received minimal instructions describing the experiment, the apparatus, and indicating that they had to pull on the vending machine door to receive reinforcement. The first group of subjects received no further instructions beyond these minimal instructions. The second and third groups of subjects were given instructions that indicated a constraint on the number of responses required to obtain reinforcement: one group was told to emit "7-10 door pulls," and the other group was told to emit "20-23 door pulls" in order to receive reinforcement. The fourth group of subjects was given instructions that indicated a constraint on the amount of time within which they had to complete the task (i.e., "in 9 minutes and 10 seconds or less"). The fifth and sixth groups of subjects were given instructions that indicated both the time constraint in which to complete the task (i.e., "in 9 minutes and 10 seconds or less") and a response constraint: one group was told to emit "7-10 door pulls," and the other group was told to emit "20-23 door pulls." The seventh group of subjects was placed on a 'modified FI27s' schedule and was given instructions that indicated both the time constraint (i.e., "in 9 minutes and 10 seconds or less") and a response constraints of "7-10 door pulls." On the 'modified FI27s' contingency schedule, reinforcement was also available after 27 seconds, but only if subjects waited at least 13.5 seconds following reinforcement before emitting their first

response (i.e., before pulling on the vending machine door). Responses prior to 13.5 seconds following reinforcement resulted in the door remaining locked at the end of the 27 second interval, resulting in the loss of reinforcement for that interval. In that case, the beginning of the following interval began four seconds after the end of the previous 27-second interval. Responses after 13.5 seconds had no delay effect. It was expected that the 'modified FI27s' schedule would result in longer pauses following the delivery of the reinforcer than would the FI27s schedule.

The results indicated that the instructed behaviours appeared to be less sensitive to the programmed contingency compared to non-instructed behaviours. Whereas all subjects who were given only minimal instructions responded with very low rates (fewer than four responses per minute during the final session of the experiment), most subjects provided with elaborate instructions responded at a much higher rate (at least 15.6 responses during this same period). Further, those provided with elaborate instructions also responded in a manner that was consistent with their instructions and not with the programmed contingency. For those subjects who were given constraints on the number of door pulls, the results indicated that the number of responses actually emitted corresponded to the instructions. Providing a time constraint served to increase response rates for most subjects. Therefore, it would appear that the elaborate instructions rendered behaviour insensitive to the programmed contingency because the response rates of those subjects given elaborate instructions were unnecessarily high for the FI27s schedule in effect. Only 1 response per 27 seconds (i.e., approximately 2 responses per minute) would be necessary to occasion reinforcement. However, a comparison of those two groups of subjects who were provided with identical instructions (both the time constraint and the response constraint of "7-10 door pulls") but who were exposed to different schedules (FI27s or 'modified

FI27s') suggests that the actual programmed schedule did have an effect on behaviour. All subjects in the 'modified FI27s' group responded with a similar pattern that consisted of a moderate pause after the delivery of reinforcement, followed by an increasing rate of responding until the delivery of the next reinforcement. Those subjects on the FI27s schedule showed two patterns of responding: (a) 20% (1/5) of subjects responded with a brief burst of responding immediately after reinforcement, followed by a pause until the end of the interval, at which time subjects began responding once again, and (b) 80% (4/5) of subjects responded in a manner that was similar to the pattern seen for those subjects on the 'modified FI27s' schedule, but the pause following reinforcement was of a shorter duration. Overall, the results of this study offer mixed support for Skinner's third prediction. The behaviour of subjects appeared to be insensitive to its consequences because responding stabilised at a rate that was consistent with the instructions and not with the programmed contingencies in effect. This is not consistent with Skinner's hypothesis that instructed behaviours would eventually come under the control of the contingency in effect. However, the fact that identical instructions resulted in different response patterns on two different schedules of reinforcement suggests that subjects had to have been at least somewhat sensitive to the contingencies in effect.

A later study by this group of researchers (Buskist & Miller, 1986) again investigated the issue of sensitivity by using inaccurate instructions, and they proposed an explanation for the previous findings of apparent insensitivity of instructed behaviours to programmed schedules of reinforcement. In this study, subjects were randomly assigned to one of the following four instruction conditions: (a) minimal instructions (n = 4), (b) instructions to "respond after 15 seconds" (n = 4), (c) instructions to "respond after 30 seconds" (n = 4), or (d) instructions to "respond after 60 seconds" (n = 4). Subjects responded by pulling a door on a modified vending

machine in order to obtain the reinforcement (money) that was located behind the door. The vending machine door was scheduled to open according to a FI30s schedule. Subjects were exposed to the task for a minimum of six sessions, and until their responding was stable (defined as less than 15% variation in mean response rates) over three consecutive sessions. Each session consisted of the delivery of 14 reinforcers.

The results demonstrated that subjects given minimal, "15 second," and "30 second" instructions all eventually produced responses approximately every 30 seconds. In contrast, participants given "60 second" instructions waited for longer periods of time between responses compared to the other three groups. These results suggest that the occurrence of apparent behavioural insensitivity depends on whether following the instructions provides any feedback that directly contradicts the instructions. Thus, responding according to the "60 second" instructions on the FI30s schedule would provide reinforcement after every response, and the subject would therefore not experience any feedback that would invalidate the instructions. However, responding according to the "15 second" instructions would result in reinforcement after only every second response. In this case, the subject would receive feedback that the programmed contingency does not result in reinforcement after every 15 seconds, and subjects would therefore modify their responding accordingly.

In light of their results, Buskist and Miller (1986) suggested the reason that insensitivity to contingencies is observed with instructed behaviours is because instructions narrow the range of responses available to make contact with the contingency (for example, responding according to the "60 second" instructions narrows the range of behaviours to one response every 60 seconds). And, when the resulting responses do not make contact with the schedule in such a way that provides feedback that would contradict the instructions, the subjects continue to

respond according to the instructions. Buskist & Miller (1986) concluded that "it is difficult to conceive that human behavior in any situation is other than a blend of contingency-control and rule-control. Even where there are seeming exceptions, it seems best to describe such performance as 'contingency-sustained rule-governed behavior,' since subjects almost always make contact with certain aspects of the contingencies, such as reinforcement, that, in effect, confirm the instructions" (p. 128). This suggestion is consistent with Skinner's prediction that instructed behaviours continue to be sensitive to their consequences. Further, it suggests that the effect of instructions is to narrow the range of responses available to make contact with contingencies, thus at times resulting in behaviour that appears to be insensitive to its consequences.

Hayes, Brownstein, Zettle, et al. (1986) also investigated the sensitivity of instructed behaviours by manipulating the accuracy of the instructions. A multiple schedule was used in this study because it provides a 'continuous measure' of schedule sensitivity. That is, each change from one component of the multiple schedule to the other should be accompanied by a corresponding change in response rates if the responding is sensitive to the contingency. In this study, subjects were required to move a light from one corner to the opposite corner of a 5 x 5 matrix by pressing two buttons. Once subjects had succeeded in moving the light from the upper left corner to the bottom right corner of the matrix, subjects were awarded 1 point, which was recorded on a visible counter. Each button moved the light in one direction: One button moved the light to the right and the other button moved the light down. Presses on these two buttons moved the light according to a multiple schedule that had the following two components: (a) Differential Reinforcement for Low Rates – 6 seconds (DRL6s), and (b) Fixed Ratio18 (FR18) (i.e., a multiple DRL6s/FR18 schedule). A DRL schedule is a reinforcement schedule in which a

response can occasion a reinforcement only if the response occurs after at least a certain amount of time has elapsed since the previous response (Domjan & Burkhard, 1986). For example, responding on a DRL6s schedule will occasion reinforcement only if at least 6 seconds have elapsed since the previous response. Any responses that occur less than 6 seconds apart do not result in reinforcement. Subjects typically respond slowly on DRL schedules (Domjan & Burkhard, 1986). In Hayes, Brownstein, Zettle, et al.'s (1986) study, the DRL6s and FR18 components of the multiple schedule alternated every two minutes, and were each associated with a specific coloured light indicating which component was in effect. Subjects were considered to be responding in a manner that was sensitive to the multiple schedule if they showed slow rates of responding during the DRL6s schedule, and rapid responding during the FR18 portion of the schedule. Subjects were exposed to the multiple schedule for a total of 48 minutes. All subjects were provided with minimal instructions relating the purpose of the experiment and indicating the desired response (i.e., presses on the buttons to move the lights in order to obtain points). In addition to these general minimal instructions, three groups of subjects were provided with additional elaborate instructions. Two groups were given instructions that were partially consistent with the programmed schedules, and were told to either press the buttons "with several seconds between them" ("Go Slow" instructions group, n = 5), or to press the buttons rapidly ("Go Fast" instructions group, n = 4). A third group of subjects was provided with instructions that were consistent with the programmed schedule ("Accurate Rate" instructions group, n = 4). A final group of subjects was provided with no additional information regarding the schedule ("Minimal" instructions group, n = 4).

The results of this study suggested that instructions affected the sensitivity of the responding to the multiple schedule. As reported above (p. 16), by the end of the experiment

(i.e., after 48 minutes) 25% (1/4) of subjects who were given only minimal instructions showed schedule-appropriate responding on the two components of the multiple schedule. In contrast, 100% (4/4) of subjects who were given elaborate accurate instructions (i.e., the "Accurate Rate" group) showed almost immediate differentiation in their responding in accordance with the programmed contingency, and they earned points on both the FR18 and DRL6s components. This finding is not very informative in terms of the sensitivity of the instructed behaviour because, as has been suggested previously, accurately instructed behaviours could merely be "mimicking" schedule-sensitive behaviour. More informative in this regard are the results for those subjects provided with partially inaccurate instructions. By the end of the experiment, 80% (4/5) of subjects in the "Go Slow" group were responding according to the instructions they had been given rather than to the programmed contingencies. These subjects showed low rates of responding on both component schedules and earned points primarily in the DRL6s component. None of the subjects in the "Go Slow" group showed a large difference in response rates between the FR18 and DRL6s components of the multiple schedule. In the "Go Fast" group, 50% (2/4) of the subjects were responding according to the instructions provided by the end of the experiment. These subjects showed high rates of responding on both component schedules, and they earned points only in the FR18 component of the multiple schedule. The other half of the subjects in the "Go Fast" group (2/4) showed schedule-appropriate responding on both the DRL6s and the FR18 components of the multiple schedule, and they earned points on both components.

The findings of Hayes, Brownstein, Zettle et al.'s (1986) study suggest that schedule-insensitivity is not an invariable consequence of instructions. Half of those provided with "Go Fast" instructions did show schedule-appropriate responding. The results also concur with Buskist & Miller's (1986) suggestion that one of the effects of instructions on responding may be

to alter the range of behaviours available to make contact with the programmed contingencies. The failure to respond appropriately to the contingency schedule could be due to the fact that following the instructions precluded effective contact with the programmed contingency. As such, subjects would not receive feedback indicating that their responding was inconsistent with the actual programmed schedules, and subjects would therefore not alter their responding. For example, if subjects followed the instructions to "Go Slow," they would not likely respond at a high enough rate to occasion very frequent reinforcement when the FR18 component was in effect. Therefore, following the "Go Slow" instructions would preclude effective contact with the FR18 component, although some reinforcement could occur when the FR18 component was in effect (i.e., even when responding slowly one could press the button a total of 18 times within a 2-minute period). For those subjects following the "Go Slow" instructions, the multiple DRL6s/FR18 schedule would produce reinforcement for both component schedules, thus providing feedback consistent with the instructions. In contrast, if subjects followed the "Go Fast" instructions, they would not likely respond at a low enough rate to ever occasion any reinforcement during the DRL6s component of the multiple schedule. Therefore, following the "Go Fast" instructions would preclude any contact with the DRL6s component, and subjects would therefore receive feedback indicating that the instructions are inconsistent with that component of the multiple schedule. One would therefore expect that following the "Go Fast" instructions would eventually result in a marked decrease in responding during the DRL6s component of the multiple schedule if behaviour is sensitive to its consequences. If subjects decreased their responding, they would eventually enter into contact with the DRL6s schedule. This is presumably why two out of the four subjects in the "Go Fast" group did show schedule appropriate responding on both the DRL6s and the FR18 components of the multiple schedule.

Interestingly, however, the other two subjects did not decrease their responding during the DRL6s component of the multiple schedule, even after having been exposed to the contingency for 48 minutes. This suggests that for at least two subjects, response rates were not sensitive to the DRL6s contingency in effect. Further, Hayes, Brownstein, Zettle et al. (1986) noted that the behaviour of these subjects did make contact with consequences that directly contradicted the instructions they were given, but that these subjects nevertheless continued to respond according to the instructions. The authors therefore concluded that the fact that instructions can restrict the range of responding cannot fully explain the results of this study.

Two caveats must be noted in the interpretation of this study. First, each group consisted of a very small number of subjects. Second, the fact that only one out of four subjects in the "Minimal Instructions" group was responding according to the multiple schedule by the end of the experiment suggests that perhaps the length of time during which subjects were exposed to the task (i.e., 48 minutes) was insufficient for subjects to receive enough feedback about their responding for the programmed contingencies to gain control of behaviour. It is possible that if subjects had been exposed to the multiple schedule for a longer period of time, the responding of all subjects would have come under control of the contingency.

Overall, the results of the studies investigating behavioural sensitivity through the use of inaccurate instructions are equivocal. Some findings show that inaccurately instructed behaviours are sensitive to their consequences, and become consistent with the programmed contingencies after a period of exposure to the contingency. And, in a number of cases in which responding is consistent with the instructions and not with the actual contingencies, it appears that this might be due to the fact that instructions narrow the range of behaviours available to make contact with the contingencies. In this case, no feedback is provided that invalidates the

instructions, and the resulting behaviour only appears to be insensitive to its consequences. However, results also suggest that in some cases responding does result in feedback that is inconsistent with the instructions, but subjects nevertheless continue to respond according to these erroneous instructions. This latter finding suggests that instructed behaviours are at times insensitive to their consequences, which contradicts Skinner's third prediction.

Schedule sensitivity as assessed with schedule changes. Shimoff et al. (1981) studied behavioural sensitivity by measuring the correspondence between changes in the programmed contingencies and behavioural changes. This study required subjects to respond on a VI15s schedule upon which a DRL3s schedule was superimposed. The DRL3s was said to be 'superimposed' on the VI15 schedule because the requirements for the delivery of a reinforcer were twofold: (a) 15 seconds had to elapse (on average) following the delivery of a reinforcer before a response could occasion reinforcement (i.e., the VI15s portion of the schedule), and (b) this response had to be preceded by a pause in responding (an interresponse time) of at least 3 seconds (i.e., the DRL3s portion of the schedule). Superimposing the DRL3s on the VI15s schedule would be expected to result in slower response rates compared to a simple VI15s schedule. All 21 subjects in this study were provided with "very minimal" instructions regarding the purpose of the experiment, and were told that they could earn points that could later be exchanged for money. For 11 subjects, the response of pressing on a telegraph key was established through shaping. The remaining 10 subjects were provided with elaborate instructions to press the telegraph key 'slowly.' Sensitivity to the programmed contingency was assessed by determining whether responding rates changed when the DRL3s component was discontinued. Shimoff et al. (1981) expected that the removal of the DRL constraint would result in an increase in response rates.

After having been exposed to the VI15s-DRL3s schedule for at least two 50-minute training sessions, the DRL3s component was discontinued 10 minutes into a 50-minute session, without any accompanying cues to alert the subjects to this fact. The results demonstrated that for those subjects whose responding was established through shaping (i.e., very minimal instructions only), 55% (6/11) of subjects responded to the contingency change appropriately by increasing their response rate within 15 minutes (5 subjects) to 40 minutes (1 subject) after the DRL component was removed. The remaining 45% (5/11) of subjects failed to increase their responding, even after having been exposed to the contingency for an additional one (3 subjects) to three (1 subject) additional 50-minute sessions. Shimoff et al. (1981) reported that 3 of these 5 subjects who did not change their responding appropriately were initially responding at such low rates that they never entered into contact with the new contingency. For those subjects who were provided with elaborate instructions, a total of 40% (4/10) of subjects responded to the contingency change appropriately. Two subjects increased their responding within the first session (i.e., within 40 minutes), and two subjects changed their responding during the second 50-minute session. The remaining 60% (6/10) of subjects who had been provided with elaborate instructions failed to change their responding, even after having been exposed to the new contingency for an additional one (1 subject), two (2 subjects), or three (1 subject) 50-minute sessions. Shimoff et al. also noted that all 6 of the instructed subjects who did not change their responding when the DRL component was removed produced interresponse times that were both greater and shorter than 3 seconds in duration. That is, these subjects produced responses that should have provided feedback that the DRL3s was no longer in effect. However, these 6 subjects nevertheless continued to respond according to the instructions provided, and not to the new contingency.

In reviewing the results of their first study, Shimoff et al. (1981) noted that the amount of reinforcement did not change substantially when the DRL was removed from the VI schedule. They therefore wondered whether responding would be more likely to change along with the contingency change if more reinforcement would accompany a change in behaviour. Shimoff et al. (1981) therefore investigated this question by using a Variable Ratio schedule on which a DRL4s schedule was superimposed. Every response that met the requirement for the DRL was eligible for reinforcement with a probability of .25. The contingency change involved changing the length of time of the DRL, from DRL4s to DRL1s. This would result in the delivery of a significantly greater number of reinforcements when subjects increased their rate of responding. In this study, responding was established through shaping for 6 participants, and through elaborate instructions (i.e., "press slowly") for 8 participants. Subjects were exposed to the VR - DRL4s schedule for one and a half sessions (i.e., 75 minutes). Halfway through the second session, the DRL was changed from DRL4s to DRL1s. The results indicated that for those subjects whose responding was established by shaping (i.e., who received only "very minimal instructions"), 67% (4/6) of subjects responded to the contingency change appropriately by increasing their response rates within the first 10 minutes following the contingency change. The remaining two shaped subjects failed to increase their response rates even after having been exposed to the new contingency for an additional 50-minute session. For those subjects who received elaborate instructions, responding increased appropriately in 38% (3/8) of subjects. Shimoff et al. (1981) do not specify exactly when the changes in responding occurred for these subjects, but report that the increases "developed more slowly than those of shaped responding" (p.216). For 62% (5/8) of instructed subjects, responding did not increase when the contingency changed, even after having been exposed to the new contingency for an additional one (3

subjects) to two (1 subject) 50-minute sessions. The authors concluded that "the effects of instructions are apparently robust; shaped responding can be sensitive to subtle changes in contingencies, whereas instructed responding is often insensitive even to major changes in contingencies" (p. 216). Although both studies by Shimoff et al. (1981) do seem consistent in suggesting that instructed behaviours are less sensitive to contingency changes than are shaped behaviours, the differences between the groups is quite small. Further, the number of subjects in each group is also very small, thus making a clear interpretation of the data difficult.

Hackenberg & Joker (1994) also investigated behavioural sensitivity by examining the correspondence between contingency changes and behaviour changes with 4 individual subjects. In this study, the instructions were initially accurate, but were made progressively less accurate as the programmed contingencies were gradually changed. The procedure used in this study required subjects to choose between two types of schedules in order to obtain maximal rates of reinforcement (points to be exchanged for money at the end of the study). The two schedules were: (a) a fixed time schedule (FT 60s) which delivered reinforcement after every 60 seconds and (b) a Progressive Time (PT) schedule in which there were progressively increasing delays to point delivery. Each time the PT schedule was chosen the time that elapsed between reinforcements increased by a specific amount of time. For example, the first time that a subject chooses the PT4s schedule, reinforcement will occur after 4 seconds have elapsed since the choice was made. The next time that the subject chooses the PT4s schedule, reinforcement will occur after 8 seconds have elapsed. The next choice of the PT4s schedule will result in reinforcement after 12 seconds, and so on.

In Hackenberg & Joker's (1994) study, each component schedule (i.e., PT or FT) was represented by a coloured square projected side by side on a computer screen. Subjects could

choose the PT or FT components by using two keys on a keyboard. The left arrow key chose the left square, and the right arrow key chose the right square. Once a subject made a choice (i.e., pressed the right or the left arrow key), the reinforcer was delivered following the period of time specified by the component contingency chosen, regardless of intervening responses. The sequence of choices between FT and PT that would result in maximal reinforcement depended on the length of the PT schedule in effect. For example, if the PT were 25 seconds in duration, the appropriate choice sequence would be: Choose PT twice, then choose FT for every subsequent choice (i.e., reinforcement would be delivered after 25seconds, 50 seconds, and then after every 60 seconds. If the subject were to choose PT three times, the third reinforcer would be delivered after 75 seconds, and therefore reinforcement would not be maximal).

Subjects were not specifically told which contingency (i.e., PT of FT) corresponded with each square, but they were given elaborate instructions that indicated the sequence of choices that they had to perform in order to obtain the maximum number of reinforcements (i.e., subjects were told the sequence in which they had to choose the left and right squares). These elaborate instructions were initially accurate for the programmed contingencies. Then, Hackenberg & Joker systematically varied the length of the PT schedule without alerting subjects to this change in order to assess the relative control by instructions and contingencies. Of note is that as the PT increased, subjects were exposed to large discrepancies between the instructions and the programmed contingencies that resulted in a significant decrease in the delivery of reinforcement. The results indicated that all four subjects initially responded in a manner consistent with the instructions. That is, they followed the sequence of choices as indicated in the instructions. When Hackenberg & Joker began to vary the PT contingency, subjects continued to respond in accordance with the instructions for several changes in contingencies. As the

discrepancy between the instructions and the programmed contingencies increased, subjects began shifting to more schedule-appropriate responding. Hackenberg & Joker (1994) noted that there was a great degree of variability between subjects in terms of the time required before this shift occurred. They also noted that for three of the four subjects, this point of transition from instruction-appropriate to more schedule-appropriate responding was abrupt and clear. These findings are consistent with those of Shimoff et al. (1981). When responding according to the instructions provides feedback that directly contradicts the instructions, subjects change their behaviour according to the programmed contingency. This therefore suggests that responding must be sensitive to its consequences, thus supporting Skinner's third prediction.

Hayes, Brownstein, Haas, et al. (1986) used a combination of two methods to assess the sensitivity of instructed behaviours: (a) they manipulated the accuracy of the instructions and (b) they introduced a change in the programmed contingencies without alerting subjects to this change. In this study, subjects were trained on a multiple DRL6s/FR18 schedule on a task that was similar to the one used in the study by Hayes, Brownstein, Zettle et al. (1986), described above. After 64 minutes of training on the DRL6s/FR18 schedule, the multiple schedule was changed to an Extinction/Extinction (EXT/EXT) schedule for a period of 32 minutes, without alerting participants to this change. During the EXT/EXT schedule, pushes on the buttons produced no effect, and subjects could not accumulate any points. The instructions provided to subjects were similar to those given in the previously described study by Hayes, Brownstein, Zettle et al. (1986). Subjects were provided with either minimal instructions only (n = 19), or minimal instructions plus partially accurate instructions ("Go Slow," n = 13; or "Go Fast," n = 7), or accurate instructions (n = 16).

As was the case in the Hayes, Brownstein, Zettle et al. (1986) study, the results suggested

that instructions affected the sensitivity of the responding to the multiple schedule. As reported above (p. 16), after 64 minutes of exposure to the multiple DRL6s/FR18 schedule, 32% (6/19) of subjects who were given only minimal instructions showed schedule-appropriate responding on the two components of the multiple schedule. In contrast, 94% (15/16) of subjects who were given elaborate accurate instructions (i.e., the "Accurate Rate" group) showed almost immediate differentiation in their responding in accordance with the programmed contingency, and they earned points on both the FR18 and DRL6s components. Again, as was the case in the study by Hayes, Brownstein, Zettle et al. (1986), this finding is not very informative in terms of the sensitivity of the instructed behaviour because accurately instructed behaviours could merely be "mimicking" schedule-sensitive behaviour. More informative in this regard are the results for those subjects provided with partially inaccurate instructions. After having been exposed to the multiple schedule for 64 minutes, 8% (1/13) of subjects in the "Go Slow" group, and 71% (5/7) of subjects in the "Go Fast" group were responding appropriately for the multiple schedule. These findings suggest that the instructions may be adversely affecting schedule-sensitivity, as evidenced by the number of subjects who failed to respond according to the multiple schedule in the groups that were given inaccurate instructions. However, as was the case in Hayes, Brownstein, Zettle et al.'s (1986) study, the fact that so few subjects in the minimal instructions group were responding appropriately after 64 minutes suggests that inadequate exposure to the contingencies is a possible explanation for these findings. Further, one cannot determine whether the responding of those subjects given accurate instructions was sensitive to the contingencies or whether it was merely mimicking schedule-sensitivity.

Even more informative are the results that are found when one examines the effect of changing the multiple schedule from DRL6s/FR18 to extinction on both component schedules.

The effects on responding were examined only for those subjects who had initially been responding appropriately on the multiple DRL6s/FR18 schedule by the end of the 64 minutes of exposure to this schedule. The results indicated that by the end of the 32 minutes of exposure to the EXT/EXT contingency, 100% (6/6) of the subjects in the minimal instructions group changed their responding and showed large extinction effects (i.e., reduced their response rates by at least 50%). Similarly, 80% (4/5) of subjects in the "Go Fast" condition and 100% (1/1) of subjects in the "Go Slow" condition changed their responding during the EXT/EXT component and showed large extinction effects. In contrast, only 53% (8/15) of subjects in the accurate instruction condition showed large extinction effects during the 32 minutes in which the EXT/EXT schedule was in effect.

The findings of the 'extinction' portion of this study suggest that responding was sensitive to the programmed contingencies when subjects were only given minimal instructions, as evidenced by the fact that all of the subjects in this group changed their behaviour in accordance with the change in the multiple schedule from DRL6s/FR18 to EXT/EXT. The findings related to the effect of the accurate elaborate instructions both support and contradict Skinner's prediction. The finding that half of the subjects who had received accurate elaborate instructions did change their responding in accordance with the change from DRL6s/FR18 to EXT/EXT suggests that their responding was sensitive to the contingencies. However, the finding that the behaviour of the other half of these subjects was not altered when the multiple contingency changed to EXT/EXT suggests that the responding of these subjects was not sensitive to the contingencies. It does not seem likely that the reason for this apparent insensitivity was due to the possibility that instructions might narrow the range of behaviours available to make contact with the contingencies. Regardless of the behaviours emitted during

the EXT/EXT portion of the study, reinforcement would never be available. Therefore, whether one is following the initial "Accurate," "Go Slow," "Go Fast," or no instructions, all behaviours would provide the same feedback, which is that no reinforcement is provided. Therefore, if responding had been sensitive to the actual contingency, one would have expected to observe large extinction effects for all subjects, regardless of instruction condition. These findings therefore contradict Skinner's third prediction.

The final study to be reviewed that examined behavioural sensitivity by measuring the correspondence between changes in the programmed contingencies and behavioural changes was conducted by Rosenfarb et al. (1992). The task used in this study was similar to that used by Hayes, Brownstein, Haas, et al. (1986) in which subjects had to press two buttons in order to make a symbol move from one corner to the opposite corner of a 5 x 5 matrix. The schedule used by Rosenfarb et al. (1992) was a multiple DRL5s/FR8 schedule, with each component alternating every 2 minutes. Following exposure to this multiple schedule for a total of 52 minutes, both components were changed, without warning to the participants, to an Extinction/Extinction (EXT/EXT) schedule for a period of 28 minutes. All subjects were given general instructions related to the purpose of the experiment, and were informed of the desired response (i.e., responding involved the buttons). A total of 29 undergraduate volunteers were randomly assigned to one of three instruction groups: (a) subjects (n = 9) were required write down instructions that would describe the programmed contingency (self-generated instructions); (b) subjects (n = 10) were 'yoked' to the self-generated instructions group, and each subject was given the elaborate instructions generated by the subject to whom they were yoked (yoked instructions; two of the subjects in this group were yoked to the same subject in the self-generated instructions group); and (c) subjects (n = 10) were provided with no additional

instructions (i.e., minimal instructions only). Only the comparison of groups (b) and (c) is relevant to the current discussion. As was reported previously (p. 17), the results indicated that providing subjects with elaborate instructions speeded up the acquisition of the multiple schedule compared to when subjects were only given minimal instructions. By the end of the period during which the DRL5s/FR8 multiple schedule was in effect (i.e., 52 minutes), 70 % (7/10) of subjects in the yoked instructions (i.e., elaborate instructions) group and 50% (5/10) of subjects in the minimal instructions group were consistently responding according to the multiple schedule. Rosenfarb et al. (1992) also reported that the instructions significantly affected schedule sensitivity during the EXT/EXT phase of the study. Of those subjects who were considered to have been initially responding according to the multiple DRL5s/FR8 in the first phase of the study (had earned points on both the DRL and FR components of the multiple schedule), Rosenfarb et al. (1992) reported the following group differences: One hundred percent (5/5) of the subjects in the minimal instructions group significantly reduced their rate of responding by the end of the experiment (i.e., after 28 minutes). In comparison, 40% (2/5) of subjects in the yoked instructions (i.e., elaborate instructions) group similarly reduced their rate of responding by the end of the extinction phase. The results therefore suggest that when subjects are provided with elaborate instructions regarding the contingency in effect, schedule sensitivity is reduced. The fact that some instructed subjects did alter their behaviour appropriately during the extinction phase suggests that instructions do not eliminate sensitivity for all subjects. Rosenfarb et al. (1992) also noted that when the extinction phase was instituted, the responding of all subjects, regardless of instruction group, decreased almost immediately. This latter observation suggests that the responding of all subjects was, at least to some degree, sensitive to the contingencies. Thus, as was the case for the findings by Hayes, Brownstein, Haas, et al.

(1986), these results provide only partial support for Skinner's third prediction. Responding appears to be sensitive for some subjects who are provided with instructions, but much less sensitive for other subjects provided with instructions. Again, the reason for this finding is unclear. It would seem that an instruction-induced narrowing of the range of behaviours would not fully explain the persistent insensitivity of some subjects because all subjects would be exposed to a lack of reinforcement during the EXT/EXT phase, regardless of their earlier rates of responding. And one would therefore expect that all subjects, regardless of instruction group, would show significant extinction effects.

In summary, the results of the studies investigating behavioural sensitivity through the use of unannounced contingency changes are equivocal. Behavioural sensitivity is seen for some, but not all subjects within and between studies. Further, some studies suggest that behavioural sensitivity only occurs when the instructions allow contact with feedback that invalidates the instructions, whereas other studies show behavioural insensitivity even when responding comes into contact with such feedback. The findings therefore do not provide clear support, or invalidation, of Skinner's third prediction.

Summary

Overall, the findings in this area concur with Skinner's prediction that humans acquire behaviours more quickly when they are instructed than when they are only exposed to the natural contingencies. The findings also suggest that, contrary to Skinner's prediction, instructed behaviours are not topographically different compared to non-instructed behaviours. Although the findings of Matthews et al. (1977) regarding the possible effect of minimal instructions suggests that minimally instructed behaviours may be topographically different from truly non-instructed behaviours (i.e., shaped behaviours), this finding has not been conclusively

demonstrated. The preponderance of evidence therefore does not support Skinner's second prediction. However, as indicated previously, the veracity of this particular prediction is admittedly difficult to determine on the basis of the laboratory studies reviewed above, given the relative simplicity of the experimental tasks. In the case of more complex tasks it seems much more likely that instructions would be unable to specify all of the subtleties of the natural contingency. Thus, although the findings do not support the prediction that instructed behaviours would differ from non-instructed behaviours in terms of their topography, it is possible that this hypothesis would be supported if more complex tasks were used.

The most interesting research findings from a behavioural perspective are those that have shown that instructed behaviours often correspond to the instructions and not to the actual contingencies, even after prolonged exposure to the natural contingencies. This has been shown by providing subjects with inaccurate instructions, and by first establishing responding on a specific contingency schedule, and then changing the schedule without alerting participants to this change. These findings directly contradict Skinner's prediction that instructed behaviours would eventually come under control of the natural contingencies, and have led many (e.g., Catania, 1984; Hayes, Brownstein, Haas, et al., 1986; Hayes, Brownstein, Zettle, et al., 1986; Rosenfarb et al., 1992) to suggest that instructions induce behavioural insensitivity. That is, these researchers have suggested that instructions somehow alter subjects' ability to be sensitive to the consequences of their behaviour. Currently, this phenomenon is not well understood and various explanations have been put forward

One suggestion by Shimoff et al. (1981) is that insensitivity is a defining property of instructions. However, this suggestion seems to be problematic on two levels. First, it is circular in nature and provides no explanation for the process through which instructions affect

behaviour. That is, it essentially asserts that instructions induce insensitivity because the function of instructions is to induce insensitivity. Second, the research reviewed above suggested that insensitivity does not always occur. In a number of studies (e.g., Hackenberg & Joker, 1994; Hayes, Brownstein, Haas at al., 1986; Hayes, Brownstein, Zettle, et al., 1986; Rosenfarb et al., 1992), some subjects did respond according to the programmed schedule despite having received instructions to respond differently.

A second suggestion was advanced by Galizio (1979) who argued that the apparent insensitivity could be due to the fact that responding according to instructions may nevertheless result in some degree of reinforcement. If this were the case, responding may never come into contact with the actual programmed contingency. That is, he suggested that it might not be that responding is insensitive to the contingency, but rather that it simply does not come into contact with the contingency. Another way of viewing this argument is to say that instructions narrow the range of behaviours emitted by individuals. If a person is emitting, and being reinforced for, behaviours which are all similar to one another, then it is less likely that behaviours will be available to make contact with the new contingency once the experimental conditions are changed. Further, if one is following inaccurate instructions that produce behaviours that engender at least some reinforcement, the behaviours are likely to persist according to the inaccurate instructions and not contact the actual contingency (which would have provided a higher degree of reinforcement).

The findings of Buskist & Miller (1986) support the view that insensitivity to programmed contingencies would be observed only when responding provides feedback that directly contradicts the instructions. In the Buskist & Miller study, the subjects who were told to respond every 15 seconds on the FI30sec schedule would have come into contact with the fact

that a response after 15 seconds did not produce any reinforcement. And, in fact, these subjects did change their response rate in accordance with the programmed contingency. Subjects told to respond every 60 seconds, however, would have been reinforced after every response if they responded according to instructions, and therefore this rate of responding was reinforced, resulting in subjects responding according to the instructions, and not the programmed contingency. Similarly, Hackenberg & Joker (1994) found that following instructions narrowed the range of patterns of behaviour, and therefore responding did not come into contact with optimal reinforcement on certain contingencies. When the instructions and programmed schedules became sufficiently disparate, subjects then began to change their behaviour to more schedule-appropriate responding. Hayes, Brownstein, Zettle, et al. (1986), and Hayes, Brownstein, Haas, et al. (1986) point out, however, that although it is possible that instructions could restrict the range of behaviour, thus making fewer behaviours available to make contact with the contingency, this interpretation does not fully explain the research findings. They note that in their studies, the behaviour of some subjects did make contact with consequences that contradicted the instructions, but that these subjects nevertheless continued to respond according to the instructions.

From the review above it is clear that further research is needed to clearly establish the effect of instructions on responding. Researchers have advanced some possible explanations for the findings, but none appear to fully fit the data. Further, methodological flaws in the area inhibit a clear interpretation of the data. First, most of the studies have very low levels of power due to the small number of subjects in each experimental group, and due to the apparently large degree of within-group variability. Therefore, although the studies strongly suggest that instructions affect behavioural sensitivity to the programmed contingencies in effect, the lack of

power in these studies renders the results less conclusive.

Second, the studies have used different methodologies and different criteria to determine sensitivity. It is noteworthy that over time studies that apparently investigated different aspects of instructions are being compared directly in the literature, without any reference to their differences. In particular, the studies of Matthews et al. (1977) and of Hayes, Brownstein, Haas et al. (1986) are often both cited (e.g., Catania, 1984; Hayes, Brownstein, Zettle, et al., 1986; Rosenfarb et al, 1992; Hackenberg & Joker, 1994) as demonstrating that behaviours established by instructions are not sensitive to programmed contingencies. However, these studies involved different types of instructions as well as different measures of sensitivity. In the Matthews et al. (1977) study, none of the subjects received any instructions regarding the response they needed to emit in order to occasion reinforcement. Rather, responding (pressing a button) was either shaped through successive approximations, or demonstrated by the investigator. The rate of responding itself was not shaped or demonstrated. Behaviour was considered to be sensitive to the contingency if the response patterns of the subjects were found to be similar to the response patterns of non-human animals on similar schedules of reinforcement. Matthews et al. (1977) interpreted their findings as indicating that behaviour established by shaping was sensitive to the natural contingency. In contrast, in the Hayes, Brownstein, Haas et al. (1986) study, the behaviour of all subjects was established through instructions. That is, all subjects were instructed that the task consisted of pressing the button. The difference of interest in this case consisted of the effect of the accuracy and elaboration of the instructions on behaviour. Some participants were told exactly how to press the button in order to receive reinforcement (i.e., were told the correct rate of responding required), others were told only to press the button (i.e., were told nothing regarding the correct rate of responding required), and others were given

partially accurate instructions regarding the rate at which to press the button. Behaviour was considered to be sensitive to the contingency if the subjects showed an observable change in behaviour following an unannounced change in contingencies. The findings in this study were reported to indicate that behaviours established through elaborate instructions were insensitive to the contingencies, and that the behaviours established through minimal instructions were sensitive to the contingencies.

The findings from the Matthews et al. (1977) and Hayes, Brownstein, Haas et al. (1986) studies do not necessarily support each other. First, if merely being instructed to press a button does in fact cause an insensitivity to programmed contingencies (as was suggested by Matthews et al., 1977), then those subjects who only received minimal instructions in Hayes Brownstein, Haas et al.'s (1986) study would not have been expected to show any more sensitivity than did those subjects who were given elaborate instructions. Second, because sensitivity was not measured in the same manner, it is difficult to determine whether both studies are measuring equivalent phenomena. Nevertheless, as indicated previously, both studies have been consistently reported to demonstrate the insensitivity of instructed behaviours. Although it is possible that both of these studies are tapping into a common phenomenon (i.e., instruction-induced insensitivity), it is equally possible that very different phenomena are at play.

The impetus for the following series of studies grew out of the problems associated with the studies investigating the effect of instructions on non-verbal behaviour. This series of studies used sufficiently large groups of subjects to allow for acceptable levels of power, used the same experimental task throughout to provide continuity, and systematically varied specific independent variables to attempt to provide a clearer picture of the role of instructions. The first step undertaken attempted to replicate the findings that showed that elaborate instructions induce

behavioural insensitivity to the programmed schedules of reinforcement. Subsequent studies attempted to determine the factors that are responsible for the observed instruction-induced insensitivity. More specifically, the following studies were designed to investigate the effect of instructions on (a) the speed and accuracy of acquisition of new behaviours and (b) the sensitivity of these behaviours to subsequent changes in contingencies. These studies also investigated (c) whether a simple warning that conditions may change would increase sensitivity of instructed behaviour to changes in contingencies. Sensitivity to the experimental contingencies was assessed by a procedure similar to that used by Hayes, Brownstein, Haas, et al. (1986). This procedure involves developing steady-state responding on a multiple schedule, and then changing the schedule parameters. A multiple schedule of low-rate responding (Differential Reinforcement for Low Rates (DRL) schedule) and high rate responding (Fixed Ratio (FR) schedule) was used because it provides a direct and continuous measure of the discriminative control necessary to produce appropriate schedule responding (Baron & Galizio, 1983). Participants received either elaborate or minimal instructions concerning response rates. In addition, some participants were forewarned that contingencies might not necessarily remain the same throughout the experiment. Participants receiving elaborate instructions were expected to exhibit appropriate schedule responding earlier than those who received only minimal instructions. The provision of a warning to some participants in the elaborate instructions condition should make these individuals more sensitive to changes in contingencies (as opposed to participants who are not made aware of possible schedule changes). It was not expected that the warning would have an effect on participants provided with minimal instructions as these individuals are expected to display schedule sensitive behaviour in the first place.

Experiment 1[1]

The first in this series of studies was an attempt to replicate previous findings which suggested that elaborate instructions induce responding that is insensitive to the programmed contingencies in effect. These studies had shown that participants provided with elaborate instructions adapted more slowly to contingency changes compared to participants provided with minimal instructions, when the schedule is changed from a multiple DRL/FR schedule to an extinction schedule (Hayes, Brownstein, Haas, et al., 1986; Rosenfarb et al., 1992). Most of the previous research did not include a sufficient number of participants in the design to allow for adequate power in the statistical analyses. This study attempted to rectify this problem by including 14 to 15 participants per group. In addition to replicating previous research, this study also investigated whether warning participants that contingencies may change affects their schedule sensitivity when the change does occur.

Method

Participants

Seventy University of Ottawa undergraduate students (48 females and 22 males) volunteered to participate. The average age was 23 years with a range of 19 to 43 years. Participants were assigned to one of four groups: Minimal Instructions-Warning (MW), Minimal Instructions-No Warning (MNW), Elaborate Instructions-Warning (EW), and Elaborate Instructions-No Warning (ENW). Assignments were random except that additional participants were added to groups where participants failed to come under adequate schedule control during the Training phase. Each group consisted of the following number of participants who had achieved adequate schedule control by the end of the Training phase of the experiment: MW = 15, MNW = 14, EW = 15, and ENW = 14.

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[1] Experiment 1 was conducted in collaboration with Carole St-Denis, another graduate student.

Setting and Apparatus

The participant's chair faced a 60-cm wide table. Directly in front of the participant, near the edge of the table was a Commodore 64 keyboard. The computer keyboard was covered by a piece of foamcore in which there were two holes exposing the keys "D" and "L." Masking tape was used to cover the symbol on each key. Behind the keyboard sat a 14-inch (36cm) diagonal Commodore video monitor (model 1902A). When operating, the monitor projected a 5 x 5 matrix of 4-cm wide by 3.5-cm high rectangles with a 1-cm in diameter circle in one of them. A border surrounding the matrix alternated colour, from black to white, every minute. The computer was connected to a printer. For each one minute period, the computer counted the number of "D" and "L" key presses during each schedule, the number of moves of the circle to the right or down, as well as the number of times participants succeeded in moving the circle to the bottom right hand corner of the matrix. This information was printed after each session and was not visible to the participant.

Procedure

Participants were run individually. Three sessions were conducted with a short break (approximately two minutes) between each. Session 1 was 24 minutes (12 blocks), Session 2 was 20 minutes (10 blocks), and Session 3 was 24 minutes (12 blocks) long. At the beginning of each session, all participants were given at least the following set of typed instructions:

> This is a straightforward study concerning learning processes. It is not a psychological test and it does not involve any deception. During this study, you will be alone in this room except for two brief breaks when I will be with you while the computer is printing. Your task is to move the circle from the upper left corner to the bottom right corner as

> many times as you can. Moving the circle involves these two buttons and the colour of the border around the screen.

Participants assigned to the Minimal Instructions-No Warning group received only these instructions at the beginning of each session. Those assigned to the Minimal Instructions-Warning group received these same instructions at the beginning of each session with the addition of a warning that "conditions may change at any time" printed on the instruction sheet provided before Session 2 and Session 3. Participants in the Elaborate Instructions conditions were provided with the following information at the end of the original set of instructions:

> When the screen border is dark, the best way to push the buttons is slowly with several seconds between each push, and when the screen border is light, the best way to push the buttons is rapidly.

Participants assigned to the Elaborate Instructions-No Warning group received no further information, while those in the Elaborate Instructions-Warning group were given the printed warning that "conditions may change at any time" printed on the instruction sheet provided before the second and third sessions.

When the participant had finished reading the instructions, the experimenter pointed to the keys, the screen border, and the circle, while saying "these are the keys, this is the screen border, and this is the circle that you must move from here [pointing to the top left corner of the grid] to here [pointing to the bottom right corner of the grid]." Any questions asked by the participant were answered by instructing the participant to reread the relevant sections of the typed instructions. The participant was then verbally instructed to use only the two keys exposed on the keyboard to move the circle and to use only one finger on the dominant hand to press the keys throughout the sessions. The participant was given a consent form to sign and was then left

alone in the room to begin the experiment.

Training phase: Sessions 1 and 2. Before leaving the room, the experimenter initiated the computer program. At the beginning of the session, the circle was in the upper left corner of the 5 x 5 matrix. Moving the circle to the lower right involved pushes on the left and right buttons. During Sessions 1 and 2, movements of the circle were scheduled on a multiple schedule whose components were Differential Reinforcement for Low Rates – 6 seconds and Fixed Ratio 18 (DRL6s/FR18). During the DRL6s component, the first button-push after 6 seconds moved the circle by one square. The six seconds was timed from the beginning of the one-minute interval the schedule component was in effect for the first button-push, and from the previous button-push for all subsequent button-pushes. Button-pushes sooner than 6 seconds reset the timer to zero. Pushes on the left button moved the circle down one row, whereas pushes on the right button moved the circle one column to the right. During the FR18 component, presses on either the right or left button counted toward a single ratio. When the 18th response was on the left button, the circle moved down one row. When the 18th response was on the right button, the circle moved right one column. During both schedules, moves farther to the right, when the circle was in the right column, caused the circle to reset to the upper left corner. And, when the circle was in the bottom row, moves down also produced a reset. Any combination of four circle movements produced by the left button and four by the right button put the circle in the lower right corner and resulted in a beeping sound informing the participant of a "win," after which the circle would reset to the upper left hand corner. The participant could work continuously during each session; there were no pauses following resets.

The procedure just described is similar to that used by Hayes, Brownstein, Haas, et al. (1986), although the duration of each schedule component differs. In Hayes Brownstein, Haas, et

al.'s study, component schedules alternated every 2 minutes. However, pilot research in this laboratory found that 2 minute intervals allowed participants to come under schedule control very rapidly, resulting in very little differentiation in acquisition time between experimental groups. The pilot research found that this ceiling effect could be avoided by reducing the interval during which each component schedule was in effect to 60 seconds. Thus, in Experiment 1, component schedules alternated every 60 seconds. Other pilot work in this laboratory indicated that presenting the FR component first resulted in very high response rates that did not subsequently decrease sufficiently for participants to make contact with the DRL component. To avoid this problem, the DRL was always presented first, as in fact appears to have been the case in most of the studies in the literature. During the DRL component, the border around the screen was black, and during the FR component, the border was white. Between each session, the screen went blank while the data was printed. Participants were given their respective set of instructions to reread while the computer was prepared for the next session.

Change phase: Session 3. Following the Training phase, both components of the multiple schedule changed to extinction. During this Change phase, the circle could not be moved, regardless of button-pressing patterns. The colour of the border did, however, continue to alternate between black and white every 60 seconds, as it had during the first two sessions.

Variables and Design

The independent between subject variables were the type of instruction (Elaborate or Minimal), and the warning (Warning or No Warning). The within subject variable was 2-minute response blocks. During the Training phase, when the multiple schedule was DRL6s/FR18, each block consisted of one minute of DRL6s (screen border was black), followed by one minute of FR18 (screen border was white). During the Change phase, when the multiple schedule was

EXT/EXT, each 'block' consisted of one minute during which the screen border was black (previously DRL during the Training phase), followed by one minute during which the screen border was white (previously FR during the Training phase). The dependent variables related to the Training phase were the Index of Response and the Training Criterion. Dependent variables related to the Change phase were the Modified Training Criterion, and the Relative Change in Extinction.

To describe schedule control during the Training phase, an Index of Response was calculated for each participant by dividing the number of responses in the FR component by the total number of responses in both the FR and DRL components during each block (Rosenfarb et al., 1992). Because the best way to earn points on the multiple schedule was to respond quickly during the FR component and slowly during the DRL component, the greater this number (ranging from 0 to 1.00), the more likely the participant was to show a combination of both high-rate FR behaviour and lower-rate DRL behaviour. A Training Criterion used to identify those subjects who displayed appropriate responding on the multiple schedule for each individual block was defined as: (a) achieving an Index of Response of at least .85, and (b) effecting movement of the circle during both components.

For the Change phase, two methods were used to determine whether participants continued to respond according to the instructions, or whether they changed their responding in accordance with the actual schedule in effect (i.e., EXT/EXT). The first method used a Modified Training Criterion. The Modified Training Criterion is based on a Modified Index of Response which is similar to the Index of Response used for the Training phase. The Modified Index of Response was calculated for each 'block' as follows: dividing the number of responses emitted during the 1-minute component during which the screen border was white (previously FR during

the Training phase) by the total number of responses emitted during the entire 2-minute 'block.' Because the best way to respond during the Training phase had been to respond quickly when the screen border was white (i.e., during the FR component) and slowly when the screen border was black (i.e., during the DRL component), the greater the value of the Modified Index of Response (ranging from 0 to 1.00), the more likely the participant was to show a combination of both high-rate responding when the screen border was white and lower-rate responding when the screen border was dark. That is, the greater the value of the Modified Index of Response, the more likely the participant was continuing to respond according to the instructions rather than to the actual contingency in effect. The Modified Training Criterion indicating responding according to the instructions rather than to the actual schedule in effect (i.e., EXT/EXT) for each individual 'block' was defined as follows: (a) achieving an Index of Response above .85, (b) emitting a total number of responses while the screen border was white that was greater than half of the average number responses emitted during the FR components for blocks 18-22 (i.e., during the last half of Session 2), and (c) emitting at least 3 responses while the screen border was black.

The second method used to describe responding during the Change phase involved calculating the Relative Change in Extinction. This measure, which was described by Hayes, Brownstein, Haas, et al. (1986), was used to measure the changes in performance during the Change phase relative to performance during the last three blocks of the Training phase (Session 2). The Relative Change in Extinction was calculated as follows. The 12 'block' long Change phase was grouped into four groups of three 'blocks' each. For each three consecutive 'blocks' of the Change phase, the total number of responses emitted while the screen border was white was divided by the total number of responses emitted during the FR components (i.e., when the screen border was white) of the last three blocks of the Training phase (blocks 20-22). This

method yielded four measures of extinction, each based on three 'blocks' of the Change phase. In Hayes, Brownstein, Haas, et al. (1986), the schedule component used for calculating the Relative Change in Extinction was the schedule with the higher response rate. This schedule was used because it was the component in which "... all subjects in all groups earned points and thus, in which a change of scheduled contingencies would consistently result in a change of contingencies actually encountered" (p. 141). In Experiment 1, the dominant component schedule for all participants was the FR component. A Relative Change in Extinction measure of 1 indicated no change in responding; values of 0.5 and below (i.e., responding reduced by at least 50%) were considered to show high sensitivity to changing contingencies.

Data Analyses

Each Session of Experiment 1 was analysed separately. The data for Session 1 were analysed using a 2 x 2 x 6 (Instruction x Warning x 2-Blocks) analysis of variance (ANOVA), with the mean Index of Response for each 2 consecutive blocks serving as repeated measures. The mean Index of Response was calculated by adding the Indexes of Response for every 2 consecutive blocks, and dividing this sum by 2. For example, the mean Index of Response for blocks 11-12 was calculated as follows: (Index of Response block 11 + Index of Response block 12) / 2. The data for Session 2 were analysed using a 2 x 2 x 5 (Instruction x Warning x 2-Blocks) ANOVA, with the mean Index of Response for each 2 consecutive blocks serving as repeated measures. The data for the Change phase (i.e., Session 3) were analysed using a 2 x 2 x 4 (Instruction x Warning x '3-Blocks') ANOVA, with the four measures of Relative Change in Extinction (each based on three 'blocks' of the Change phase) serving as repeated measures. In addition, chi-squares were used to examine group differences during the Change phase. Only those participants who were considered to have successfully come under control of both

component schedules of the multiple contingency during the Training Phase were included in the analyses. Adequate schedule control was defined as responding at Training Criterion during at least each of the last three blocks of the Training phase (Session 2).

Results

Training: Session 1

The data for three participants were rejected because of technical problems. Three extra participants were run to replace these three. In addition, a total of 9 participants were added to replace participants who did not demonstrate adequate schedule control during the Training phase: 2 in the ENW group; 2 in the MW group; and 5 in the MNW group.

Figure 1 shows the mean Index of Response for each of the four experimental groups for each two consecutive blocks of Session 1. The results of the 2 x 2 x 6 (Instruction x Warning x 2-Blocks) repeated measures ANOVA are shown in Table 1. As can be seen, the main effects of Instruction and of 2-Blocks, as well as the interaction between Instruction and 2-Blocks, are significant. The presence of the interaction suggests caution in interpreting the main effects. Nevertheless, examination of Figure 1 shows that the two Elaborate Instructions groups (EW and ENW) began responding in accordance with the multiple schedule significantly more quickly than did the two Minimal Instructions groups (MW and MNW). Further, Figure 1 shows that all groups improved their mean Index of Response over time. The significant interaction between Instruction and 2-Blocks is due to a decrease, across the Session, in the difference between the mean Indexes of Response of the Elaborate Instructions groups and the mean Indexes of Response of the Minimal Instructions groups.

Training: Session 2

Figure 2 shows the mean Index of Response for each of the four experimental groups for

each two consecutive blocks of Session 2. Because participants were being trained to a criterion, there is a clear ceiling effect on performance, which could lead to spurious effects in the statistical analyses. Data of this nature are amenable to an arcsine transformation to counter this problem. A comparison of transformed data to data in raw form showed no differences. Therefore, the analyses presented below were done on the actual data in raw form.

The results of the 2 x 2 x 5 (Instruction x Warning x 2-Blocks) repeated measures ANOVA, which are shown in Table 2, indicate that only the main effect of 2-Blocks is significant. Figure 2 shows that the mean Indexes of Response of each of the four groups continued to improve slightly across each two consecutive blocks. No other effects are significant, and the initial difference between the groups that was found in Session 1 was no longer present in Session 2. The analysis indicates that during the second Training session, the mean Indexes of Response for each of the four groups were at similar levels.

Change: Session 3

To determine whether participants continued responding in a manner similar to the pattern established during the Training phase, the total number of 'blocks' during which participants responded according to the Modified Training Criterion was examined. Figure 3 shows the distribution of participants in each of the four groups on the number of 'blocks' during which they responded at Modified Training Criterion levels during the Change phase. It was hypothesised that providing participants receiving elaborate instructions with a warning that "conditions may change at any time" would allow for rapid adaptation to the contingency change. Consequently, it was expected that the response to the Change phase of participants in the EW group would be similar to that of participants receiving minimal instructions (i.e., the MW and MNW groups). Visual inspection of the data suggests that this is the case, and a chi-

square test was performed on these three groups. Results indicate that there were no significant differences between the EW, MW, and MNW groups on the number of participants who never responded in accordance with the Modified Training Criterion during the whole of the change phase, χ^2 (2, $\underline{N}$ = 44) = 1.99, $p > .25$. During the Change phase, 60% (9/15) of participants in the MW group, 64% (9/14) of participants in the MNW group, and 40% (6/15) of participants in the EW group never responded in accordance to the Modified Training Criterion. It was also expected that a greater number of participants in the ENW group, compared to the other three groups, would continue to respond at Modified Training Criterion levels during the Change phase. Because no significant differences were found between the EW, MW, and MNW groups on the number of participants who never responded in accordance with the Modified Training Criterion, their data were collapsed and compared to the ENW group. This chi-square analysis was statistically significant, χ^2 (1, $\underline{N}$ = 58) = 13.03, $p < .005$. Thus, whereas 40-60% of subjects in the EW, MW, and MNW groups never responded according to the Modified Training Criterion during the whole of the Change phase (as reported above), this was not the case for any of the participants in the ENW group. In other words, 100% (14/14) of the subjects in the ENW group did respond in accordance with the Modified Training Criterion for at least one 'block' during the Change phase.

Figure 4 shows the Relative Change in Extinction for each of the four groups for each three consecutive 'blocks' of the Change phase. Table 3 presents the results of the 2 x 2 x 4 (Instruction x Warning x '3-Blocks') repeated measures ANOVA for the Relative Change in Extinction during Session 3. These results show a significant main effect of '3-Blocks,' as well as significant interactions between Instruction and '3-Blocks' and between Warning and '3-Blocks.' The presence of these two interactions suggests that the main effect of '3-Blocks'

should be interpreted with caution. Examination of Figure 4 indicates that each of the four experimental groups showed a decrease in the value of the Relative Change in Extinction across the Change phase. Examination of the first 3 'blocks' of the Change phase (i.e., 'blocks' 23-25) also suggests that the two Elaborate Instructions groups (EW and ENW) had larger Relative Change in Extinction values than did the two Minimal Instructions groups (MW and MNW). This difference was no longer apparent after the first three 'blocks' of the Change phase, and seems to be responsible for the significant interaction between Instruction and '3-Blocks.' A further analysis investigating the simple main effect of Instruction condition at each level of '3-Blocks' supports this interpretation and shows that the simple main effect of Instruction is only significant at 'blocks' 23-25 (i.e., the first three 'blocks' of extinction), F (1, 54) = 17.52, p = .0001.

To more easily see the relationship between Warning and '3-Blocks,' it is helpful to examine Figure 5, which shows the interaction between Warning and '3-Blocks' across the Change phase. This figure shows that there was no difference in the average values of the Relative Change in Extinction between the two Warning conditions (i.e., EW and MW versus ENW and MNW) during the first 6 'blocks' of the Change phase. However, there was a greater decrease in the average values of the Relative Change in Extinction between the first and second half of the Change phase ('blocks' 23-28 to 'blocks' 29-34) for the two No Warning conditions (i.e., ENW and MNW) than for the two Warning conditions (i.e., EW and MW).

Discussion

The results from the Training phase support the findings from previous research that indicated that behaviours are acquired more rapidly when participants are given elaborate instructions, compared to when they are only exposed to the programmed contingencies. The

results of Experiment 1 showed that, on average, the participants in each of the Elaborate Instructions groups (i.e., EW and ENW) began responding in accordance with the programmed schedule significantly more quickly than did participants in each of the Minimal Instructions groups (i.e., MW and MNW). By the end of Session 1, most participants in all four experimental groups had begun responding in accordance with the multiple schedule. Further, by the end of Session 2 there were no significant differences in responding between the four experimental groups.

The results from the Change phase indicate two clear findings. First, each of the four groups showed a decrease in responding over time during the period in which the screen border was white (previously the FR component of the Training phase), as indicated by a decrease in the Relative Change in Extinction values across the Change phase. This suggests that the average behaviour of participants in each of the four groups was sensitive, at least to some degree, to its consequences. Second, during the first 6 minutes of the Change phase (i.e., the first three 'blocks' of the Change phase), the two Minimal Instructions groups (i.e., MW and MNW) showed greater extinction effects than did the two Elaborate Instructions groups (EW and ENW). That is, during the first 6 minutes of the Change phase, participants in the Minimal Instructions groups had smaller Relative Change in Extinction values on average than did participants in the Elaborate Instructions groups. Thus, as was the case for previous research, these findings both support and contradict Skinner's third prediction regarding the effect of elaborate instructions. Responding appeared to be sensitive to its consequences overall, but the instructions did appear to engender some degree of behavioural insensitivity at the beginning of the Change phase.

The results for the Warning condition are somewhat perplexing. First, results of the ANOVA indicate that there was no overall effect of Warning condition during the Change phase.

Rather, the Warning condition affected responding during the second half of the Change phase only. The groups that did not receive the warning (i.e., ENW and MNW) showed more dramatic extinction effects (i.e., greater decreases in the values of the Relative Change in Extinction) after the first half of the Change compared to those groups that did receive the warning (i.e., EW and MW). This is contrary to the prediction that the warning would serve to alert participants to the contingency change, thus resulting in quicker rates of adaptation during Session 3. It is not clear why the warning may have had this effect. One explanation is that perhaps the warning served as an implicit instruction to "keep trying because things might change, even though they may not be working now." Thus, those groups that were not told that conditions may change may have been coming under control of the extinction schedule toward the end of the Change phase, whereas those groups that were provided with the warning may have been under instructional control to "keep trying," thus encouraging continued responding. Finally, the ANOVA also indicates that the Warning condition did not interact with the Instruction condition, which is also contrary to the prediction that the warning would affect mainly those groups receiving elaborate instructions.

An examination of the pattern of responding (i.e., number of responses while the screen border was white [previously the FR component during the Training phase] relative to the number of responses while the screen border was black [previously the DRL component during the Training phase]) for each 'block' of the Change phase using chi-square analyses revealed some further effects of the Warning condition which were not captured by the ANOVA. A greater number of participants who received elaborate instructions without a warning (ENW) responded in accordance with the contingency in effect during the Training phase for at least one 'block' of the Change phase than did participants who were given elaborate instructions with a warning (EW), or participants who were not given elaborate instructions (MNW and MW).

Overall, the results of Experiment 1 replicated the previous findings indicating that elaborate instructions speed up the acquisition of schedule-appropriate responding. These findings add to the literature by confirming the findings with statistical analyses. The results of Experiment 1 also showed that when conditions change from a DRL6s/FR18 schedule to an EXT/EXT schedule, participants who are given elaborate instructions are, on average, initially slower to change their responding in accordance with the contingency change than are participants who are only given minimal instructions. However, this difference between the groups was found to last for only approximately 6 minutes, after which time all groups modified their behaviour in accordance with the EXT/EXT contingency. The provision of a warning appears to decrease the amount of time that the groups receiving elaborate instructions continue responding in a manner similar to the pattern acquired during the Training phase. Further, the Warning condition appears to affect responding for both the Elaborate Instructions group and the Minimal Instructions group during the second half of the Change phase. Those groups that received a warning showed smaller extinction effects during the second half of the Change phase compared to those groups that did not receive a warning.

Experiment 2[2]

Experiment 1, as well as experiments by Hayes, Brownstein, Haas, et al. (1986) and Rosenfarb et al. (1992), have investigated only the effect of changing from a multiple DRL/FR schedule to an EXT/EXT schedule. Experiment 2 evaluated the generalisability of the previous research by determining whether the "insensitivity effect" occurs under conditions other than a change to extinction. This experiment investigated the effect of changing from a multiple

[2] Experiment 2 was conducted in collaboration with Carole St-Denis, another graduate student.

DRL6s/FR18 schedule to an FR18/FR18 schedule. In addition, it included the Warning vs. No Warning manipulation condition.

Method

Participants

Eighty-two University of Ottawa undergraduate students (62 females and 20 males) volunteered to participate. The average age was 23 years with a range of 18 to 45 years. As in Experiment 1, participants were randomly assigned to one of four groups: Minimal Instructions-Warning (MW), Minimal Instructions-No Warning (MNW), Elaborate Instructions-Warning (EW), and Elaborate Instructions-No Warning (ENW). Additional participants were added to groups where participants failed to come under adequate schedule control during the Training phase. Each group consisted of 15 participants who had achieved adequate schedule control by the end of the Training phase of the experiment.

Setting and Apparatus

The setting and apparatus were identical to those of Experiment 1.

Procedure

The procedure was identical to that of Experiment 1 with the following exception: Rather than changing to EXT/EXT, Session 3 involved a change of contingency to FR18 for both component schedules (i.e., FR18/FR18).

Variables and Design

The independent between subject variables were the type of instruction (Elaborate or Minimal), and the warning (Warning or No Warning). The within subject variable was 2-minute response blocks. During the Training phase, when the multiple schedule was DRL6s/FR18, each block consisted of one minute of DRL6s (screen border was black), followed by one minute of

FR18 (screen border was white). During the Change phase, when the multiple schedule was FR18/FR18, each 'block' consisted of one minute during which the screen border was black (previously DRL during the Training phase), followed by one minute during which the screen border was white (previously FR during the Training phase). The dependent variables related to the Training phase were the Index of Response and the Training Criterion. The dependent variables related to the Change phase were the Modified Index of Response and the Change Criterion.

The variables used to describe schedule control during the Training phase (the Index of Response and the Training Criterion) were the same as those used in Experiment 1 (pp. 61-62). One of the two variables used to describe schedule control during the Change phase (the Modified Index of Response) was identical to that used in Experiment 1 (p. 62). However, a new criterion for schedule-appropriate responding had to be defined for the Change phase of Experiment 2. The Modified Training Criterion that was used in Experiment 1 was only relevant to the EXT/EXT contingency, and did not apply to the FR18/FR18 contingency that was in effect during the Change phase of Experiment 2. This new criterion was called the Change Criterion, and was defined as follows: Participants were considered to be responding at the Change Criterion if their Modified Index of Response was between .35 and .65. Because the best way to earn points on the FR18/FR18 multiple schedule was to respond quickly during both components, participants would be more likely to be responding appropriately to the multiple schedule if their response rates were approximately equal on both component schedules (i.e., when the screen border was white and when the screen border was black). Optimal responding on this schedule would produce a Modified Index of Response of .5. After examination of the data, it was decided that a Modified Index of Response of .5 plus or minus .15 represented

schedule-appropriate responding.

Data Analyses

Each Session of Experiment 2 was analysed separately. The data for Session 1 were analysed using a 2 x 2 x 6 (Instruction x Warning x 2-Blocks) analysis of Variance (ANOVA), with the mean Index of Response for each 2 consecutive blocks serving as repeated measures. The data for Session 2 were analysed using a 2 x 2 x 5 (Instruction x Warning x 2-Blocks) ANOVA, with the mean Index of Response for each 2 consecutive blocks serving as repeated measures. The data for the Change phase were analysed using a 2 x 2 x 12 (Instruction x Warning x 'Block') ANOVA, with the Modified Index of Response for each 'block' serving as repeated measures. In addition, chi-squares were used to examine group differences during the Change phase. Only those participants who were considered to have successfully come under control of both component schedules of the multiple contingency during the Training Phase were included in the analyses (this was 15 participants per group). Adequate schedule control was defined as responding at Training Criterion during at least each of the last three blocks of the Training phase (Session 2).

Results

Training: Session 1

The data for two participants were rejected because of technical problems, and the data for a third participant were rejected because he was not attending to the task (was found to be reading a book). Three extra participants were run to replace these three. In addition, a total of 19 participants were added to replace participants who did not demonstrate adequate schedule control during the Training phase: 3 in the EW group; 2 in the ENW group; 12 in the MW group; and 2 in the MNW group.

Figure 6 shows the mean Index of Response for each of the four experimental groups for each two consecutive blocks of Session 1. The results of the 2 x 2 x 6 (Instruction x Warning x 2-Blocks) repeated measures ANOVA are shown in Table 4. As was the case in Experiment 1, the main effects of Instruction and of 2-Blocks, as well as the interaction between Instruction and 2-Blocks, are significant. The presence of the interaction suggests caution in interpreting the main effects. Examination of Figure 6 indicates that the two Elaborate Instructions groups (i.e., EW and ENW) began responding in accordance with the multiple schedule significantly more quickly than the two Minimal Instructions groups (i.e., MW and MNW). Further, Figure 6 shows that each of the four groups improved their mean Index of Response over time. The significant interaction between Instruction and 2-Blocks is due to a decrease, across the Session, in the difference between the mean Indexes of Response of the two Elaborate Instructions groups and the mean Indexes of Response of the two Minimal Instructions groups.

Training: Session 2

Figure 7 shows the mean Index of Response of each of the four experimental groups for each two consecutive blocks of Session 2. Because participants were being trained to a criterion, there is a clear ceiling effect on performance, which could lead to spurious effects in the statistical analyses. As was the case in Experiment 1, a comparison of arcsine transformed data to data in raw form showed no differences. Therefore, the analyses presented below were done on the actual data in raw form.

The results of the 2 x 2 x 5 (Instruction x Warning x 2-Blocks) repeated measures ANOVA are shown in Table 5. As can be seen, the main effect of 2-Blocks, as well as the interaction between Instruction and 2-Blocks, are significant. In addition, the interaction between Instruction, Warning, and 2-Blocks is significant. The presence of the three-way interaction

suggests caution in interpreting all lower-level effects. Examination of Figure 7 suggests that the three-way interaction is due to the different rates at which the mean Indexes of Response change, for each of the four experimental groups, across blocks 13-14 to blocks 15-16. In addition, whereas the Elaborate Instructions-Warning group and the two Minimal Instructions groups continued to improve their mean Indexes of Response slightly over Session 2, the Elaborate Instructions-No Warning group's mean Index of Response was essentially stable throughout Session 2. Nevertheless, by the end of Session 2, each of the four groups showed mean Indexes of Response that were well above the Training Criterion cut-off (i.e., Index of Response greater or equal to .85), and there was no significant difference between the ENW group and any of the other three groups at any point over the course of the Session.

Change: Session 3

Figure 8 shows the number of participants responding at the Change Criterion by the end of each quartile (3 'blocks') of the Change phase. It also includes the number of participants responding at Change Criterion during the first 'block' of the Change phase ('block' 23), as well as the number of participants who never achieved the Change Criterion. It was hypothesised that providing participants receiving elaborate instructions with a warning that "conditions may change at any time" would allow for rapid adaptation to the contingency change. Consequently, it was expected that the response to the Change phase of participants in the EW group would be similar to that of participants in the MW and MNW groups. Visual inspection of the data suggests that this is the case, and a chi-square test performed on the MW, EW, and MNW groups indicates that there were no significant differences between the number of participants responding at the Change Criterion by the end of the first quarter of the Change phase (i.e., by the end of 'block' 25) for these three groups, χ^2 (2, $\underline{N}$ = 45) = 0.536, $p > .75$. By the end of the

first three 'blocks' of Session 3, 93% (14/15) of participants in the MW group and 93% (14/15) of participants in the EW group and 87% (13/15) of participants in the MNW group were responding at Change Criterion. Because no significant differences in Change Criterion responding were found between the MW, MNW, and EW groups, their data were collapsed and compared to the ENW group. This chi-square analysis was statistically significant, χ^2 (1, $\underline{N}$ = 60) = 13.88, $p < .005$. Only 47% (7/15) of participants in the Elaborate Instructions-No Warning group were responding at Change Criterion by the end of that same period of time.

Next, the data were analysed using repeated measures ANOVAs. Figure 9 shows the Modified Index of Response of each of the four experimental groups for each 'block' of the entire Change phase. In Experiment 1, the Change phase was analysed by averaging across each three consecutive 'blocks' of the Change phase. This was done because the method that was used to analyse the data followed the method outlined by Hayes, Brownstein, Haas, et al. (1986), which applied specifically to a change in contingencies from DRL/FR to EXT/EXT. However, because the change in contingencies in Experiment 2 was to FR18/FR18, the method used in Experiment 1 did not apply for the data of Experiment 2. Instead, that data were analysed using a 2 x 2 x 12 (Instruction x Warning x 'Block') repeated measures ANOVA. The results of this analysis are shown in Table 6. As can be seen, the main effects of Instruction and of 'Block' are significant, as is the interaction between Instruction and 'Block.' However, the interesting effect of Warning is not significant, although visual examination of Figure 9 suggests that the Warning may be having an effect during the first part of the Change phase, but not toward the end. Two factors may contribute to this lack of effect. First, visual inspection of Figure 9 suggests that the effect of the Warning may be 'diluted' by conducting the analysis over the entire Change phase because the latter half of the data is quite flat. The second factor may be the very conservative

correction factor for sphericity that is used (Howell, 1997). To be better able to capture the effect of the Warning, a decision was made to analyse the first half of the Change phase separately from the second half of the Change phase. Table 7 shows the results of the 2 x 2 x 6 (Instruction x Warning x 'Block') repeated measures ANOVA done on the first 6 'blocks' of the Change phase. As can be seen in Table 7, the main effects of Instruction and of 'Block' are significant, as is the interaction between Instruction and Warning. The presence of the interaction suggests that the main effect of Instruction should interpreted with caution. Examination of Figure 9 indicates that each of the four experimental groups decreased their Modified Indexes of Response across the first six 'blocks' of Session 3. The interaction between Instruction and Warning indicates that the level of responding also depended on both the level of Instruction and the level of Warning. In order to tease out the meaning of this interaction, a series of ANOVAs were performed. These analyses indicate that the difference between the Elaborate Instructions-No Warning group and the other three groups is responsible for this interaction. There is a statistically significant simple simple effect of Warning at Elaborate Instructions at 'block' 23 (F (1, 56) = 6.10, $p < .05$), 'block' 24 (F (1, 56) = 7.39, $p < .01$), 'block' 26 (F (1, 56) = 3.99, $p < .05$), and 'block' 27 (F (1, 56) = 4.30, $p < .05$). There is no simple simple effect of Warning at Minimal Instruction at any level of 'Block.' In addition, the Modified Indexes of Response of the MW, MNW, and ENW are not statistically different from each other across any of the first six 'blocks' of the Change phase.

Next, the second half of the Change phase was analysed. Table 8 shows the results of the 2 x 2 x 6 (Instruction x Warning x 'Block') repeated measures ANOVA for the last 6 'blocks' of the Change phase. As can be seen, only the main effect of 'Block' is significant, indicating that each of the four experimental groups continued to decrease their Modified Indexes of Response across

the latter half of Session 3. The analysis also shows that there were no longer any statistically significant differences in the Modified Indexes of Response between any of the four experimental groups. Figure 9 shows that by the end of the Change Phase, participants in all four groups were, on average, performing at the Change Criterion.

Discussion

The results of the Training phase (i.e., Sessions 1 and 2) of Experiments 1 and 2 confirm the previous findings that elaborate instructions facilitate the acquisition of a new behaviour. Both studies demonstrated that participants who were given elaborate instructions as to how to perform the task began responding in accordance with the programmed contingencies more rapidly, on average, than did participants who were given minimal instructions.

The results of the Change phase (i.e., Session 3) for Experiments 1 and 2 indicate that once contingencies are changed, a greater number of participants who were initially provided with elaborate instructions continued to respond in accordance with the programmed contingencies which were in effect during the Training phase for a longer period of time than did those participants who were given only minimal instructions. One explanation suggested in the literature for this finding is that instructions produce a restricted range of behaviours which precludes effective contact with the changed contingency (e.g., Galizio, 1979; Hackenberg & Joker, 1994). This hypothesis suggests that instructions lead to fewer behaviours being available to make contact with new schedules, and participants therefore fail to change their behaviour because they never come into contact with the changed contingency. This hypothesis thus predicts that a failure to adapt behaviour to new contingencies should only occur for those instructions that do not allow contact with the new contingency. Although this may well be one of the effects of instructions, it does not fully explain the findings of either Experiments 1 or 2. If

participants continued to follow the instructions provided during Training after the change in contingencies was instituted, all participants would have come into contact with the new contingency. In Experiment 1, reinforcement was never available during the Change phase and therefore all participants would have encountered a lack of reinforcement on both component schedules. In Experiment 2, continuing with the same behavioural pattern would have led to a marked decrease in reinforcement when the DRL component of the multiple schedule changed to FR18 during the Change phase. Thus, some factors other than a restricted range of behaviours must have been responsible for the results.

A second finding for the Change phase in both Experiment 1 and 2, which is original to these two experiments, is that providing a warning that conditions may change in addition to elaborate instructions appeared to decrease the schedule insensitivity observed in previous research (e.g., Hayes, Brownstein, Haas, et al., 1986; Rosenfarb, et al., 1992). On average, participants provided with a warning in addition to elaborate instructions responded to the change in a manner similar to that of participants who only received minimal instructions. Again, it seems unlikely that an instruction-induced reduction in the range of behaviours available to make contact with the new contingency could be responsible for this finding.

The results also demonstrate that the apparent schedule insensitivity that had been observed in previous research when participants were provided with elaborate instructions (e.g., Hayes, Brownstein, Haas, et al., 1986) is not unequivocal. In both Experiments 1 and 2 the insensitivity effect was only evident during the first six minutes after the change was instituted. After this time, most participants, regardless of whether they initially acquired their behaviours through elaborate or minimal instructions, modified their behaviour. Furthermore, in Experiment 2, nearly half of the participants who received elaborate instructions without a warning

appropriately changed their behaviour within the first three 'blocks' after the change in contingencies occurred. The other half of the participants in this group achieved the Change Criterion at various times across the Session. Thus, the so-called insensitivity effect occurred in only half of the participants receiving elaborate instructions without a warning. The other half modified their behaviour as quickly as did participants in the other groups.

Although the effect of Instruction was significant, it had been expected that the difference in responding between the elaborate versus minimal instructions groups would have lasted much longer, based on the findings from previous research. In fact, previous studies (e.g., Hayes, Brownstein, Haas, et al., 1986; Rosenfarb et al., 1992) showed group differences until the end of the Change phase. It is possible that part of the problem with these studies is that the researchers overstated their results. As mentioned previously, those studies were based on small sample sizes and there was between-subject variability. However, examination of their data does suggest that their participants who were given elaborate instructions seemed to take a much longer time to change their responding in accordance with the change in contingencies compared to the amount of time it took the participants given elaborate instructions in Experiments 1 and 2.

A careful examination of the procedure used in some of the studies in the literature revealed that one difference with the current series of experiments involved the participants being observed. Some studies note that participants were being observed behind a one-way mirror (e.g., Hayes, Brownstein, Haas, et al., 1986; Matthews et al., 1977; Shimoff et al., 1981). Although it is not specified whether participants were aware that they were being observed, one can infer that they were aware of this fact because the experimenter would sometimes communicate with the participants through a speaker during the experiment. In Experiments 1 and 2, participants were not being directly observed. The door to the room in which the

participant was performing the task was at times wide open, and at other times almost completely closed. Thus, some participants could see the experimenter, whereas other participants could not. The "experimenter" variable was therefore not controlled in Experiments 1 and 2.

This discrepancy in procedures suggested the following question: Based on a radical behavioural framework, would the presence of the experimenter be expected to affect responding? Because the experimenter is considered to be a stimulus in the participant's environment, it is certainly possible, based on simple principles of reinforcement, that the experimenter could affect responding. The initial difficulty with this idea is that participants are exposed to the experimenter only briefly, and it seems unlikely that much conditioning would have had time to occur. Nevertheless, the only substantial procedural difference detected between these studies and previous research was the fact that participants were observed. The behavioural literature was therefore searched to determine whether this issue had been addressed either experimentally or theoretically, and it was discovered that Hayes had discussed instructions in terms of the importance of a "social variable." A summary of his analysis follows.

Hayes and his colleagues (e.g., Hayes & Wolf, 1984; Rosenfarb & Hayes, 1984; Zettle & Hayes, 1982) have suggested that one of the functions of instructions is that they establish new sets of contingencies which may be completely unrelated to the contingencies in the natural environment. These "instruction-created" contingencies then compete with the actual programmed contingencies in effect. Hayes (1987) further suggested that there are at least two different kinds of instructions that may produce functionally distinct classes of instruction-governed behaviour. Hayes has based his typology of instructions on Skinner's (1957) analysis of verbal behaviour. In contrast to Skinner's analysis, however, where the speaker is the main unit of analysis, Hayes' typology is centred around the listener, i.e., the person to whom the

instructions are given. The first type of instruction, which Hayes has termed a track, serves to describe an actual contingency, and is followed because of an apparent correspondence between the instruction and the natural, non-arbitrary, contingencies. Hayes termed this type of instruction-governed behaviour tracking, to suggest following a path (Zettle & Hayes, 1982). The behavioural effects of tracking are produced by the contingencies that are contacted by a person following the instruction (Hayes, Brownstein, Zettle, et al., 1986). Further, tracking is independent of the source of the instruction, so that instructions from a book are as likely to be followed as are those from an actual person (Zettle & Hayes, 1982).

The second type of instruction defined by Hayes is the ply, which is an instruction that is followed not because it corresponds to the natural contingency, but rather "... because of a past history of socially mediated reinforcement for a correspondence between similar [instructions] and relevant behaviour" (Hayes, Brownstein, Zettle, et al., 1986, p. 253). Thus, the consequences for following a ply are delivered for the correspondence between the behaviour and the ply. Hayes and others argue that humans have a lengthy conditioning history of being socially reinforced for following instructions, and punished for failing to do so, and therefore humans are likely to follow instructions regardless of the effects of the behaviour specified by the instructions (Zettle & Hayes, 1982). Hayes hypothesised that the same instruction will function as a ply or a track, depending on the accompanying environmental cues. When social mediation is possible, that is, when the mediator (who is usually, although not necessarily, the speaker) has access to the relevant instructions and is able to monitor the behaviour of the listener, instructions are likely to function as plys; when no-one is monitoring the instruction-following, instructions are more likely to function as tracks. This hypothesis is supported by social-psychological research which has demonstrated that pliance is most likely to occur when

instruction-following can be monitored and the socially-mediated contingencies for instruction-following are strong (e.g., Hayes & Wolf, 1984; Hayes, Rosenfarb, Wulfert, Munt, Korn, & Zettle, 1985; Rosenfarb & Hayes, 1984).

Thus, the conditions for following tracks and plys differ. Plys should be followed regardless of the actual programmed contingencies, whereas tracks should be followed only when they are found to correspond to the programmed contingencies. Both types of instructions may produce apparently "schedule-insensitive" behaviour. However, tracks will only do so if the instruction precludes contact with the actual contingency, and responding is nevertheless reinforced to some degree by the programmed contingency. Plys, on the other hand, will produce apparently "schedule-insensitive" behaviour when there are discrepancies between the programmed contingency and the instruction, even when following the instruction markedly reduces reinforcement. Hayes' typology of instructions and instruction-following is consistent with behavioural theory which posits that individuals respond in certain ways based on their history of reinforcement and punishment, and that stimuli associated with the situation in which these behaviours were acquired then gain some control over the behaviours. These situational stimuli are called discriminative stimuli (S^Ds).

This analysis suggests some explanations for the findings of the Change phase in Experiments 1 and 2. First, based on behavioural theory and Hayes' typology of instructions, it is possible that the experimenter could serve as an S^D for instruction-following, and that under this condition the instructions would function as plys. Pliance would occur because people have learned to follow instructions (a) when someone is there to monitor the behaviour and (b) when that person monitoring the behaviour knows the instructions that have been given. However, in Experiments 1 and 2, the S^D for instruction-following was likely weak, though not completely

absent. Participants were not being directly observed, but, as mentioned above, some participants could see the experimenter, while other participants could not. The S^D for instruction-following was likely weaker in Experiments 1 and 2 than in those studies in which participants were obviously being observed behind a one-way mirror, which might explain why a far less dramatic effect of instructions was found in this series of studies compared to previous research.

Support for the role of a competing social factor was provided by an experiment by Hayes, Brownstein, Zettle, et al., (1986), where they first introduced instructions, and subsequently withdrew them, reasoning that once instructions are withdrawn, "...the history of consequences for responding in compliance with rules should be less a factor" (p. 242). Although they conceded that it is impossible to fully withdraw the effects of instructions, they were able to at least partially withdraw instructions by pairing specific instructions with specific signals, which in turn could be presented or withdrawn. All participants in this study responded on a multiple DRL6s/FR18 schedule, and were given instructions as to the rate of response required, depending on which "instruction light" was lit. Their findings indicated that when an "instruction light" was lit, most participants responded in accordance with the instructions which had been paired with that light, even when the instructions did not correspond to the programmed contingency in effect. This apparent insensitivity to the programmed contingency was also evident when the instructions allowed contact with the programmed contingency. However, when the "instruction light" was subsequently turned off, participants eventually modified their behaviour in accordance with the programmed contingency. The withdrawal of the "instruction light" may have implicitly indicated to participants that they no longer were required to follow instructions.

The distinction between tracks and plys may also explain why participants who received

a warning in addition to elaborate instructions did not show the "insensitivity effect" in Experiments 1 and 2. It is possible that the warning provided to the EW group served to modify the function of the instructions from a ply to a track. As may have been the case for the withdrawal of the "instruction light" in Hayes, Brownstein, Zettle, et al.'s (1986) experiment, telling participants that conditions may change could have implicitly indicated to participants that they did not have to follow the instructions, resulting in a weakened social contingency. These possibilities remain speculative because the social contingency was not controlled for in either Experiments 1 or 2. The next experiment was therefore designed to directly manipulate the social factor to determine whether the "insensitivity effect" which was observed in Experiments 1 and 2, as well as in previous research (e.g., Hayes, Brownstein, Haas, et al., 1986; Rosenfarb et al., 1992) could be due primarily to the effect of the S^D for instruction-following (i.e., experimenter aware of instructions and present during the experiment).

Experiment 3

Experiment 3 attempted to investigate more directly whether the "experimenter as an S^D for instruction-following" is a factor in producing the behavioural insensitivity observed in the literature on human operant behaviour. The same experimenter ran participants in all conditions in order to control for possible experimenter effects. The "experimenter as an S^D" factor was manipulated by comparing a highly salient social stimulus with one in which attempts were made to decrease the salience of the social stimulus. In the High Social conditions, the experimenter was aware of the instructions given and it was obvious to the participant that this was the case. In addition, the experimenter was present in the room during the experiment. In the Low Social conditions, participants were told that the experimenter was unaware of the experimental conditions, and the experimenter was not in the room during the experiment. Because it had

already been determined that behavioural insensitivity occurred primarily for those participants receiving elaborate instructions, it was decided that the "experimenter as an S^D" would be investigated for the elaborate instructions condition.

If the "experimenter as an S^D" is a factor in producing behavioural insensitivity, it was expected that when elaborate instructions were provided, participants in the Low Social conditions would adapt more quickly to contingency changes than would participants in the High Social conditions. The reasoning for this prediction is as follows: When the programmed contingencies are changed from DRL6s/FR18 to FR18/FR18, all participants encounter a discrepancy between the initial instructions and the consequences of their behaviour. For participants in the Low Social condition, the experimenter was unaware of the instructions and did not monitor the participant's behaviour. Thus, the S^D for instruction-following was basically absent, and the instructions should therefore function as tracks. Participants in this condition should quickly alter their behaviour in accordance with the change in contingency once the instructions they had been given no longer worked. In contrast, the experimenter was aware of the instructions and was present during the experiment in the High Social condition. In this case, the S^D for instruction-following should be highly salient to participants and it is hypothesised that the instructions would be more likely to function as plys. Participants in the High Social groups are therefore expected to be more likely to continue responding according to the instructions, despite the discrepancy between those instructions and the consequences of participants' behaviour once the programmed contingencies change.

In addition to the "experimenter as an S^D," Experiment 3 also investigated the effect of the Warning versus no Warning manipulation condition. This permitted the possibility of replicating a portion of the results of Experiment 2, as well as the possibility of determining

whether the Warning condition would interact with the salience of the social stimulus.

Method

Participants

Seventy University of Ottawa undergraduate students (47 females and 23 males) volunteered to participate in this study. The average age was 24 years with a range of 19 to 40 years. Participants were assigned to one of four groups: High Social-No Warning (HNW), High Social-Warning (HW), Low Social-No Warning (LNW), and Low Social-Warning (LW). Assignments were random except that additional participants were added to groups where participants failed to come under adequate schedule control during the Training phase. Each group consisted of 15 participants who had achieved adequate schedule control by the end of the Training phase of the experiment.

Setting and Apparatus

The setting and apparatus were identical to those of Experiment 1 and Experiment 2.

Procedure

The procedure was identical to that of Experiment 2 except for the following changes: For participants assigned to the High Social group, the experimenter was present in the room, watching the participant for the duration of the experiment. Participants in this group were given their instructions in an envelope, in which there was a duplicate set of instructions for the experimenter which the participant was told to hand to the experimenter. While the participant was reading the instructions, the experimenter was also reading her own set of identical instructions. Participants assigned to the Low Social group were alone in the room while they were reading the instructions and while they were performing the task. These participants were given their instructions in an envelope identified only with a letter and they were told that the

experimenter was blind to the experimental conditions. While the participants read the instructions, the experimenter left the room, and returned only once the participants had replaced the instructions in the envelope and had told the experimenter that they were finished. The experimenter left the room once the experiment had begun. To control for possible inter-experimenter effects, one experimenter ran all participants in all four experimental groups.

Variables and Design

The independent between subject variables were the experimenter present and aware of instructions versus the experimenter absent and not aware of the instructions (High Social vs. Low Social), and the warning (Warning vs. No Warning). The within subject variable was 2-minute response blocks. During the Training phase, when the multiple schedule was DRL6s/FR18, each block consisted of one minute of DRL6s (screen border was black), followed by one minute of FR18 (screen border was white). During the Change phase, when the multiple schedule was FR18/FR18, each 'block' consisted of one minute during which the screen border was black (previously DRL during the Training phase), followed by one minute during which the screen border was white (previously FR during the Training phase). The dependent variables related to the Training phase were the Index of Response and the Training Criterion. The dependent variables related to the Change phase were the Modified Index of Response and the Change Criterion.

The variables used to describe schedule control during the Training phase (the Index of Response and the Training Criterion) were the same as those used in Experiments 1 and 2 (see pp. 61-62 for a description). The variables used to describe schedule control during the Change phase (the Modified Index of Response [p. 62] and the Change Criterion [p. 73]) were the same as those used in Experiment 2. The Modified Index of Response was also used in Experiment 1.

Data Analyses

Each Session of Experiment 3 was analysed separately. The data for Session 1 were analysed using a 2 x 2 x 6 (Social x Warning x 2-Blocks) analysis of Variance (ANOVA), with the mean Index of Response for each 2 consecutive blocks serving as repeated measures. The data for Session 2 were analysed using a 2 x 2 x 5 (Social x Warning x 2-Blocks) ANOVA, with the mean Index of Response for each 2 consecutive blocks serving as repeated measures. The data for the Change phase were analysed using a 2 x 2 x 12 (Social x Warning x 'Block') ANOVA, with the Modified Index of Response for each 'block' serving as repeated measures. In addition, chi-squares were used to examine group differences during the Change phase. Only those participants who were considered to have successfully come under control of both component schedules of the multiple contingency during the Training Phase were included in the analyses (this was 15 participants per group). Adequate schedule control was defined as responding at Training Criterion during at least each of the last three blocks of the Training phase (Session 2).

Results

Training: Session 1

The data for five participants were rejected because of technical problems. Five extra participants were run to replace these five. In addition, a total of five participants were added to replace participants who did not demonstrate adequate schedule control during the Training phase: 1 in the HNW group; 1 in the HW group; and 3 in the LNW group.

Figure 10 shows the mean Index of Response for each of the four experimental groups for each two consecutive blocks of Session 1. The results of the 2 x 2 x 6 (Social x Warning x 2-Blocks) repeated measures ANOVA are shown in Table 9. As was the case in both Experiments

1 and 2, the main effect of 2-Blocks is significant. There is also a significant interaction between 2-Blocks and Social, which suggests caution in interpreting the main effect of 2-Blocks. Examination of Figure 10 indicates that the mean Indexes of Response of each of the four experimental groups increased across Session 1. However, the ANOVA also indicates that the rate at which the mean Indexes of Response changed depended on both the level of Social and the level of 2-Blocks. To tease out this interaction, a series of ANOVAs was performed, evaluating the simple effect of Social at each level of 2-Block. This analysis shows a simple main effect of Social, $\underline{F}$ (1,56) = 14.587, $p < .001$ at blocks 1-2 only. By blocks 3-4, this effect has disappeared, $\underline{F}$ (1,56) = 2.521, $p > .05$.

Training: Session 2

Figure 11 shows the mean Index of Response for each of the four experimental groups for each two consecutive blocks of Session 2. Because participants were being trained to a criterion, there is a clear ceiling effect on performance, which could lead to spurious effects in the statistical analyses. As was the case in Experiments 1 and 2, a comparison of arcsine transformed data to data in raw form showed no differences. Therefore, the analyses presented below were done on the actual data in raw form.

The results of the 2 x 2 x 5 (Social x Warning x 2-Blocks) repeated measures ANOVA are shown in Table 10. Once again, the main effect of 2-Blocks is significant. As can be seen in Figure 11, the mean Indexes of Response for each of the four experimental groups continued to increase slightly across blocks. No other effects are significant (the initial difference between the groups seen in Session 1 has disappeared). The analysis indicates that during the second training session, all groups were performing at similar levels.

Change: Session 3

Figure 12 shows the number of participants responding at the Change Criterion by the end of each quartile (3 'blocks') of the Change phase. It also includes the number of participants responding at Change Criterion during the first 'block' of the Change phase (i.e., 'block' 23), as well as the number of participants who never achieved the Change Criterion. Visual examination of Figure 12 indicates that by the end of the first quartile of the Change phase, a similar number of participants in the HW, LW, and LNW groups were responding at Change Criterion levels. A chi-square test performed on these three groups indicates that there were no significant differences between them by the end of the first quartile of the Change phase, (i.e. by the end of 'block' 25), χ^2 (2, $\underline{N}$ = 45) = .18, p > .05. By the end of the first three 'blocks' of Session 3, 60% (9/15) of participants in the HW group, 60% (9/15) of participants in the LNW group, and 53% (8/15) of participants in the LW group were responding at the Change Criterion. Because no significant differences in Change Criterion responding were found between the HW, LW, and LNW groups, their data were collapsed and compared to the HNW group. This chi-square analysis was significant, χ^2 (1, $\underline{N}$ = 60) = 6.43, p < .05. Only 20% (3/15) of the participants in the HNW group were performing at the Change Criterion by the end of that same period of time.

Figure 12 also shows that, by the end of the Change phase, twice as many participants in the HNW group (8/15) had failed to achieve the Change Criterion compared to the number of participants in the HW (4/15), LNW (4/15), and the LW (3/15) groups. A chi-square test comparing the HNW group to the other three groups (collapsed data) was significant, χ^2 (1, $\underline{N}$ = 60) = 4.33, p < .05. Examination of each subject's data found that that all participants who failed to meet the Change Criterion were continuing to respond according to the instructions given during Sessions 1 and 2. That is, participants not meeting the Change Criterion were continuing

to respond with low-rate responding while the screen border was black, alternating with high-rate responding while the screen border was white.

Further visual examination of Figure 12 suggests that, regardless of the level of the Social stimulus, a greater number of participants in the groups that were given a warning were responding at the Change Criterion during the first 'block' of the Change phase compared to the number of participants in the groups that were not given a warning. Only 13% (4/30) of participants who never received a warning (i.e., HNW and LNW) were responding according to the Change Criterion during the first 'block' of the Change phase, compared to nearly three times as many participants (11/30) in the two groups that did receive a warning (i.e., HW and LW). A chi-square test performed on the first 'block' of the change phase comparing the groups that received a warning (collapsed data of groups LW and EW) to those that did not receive a warning (collapsed data of groups LNW and HNW) confirms that there was a significant difference: $\chi^2 (1, \underline{N} = 60) = 4.35, \underline{p} < .05$.

Next, the data were analysed using repeated-measures ANOVAs. Figure 13 shows the Modified Index of Response of each of the four experimental groups for each 'block' of the Change phase. Table 11 shows the results of the 2 x 2 x 12 (Social x Warning x 'Block') repeated measures ANOVA done on the entire Change phase. As can be seen, there is only a significant main effect of 'Block,' and there are no significant effects of Social or of Warning. Visual examination of Figure 13 suggests that there may be an effect of Social and of Warning, particularly during the first part of the Change phase. As was the case in Experiment 2, two factors may be contributing to this effect. First, the effects may be diluted by conducting the analysis over the entire 12 'blocks' of the Change phase. The second factor may be the very conservative correction factor for sphericity that is used. Hence, a decision was again made to

analyse the first half of the Change phase separately from the second half of the Change phase. Table 12 shows the results of the 2 x 2 x 6 (Social x Warning x 'Block') repeated measures ANOVA done on the first 6 'blocks' of the Change phase. As can be seen in Table 12, there is a significant main effect of 'Block' and a significant three-way interaction between Social, Warning, and 'Block,' which suggests that the lower-level result should be interpreted with caution. Examination of Figure 13 indicates that each of the four experimental groups decreased their Modified Indexes of Response over the first 6 'blocks' of Session 3. The interaction between Social, Warning, and 'Block' indicates that the rate at which the groups decreased their Modified Indexes of Response across the Change phase depended on both the level of Warning and the level of Social stimulus. To begin to tease out the components of this interaction, Figure 13 was first inspected visually. It appears that the two groups that were given a warning (LW and HW) showed a greater decrease in the value of the Modified Index of Response during the first 'block' of the Change phase than did the two groups that were not given a warning (HNW and LNW) groups. An ANOVA on Warning versus No Warning across Social stimulus was performed on the first 'block' of the Change phase. The results of this analysis did not show a significant simple main effect of Warning during the first 'block' of the Change phase, $\underline{F}$ (1,56) = 2.59, $\underline{p} > .05$. Next, based both on visual inspection of Figure 13 and on the prediction that the High Social-No Warning group would be significantly different from the Low Social-No Warning group, the simple simple effect of Social at No Warning was analysed at each level of 'Block.' This analysis indicated a significant simple simple effect of Social at No Warning for 'block' 25 only, $\underline{F}$ (1,56) = 4.244, $\underline{p} < .05$.

Next, the second half of the Change phase was analysed. Table 13 shows the results of the 2 x 2 x 6 (Instruction x Warning x 'Block') repeated measures ANOVA for the last 6

'blocks' of the Change phase. As can be seen, only the main effect of 'Block' is significant, indicating that each of the four experimental groups continued to decrease their Modified Indexes of Response across the latter half of Session 3. The analysis also shows that overall, there were no longer any statistically significant differences in the Modified Indexes of Response between the four experimental groups. However, visual inspection of Figure 13 suggests that the HNW group continued to be different from the other three groups until the end of the Change phase. Although traditionally it had been suggested that individual comparisons were not appropriate if there was not a significant overall group effect, contemporary thinking indicates otherwise. Howell (1997) states that the "hypotheses tested by the overall test and a multiple-comparison test are quite different" (p.351), and therefore overall significance is no longer a prerequisite for making specific comparisons. In line with this thinking, a contrast comparing the HNW group to the HW, LW, and LNW groups on the last 'block' of the Change phase (i.e., 'block' 34) was done. This comparison was significant: $\underline{F}$ (1,56) = 4.556, $\underline{p} < .05$.

Discussion

The results of Session 1 of Experiment 3 suggest that the presence of the experimenter initially impeded the acquisition of the multiple contingency. However, this difference was only present during the first two blocks (4 minutes) of Session 1. During Session 2, there were no differences in performance among the four experimental groups.

The results of the Change phase demonstrated two strong effects: (a) that of the "experimenter as an S^D," and (b) that of the warning. As predicted, participants for whom the experimenter was aware of the instructions and was present during the task adjusted more slowly, on average, to the change in contingencies than did participants for whom the experimenter was unaware of the instructions and not present. However, this was true only for

those participants in the experimenter-present group who were not given a warning. Receiving the warning that "conditions may change at any time" appeared to remove the "experimenter as an S^{D}" effect. On average, participants in the HW group performed similarly to participants in the LW group from the onset of the Change phase. Further, for at least the first 'block' of the Change phase, the only significant effect was the difference between the groups who had received a warning compared to the groups that had not received a warning. Although the ANOVA did not pull out this effect on the first 'block,' the chi-square analysis suggests that there was a difference between the groups. Almost three times as many participants in the groups receiving a warning began responding according to the Change Criterion during the very first 'block' of the Change phase compared to the groups that did not receive a warning. After the first 'block' the HW and LW groups continued to alter their responding at a similar rate. Although it is not clear how the warning is functioning, it is possible, as was hypothesised in Experiment 2, that the warning served as an implicit instruction stating something like: "If the instruction no longer works, try something else." For those participants for whom the experimenter was present and aware of the instructions (i.e., the HW group), this would be particularly important because it would serve as an instruction indicating that it is acceptable not to follow the given instruction. Viewed from Hayes' typology of instructions, the presence of a warning could be altering the function of the instruction from a ply to a track.

The results of Experiment 3 also indicate that the effect of the Social stimuli started to become apparent during the second 'block' of the Change phase, where participants in the Low Social-No Warning group began, on average, to change their responding in accordance to the Change Criterion. By the end of the third 'block' of the Change phase, participants in the LNW group were responding, on average, at rates similar to the average of those participants in the two

groups that did receive a warning (HW and LW). In contrast, participants in the High Social group who did not receive a warning continued to respond differently, on average, from the other three groups. That is, a smaller number of participants in the HNW group were responding according to the Change Criterion compared to participants in the HW, LW, and LNW groups. Equivalently, a greater number of participants in the HNW group continued to respond according to the initial contingency (i.e., were showing insensitivity to the programmed contingency) compared to the other three groups. This difference in responding between the HNW group and the HW, LW, and LNW groups was still present by the end of Session 3, which is consistent with the findings of previous research that had shown group differences until the end of the Change phase (e.g., Hayes, Brownstein, Haas, et al., 1986; Rosenfarb et al., 1992). This finding differs from those of Experiments 1 and 2, in which there were no significant differences between the groups by the end of the final phase of the experiments.

Experiment 3 therefore supports the findings of Experiment 2 which showed that providing participants with a warning that "conditions may change at any time" eliminates the schedule insensitivity which had been observed in participants who were provided with elaborate instructions. Experiment 3 also shows that the "social" aspect of instructions is at least partly responsible for producing the insensitivity to the contingencies in effect. It supports Hayes' analysis that instructions are likely to function as plys when the person giving the instructions is aware of the instruction and monitors the "instruction-following." Unfortunately, it is not possible, based on the results of Experiment 3, to determine whether the salience of the social stimuli is the only factor responsible for the observed schedule insensitivity. It is possible that some other unknown aspect of instructions, in addition to the social component, is also responsible for producing insensitivity. In order to determine how much of the instruction-

induced insensitivity is due to the salience of the social stimuli (versus some other aspect of instructions), we would have to compare the responding of the Elaborate Instruction groups (High and Low Social) to the responding of the Minimal Instruction groups (High and Low Social). If the salience of the social stimuli is solely responsible for producing the schedule insensitivity, one would expect that the responding of those receiving minimal instructions and those receiving elaborate instructions would be identical in the Low Social condition. If another aspect of instructions is a factor in producing the schedule insensitivity, one would expect that participants receiving elaborate instructions would show more insensitivity compared to those receiving minimal instructions in the Low Social condition. Because the salience of the social stimuli (i.e., experimenter present and aware of the instructions) is postulated only to have an effect when participants are given elaborate instructions, it is expected that there will be no difference between the High and Low Social conditions for groups receiving minimal instructions.

Experiment 4

The final experiment investigated how much of the "insensitivity effect" observed in the literature on human operant behaviour is due to the importance of the salience of the social stimuli for behaviours established through elaborate instructions. Because the effect of the warning has been clearly demonstrated in Experiments 2 and 3, it was not investigated further and the final experiment focussed only on the unique contribution of the 'social' aspect of instructions. Experiment 4 directly compared the High Social and Low Social conditions for both minimal and elaborate instructions. Any differences in responding between the Low Social-Elaborate Instructions group and the Low and High Social-Minimal Instruction groups will be an indication that elaborate instructions themselves engender schedule insensitivity above and

beyond the insensitivity which was found to be related to the S^D for instruction-following in Experiment 3.

Method

Participants

Eighty-three University of Ottawa undergraduate students (65 females and 18 males) volunteered to participate. The average age was 24 years with a range of 17 to 61 years. Participants were assigned to one of four groups: Low Social-Minimal Instructions (LM), Low Social-Elaborate Instructions (LE), High Social-Minimal Instructions (HM), or High Social-Elaborate Instructions (HE). Assignments were random except that additional participants were added to groups where participants failed to come under adequate schedule control during the Training phase. Each group consisted of 15 participants who had achieved adequate schedule control by the end of the Training phase of the experiment.

Setting and Apparatus

The setting and apparatus were identical to those used in Experiment 1, Experiment 2, and Experiment 3.

Procedure

The procedure was identical to that of Experiment 3 except for the following changes: Participants in the Minimal Instructions conditions were provided with instructions that were identical to those given to participants in the Minimal Instructions conditions in Experiments 1 and 2. Finally, there was not a Warning versus No Warning manipulation condition in Experiment 4.

Variables and Design

The independent between subject variables were the experimenter present and aware of

instructions versus the experimenter absent and not aware of the instructions (High Social vs. Low Social), and the type of instruction (Elaborate or Minimal). The within subject variable was 2-minute response blocks. During the Training phase, when the multiple schedule was DRL6s/FR18, each block consisted of one minute of DRL6s (screen border was black), followed by one minute of FR18 (screen border was white). During the Change phase, when the multiple schedule was FR18/FR18, each 'block' consisted of one minute during which the screen border was black (previously DRL during the Training phase), followed by one minute during which the screen border was white (previously FR during the Training phase). The dependent variables related to the Training phase were the Index of Response and the Training Criterion. The dependent variables related to the Change phase were the Modified Index of Response and the Change Criterion.

The variables used to describe schedule control during the Training phase (the Index of Response and the Training Criterion) were the same as those used in Experiments 1, 2, and 3 (see pp. 61-62 for a description). The variables used to describe schedule control during the Change phase (the Modified Index of Response [p. 62] and the Change Criterion [p. 73]) were the same as those used in Experiments 2 and 3. The Modified Index of Response was also used in Experiment 1.

Data Analyses

Each Session of Experiment 4 was analysed separately. The data for Session 1 were analysed using a 2 x 2 x 6 (Social x Instruction x 2-Blocks) analysis of Variance (ANOVA), with the mean Index of Response for each 2 consecutive blocks serving as repeated measures. The data for Session 2 were analysed using a 2 x 2 x 5 (Social x Instruction x 2-Blocks) ANOVA, with the mean Index of Response for each 2 consecutive blocks serving as repeated measures.

The data for Change phase were analysed using a 2 x 2 x 12 (Social x Instruction x 'Block') ANOVA, with the Modified Index of Response for each 'block' serving as repeated measures. In addition, chi-squares were used to examine group differences during the Change phase. Only those participants who were considered to have successfully come under control of both component schedules of the multiple contingency during the Training Phase were included in the analyses (this was 15 participants per group). Adequate schedule control was defined as responding at Training Criterion during at least each of the last three blocks of the Training phase (Session 2).

Results

Training: Session 1

The data for three participants were rejected because of technical problems. Three extra participants were run to replace these three. In addition, a total of 20 participants were added to replace participants who did not demonstrate adequate schedule control during the Training phase: 13 in the LM group; 2 in the LE group; 3 in the HM group; and 2 in the HE group.

Figure 14 shows the mean Index of Response for each of the four experimental groups for each two consecutive blocks of Session 1. The results of the 2 x 2 x 6 (Social x Instruction x 2-Blocks) repeated measures ANOVA are shown in Table 14. As can be seen, there is a significant main effect of 2-Blocks, as well as a significant main effect of Instruction. There is also a significant interaction between 2-Blocks and Instruction, which suggests caution in interpreting the two lower-level effects. Examination of Figure 14 indicates that the mean Indexes of Response for each of the four experimental groups increased across Session 1. In addition, the two groups that received elaborate instructions (LE and HE) began responding at a rate consistent with the Training Criterion much more quickly than did the two groups given

only minimal instructions (LM and HM). Figure 14 indicates that the interaction between 2-Blocks and Instruction is due to the different rates at which the mean Indexes of Response changed across the Session for the two Minimal Instructions groups compared to the two Elaborate Instructions. The rate of increase in the Index of Response was much smaller for the two Elaborate Instructions groups compared to the rate of the two Minimal Instructions groups.

Training: Session 2

Figure 15 shows the mean Index of Response for each of the four experimental groups for each two consecutive blocks of Session 2. Because participants were being trained to a criterion, there is a clear ceiling effect on performance, which could lead to spurious effects in the statistical analyses. As was the case in Experiments 1, 2, and 3, a comparison of arcsine transformed data to data in raw form showed no differences. Therefore, the analyses presented below were done on the actual data in raw form.

The results of the 2 x 2 x 5 (Social x Instruction x 2-Blocks) repeated measures ANOVA are shown in Table 15. Once again, the main effect of 2-Blocks is significant. As can be seen in Figure 15, the mean Indexes of Response for each of the four experimental groups continued to increase slightly across blocks. The results of the ANOVA also indicate that there was a significant main effect of Instruction, as well as a significant interaction between Instruction and 2-Blocks. Figure 15 suggests that the two groups that had received minimal instructions (LM and HM) continued to increase their Indexes of Response across blocks, whereas the Indexes of Response of the two groups that received elaborate instructions (LE and HE) had essentially reached a plateau during the second Session. Figure 15 also indicates that by the end of Session 2, the mean Indexes of Response of the two Minimal Instructions groups were similar to the mean Indexes of Response of the two Elaborate Instructions groups. This is confirmed by an

ANOVA performed on the final two blocks of Session 2 (blocks 21-22), which indicates that there were no longer any significant differences between the mean Indexes of Response between the two Elaborate Instructions groups (LE and HE) versus the two Minimal Instructions groups (LM and HM): $\underline{F}$ (1,56) = 2.50, $\underline{p} > .05$.

Change: Session 3

Figure 16 shows the number of participants responding at the Change Criterion by the end of each quartile (3 'blocks') of the Change phase. It also includes the number of participants responding at Change Criterion during the first 'block' of the Change phase (i.e., 'block' 23), as well as the number of participants who never achieved the Change Criterion. Visual examination of Figure 16 indicates that during the first 'block' of the Change phase a far greater number of participants who were given minimal instructions (LM and HM) were responding according to the Change Criterion, compared to the number of participants who were given elaborate instructions (LE and HE), regardless of the level of the social stimulus: 80% (12/15) of participants in the Low Social-Minimal Instructions group (LM) and 80% (12/15) of participants in the High Social-Minimal Instructions group (HM) were responding according to the Change Criterion, compared to only 13% (2/15) in the Low Social-Elaborate Instructions (LE) group, and none (0/15) in the High Social-Elaborate Instructions group. To determine whether there was a significant difference between the number of participants in the two Elaborate Instructions groups (LE and HE) who were performing at the Change Criterion during the first 'block' of the Change phase, a chi-square test was performed on these two groups. The results indicate that there was no significant difference between these two groups: $\chi^2(1,\underline{N} = 30) = 2.14$, $\underline{p} > .05$. A chi-square test was also performed on the first 'block' of the Change phase comparing those participants receiving elaborate instructions (collapsed data of groups LE and HE) to those

participants receiving minimal instructions (collapsed data of groups LM and HM). This analysis yielded a significant difference: $\chi^2(1, \underline{N} = 60) = 32.86$, $\underline{p} < .005$. These results indicate that there was no significant difference in the number of participants responding at the Change Criterion between the two levels of social stimulus by the end of the first 'block' of the Change phase. The results also show that the only significant difference was that a greater number of participants who had received minimal instructions were responding at the Change Criterion compared to the number of participants who had received elaborate instructions.

Further examination of Figure 16 indicates that this trend changed across time. By the end of the first quartile (i.e., 'block' 25), only 13% (2/15) of the participants in the High Social-Elaborate Instructions group were responding at the Change Criterion, compared to three times as many participants (40% [6/15]) in the Low Social-Elaborate Instructions group. However, a chi-square test performed on these two groups indicates that the difference was not significant: $\chi^2(1, \underline{N} = 30) = 2.72$, $\underline{p} > .05$. In comparison, 100% (30/30) of the participants in both of the Minimal Instructions groups were responding at the Change Criterion by the end of the first quartile. A comparison between the two levels of Instruction (i.e., collapsed data for HE and LE groups vs. collapsed data for HM and LM groups) for this time period confirms that there was still a significant difference between the groups receiving minimal instructions and the groups receiving accurate instructions: $\chi^2(1, \underline{N} = 60) = 34.8$, $\underline{p} < .005$.

Figure 16 also shows that by the end of the second quartile ('block' 28), the number of participants in the Low Social-Elaborate Instructions (LE) group who were responding at Change Criterion had increased to 73% (11/15). In comparison, the High Social-Elaborate Instructions group had made only modest improvements during this same period, with 20% (3/15) of participants responding at Change Criterion. A chi-square test performed on the two Elaborate

Instructions groups confirms that they were significantly different by the end of the second quartile: χ^2 (1, N = 30) = 8.58, p > .005. Examination of Figure 16 also suggests that, by the end of the second quartile, the number of participants in the Low Social-Elaborate Instructions group who were performing at the Change Criterion was similar to the number of the participants performing at the Change Criterion in the two Minimal Instruction groups. However, a chi-square test comparing the two Low Social groups (LE vs. LM) indicates that there was still a significant difference between the two levels of Instruction: χ^2 (1, N = 30) = 4.6, p < .05. By the end of the third quartile, participants in the Low Social-Elaborate Instructions group further improved their performance, and there was no longer a significant difference between the two Low Social groups (LE and LM) on the number of participants responding at the Change Criterion: χ^2 (1, N = 30) = 3.33, p > .05. In contrast the number of participants responding at the Change Criterion in the High Social-Elaborate Instructions group had not increased from the second to the third quartile. A chi-square analysis comparing the LE, LH, and HM groups (collapsed data) to the HE group was significant: χ^2 (1, N = 60) = 32.27, p < .005. Finally, Figure 16 suggests that this difference between the HE group and the other three groups persists until the end of the Change phase. This is confirmed by the results of a chi-square test comparing the LE, LH, and LM groups (collapsed data) to the HE group on the fourth quartile of Session 3: χ^2 (1, N = 60) = 27.95, p < .005.

Next, the data were analysed using repeated-measures ANOVAs. Figure 17 shows the Modified Index of Response of each of the four experimental groups for each 'block' of the Change phase. The results of the 2 x 2 x 12 (Social x Instruction x 'Block') repeated measures ANOVA done on the entire Change phase are shown in Table 16. As can be seen, there are significant main effects of Social, Instruction, and 'Block.' In addition, there are significant two-

way interactions between Social and Instruction, Social and 'Block,' and Instruction and 'Block.' Although there are clearly significant effects across the Change phase, visual examination of Figure 17 suggests that the first part of the Change phase may differ from the latter part. In order to be consistent with Experiments 2 and 3, and to determine whether there would again be a 'split' in the data between the two halves of the Change phase, a decision was made to analyse the first half of the Change phase separately from the second half.

The results of the 2 x 2 x 6 (Social x Instruction x 'Block') repeated measures ANOVA done on the first half of the Change phase are shown in Table 17. As can be seen, there are significant main effects of Social, Instruction, and 'Block.' In addition, there are significant two-way interactions between Social and Instruction, and between Social and 'Block', which suggest that the lower-level results should be interpreted with caution. Figure 17 indicates that each of the four experimental groups decreased their Modified Indexes of Response over the first 6 'blocks' of Session 3. The two-way interaction between Instruction and Social indicates that the Modified Indexes of Response also depended on both the level of Social and the level of Instruction. In order to better understand this interaction, it is helpful to examine Figure 18, which shows the interaction between Social and Instruction during the first half of the Change phase. This figure indicates that the two groups that were given minimal instructions, regardless of the level of Social, had similar Modified Indexes of Response. However, the level of Social affected the Modified Indexes of Response for the two groups that were given elaborate instructions. The Low Social-Elaborate Instructions group responded at a lower Index of Response compared to the High Social-Elaborate Instructions group.

The two-way interaction between Social and 'Block' indicates that the level of Social affected the rate at which the Modified Indexes of Response changed over the course of the first

six 'blocks' of the Change phase. Figure 19 shows the interaction of Social and 'Block' over the first half of Session 3. This figure indicates that the two High Social groups (HM and HE) changed their Modified Indexes of Response across 'blocks' at a slower rate than did the two Low Social groups (LM and LE). However, closer examination of Figure 17 indicates that the High Social-Minimal Instructions group had achieved near-perfect responding during the very first 'block' of Session 3, therefore leaving very little room for change. The biggest change across 'blocks' appears to come from the Low Social-Elaborate Instructions group, which started off at a Modified Index of Response similar to that of the High Social-Elaborate Instructions group, but then rapidly decreased its Modified Index of Response across time.

To determine how the level of Social affected responding for the two groups that were given elaborate instructions, a series of ANOVAs were performed on Social at Elaborate Instructions for each level of 'Block.' The results indicate that there was no significant difference between the High and Low Social conditions for Elaborate Instructions on the first 'block' ('block 23) of the Change phase: $\underline{F}$ (1,56) = 3.15, $\underline{p} > .05$. However, by the second 'block' ('block 24'), there was a significant difference between these groups ($\underline{F}$ (1,56) = 5.21, $\underline{p} < .05$), which was maintained until the end of the first half of the Change phase. In contrast, there were no differences between the two Minimal Instructions groups, even during the first 'block' ($\underline{F}$ (1,56) = 2.93, $\underline{p} > .05$). Figure 17 also indicates that, over time, the Modified Indexes of Response of the Low Social-Elaborate Instructions group approached those of the two Minimal Instructions groups. Finally, a series of the ANOVAs examining the simple simple effects of Minimal versus Elaborate Instructions at Low Social across each level of 'Block' were performed. These results indicate that there was a significant difference between these two groups across the first half of the Change phase. However, the decreasing difference between the

groups is reflected by the relatively steady decline in F values across 'blocks', as can be seen in Table 18.

Next, the second half of the Change phase was analysed. Table 19 shows the results of the 2 x 2 x 6 (Social x Instruction x 'Block') repeated measures ANOVA for the last 6 'blocks' of Session 3. In contrast to the first half of the Change phase, there were no longer any effects attributable to 'Block.' During the last 6 'blocks' of the change phase, the Modified Indexes of Response of each of the four groups had, for the most part, stabilised. And, similar to the first half, there were significant main effects of Social, Instruction, and a significant interaction between Social and Instruction. The presence of the interaction suggests caution in interpreting the two main effects. In order to better understand this interaction, it is helpful to examine Figure 20, which shows the interaction between Social and Instruction during the Second half of the Change phase. This figure indicates both of the groups that received minimal instructions, regardless of the level of Social, had similar Modified Indexes of Response. However, the level of Social affected the Modified Index of Response for the groups that were given elaborate instructions. The Low Social-Elaborate Instructions group responded at a lower Index of Response compared to the High Social-Elaborate Instructions group. A contrast comparing the Low Social-Elaborate Instructions group to the High Social-Elaborate group (collapsed across 'Block') was significant: $F(1,56) = 24.325$, $p < .001$. Examination of Figure 17 also suggests that there may be a difference between the Low Social-Elaborate Instructions and the two Minimal Instructions groups. A contrast comparing the Low Social-Elaborate Instructions group to the Low Social-Minimal Instructions group (collapsed across 'Block') was not statistically significant: $F(1,56) = 3.879$, $p > .05$.

Discussion

The results of the Training phase (i.e., Sessions 1 and 2) of Experiment 4 showed that behaviours are acquired more rapidly when participants are given elaborate instructions, compared to when they are provided with minimal instructions. The results showed that on average, the participants in each of the Elaborate Instructions groups (HE and LE) began responding in accordance with the programmed schedule significantly more quickly than did participants in each of the Minimal Instructions groups (HM and LM). The salience of the social stimuli (i.e., experimenter present and aware of the instructions) did not appear to affect the acquisition of the multiple contingency.

The results of the Change phase (i.e., Session 3) demonstrated two strong effects: (a) that of the instructions and (b) that of the salience of the social stimuli. A greater number of participants who were initially provided with elaborate instructions (regardless of the level of Social) continued to respond in accordance with the Training phase contingencies for a longer period of time than did those participants who were given only minimal instructions. This finding is consistent with the findings of Experiments 1 and 2 that had compared the effects of minimal instructions to the effects of elaborate instructions. However, this effect of instructions was only present during the first two minutes (i.e., the first 'block') of the Change phase. After the first 'block' the effect of the salience of the social stimuli began to become apparent. After the first 'block' of the Change phase, the Low Social-Elaborate Instructions (LE) group showed a relatively steady adjustment resulting in responding which was increasingly appropriate for the new contingency, as evidenced by the decrease in the value of the Modified Index of Response across the Change phase. By approximately mid-way through Session 3, the average responding of the participants in the LE group was similar to the average responding of the participants in

the two groups that had received Minimal Instructions (HM and LM). Interestingly, the greatest difference in the Modified Index of Response between the LE group and the HM and LM groups occurred during the first 3 to 6 'blocks' of the Change phase. This is consistent with the period of time during which the Minimal and Elaborate Instructions groups were most different from each other in Experiments 1 and 2. In contrast, the group that received elaborate instructions but for which the experimenter was present and aware of the instructions (HE) responded at a significantly higher Modified Index of Response across the entire Session. A greater number of participants in the HE group continued to respond according to the contingency in effect during the Training phase until the very end of Session 3, compared to the number of participants doing so in any of the other three groups (i.e., LE, HM, and LM).

General Discussion

The major intent of the current series of studies was to replicate and extend the previously published research that had investigated the effect of instructions on schedule sensitivity from a behavioural perspective. Clearly previous work, as well as the current series of studies, could be interpreted from within various theoretical frameworks other than a radical behavioural perspective (e.g., see Brewer (1974) for an alternative cognitive perspective, or Kunkel (1997) for a social psychological interpretation). However, this thesis was undertaken from a behavioural perspective and was designed to test hypotheses generated from the radical behavioural framework. The discussion that follows remains consistent with the initial intent of the thesis and limits its focus to behavioural interpretations of the findings.

In reviewing the previously published behavioural research, it is interesting to note that some of the studies had found that elaborately instructed behaviours were insensitive to their consequences. This is a particularly interesting finding from a radical behavioural perspective

because it contradicts Skinner's third prediction regarding the long-term effects of instructions on behaviour. Skinner (1976) had predicted that instructed behaviours would be sensitive to their effects on the environment, and therefore would eventually come under the control of the environmental contingencies. A number of studies have not supported this prediction (e.g., Hayes, Brownstein, Haas, et al., 1986; Hayes, Brownstein, Zettle, et al., 1986; Kaufman et al., 1966; Lippman & Meyer, 1967; Rosenfarb et al., 1992; Shimoff et al., 1981). The results of these previously published studies suggested that elaborately instructed behaviours are not sensitive to their consequences, and are often either not appropriate for the programmed schedule in effect, or fail to adjust to unannounced schedule changes. Furthermore, these studies found that elaborately instructed behaviours were often consistent with the instructions rather than the programmed contingencies. Unfortunately, methodological flaws in the previously published research makes a clear interpretation of the data difficult. First, most of the studies have very low levels of power due to the small number of participants in each experimental group, and due to the apparently large degree of within-group variability. Second, the studies have used different methodologies and different criteria to determine sensitivities. It was hoped that the current series of studies would demonstrate the "insensitivity effect" of elaborate instructions more conclusively, by using adequate sample sizes applying conventional statistical analyses and using a consistent methodology throughout. It was also hoped that this series of studies would elucidate the process by which elaborate instructions induce schedule insensitivity, as well as identify factors that might reduce or eliminate this insensitivity.

A second focus of the current series of studies was the investigation of the veracity of Skinner's first prediction about instructions. This prediction (Skinner, 1976) posited that behaviours could be acquired more rapidly when the participant was instructed than when the

participant was merely exposed to the natural contingencies. The findings in the previously published literature regarding the facilitative effects of instructions were clear. All of the studies reviewed found that participants acquire behaviours more quickly when they are provided with elaborate instructions as to how to respond (e.g., Ayllon & Azrin, 1964; Baron et al., 1969; Hayes, Brownstein, Haas, et al., 1986; Hayes, Brownstein, Zettle, et al., 1986; Lippman & Meyer, 1967; Rosenfarb et al., 1992). When participants are given only minimal instructions that provide no information regarding the contingency in effect or regarding the specific manner in which to respond, participants acquire behaviours much more slowly. It was expected that similar results would be found in the current series of studies.

A general overview of the results of Experiments 1-4 will be presented next, using Skinner's first and third hypotheses about the effect of instructions on non-verbal behaviour as a framework. First, the findings related to the effect of instructions on the acquisition of behaviour will be discussed. Next, the findings regarding the long-term differences in schedule sensitivity between elaborately instructed and minimally instructed behaviours will be discussed. Included will be a discussion of the findings regarding the importance of the salience of the social stimuli and a discussion of the findings related to the effect of the 'warning.' Following this general overview, the implications of these findings for the behavioural literature will be discussed, and some suggestions for future research in this area will be proposed.

Overview of Results

Instructions and the Acquisition of Behaviour

Overall, the results of Experiments 1, 2, and 4 support Skinner's first prediction that people acquire behaviours more quickly when they are given specific instructions as to how to respond. In each of these three studies, participants began responding according to the multiple

contingency more slowly, on average, when they were given only minimal instructions that provided no information regarding the contingencies in effect, compared to those who were provided with elaborate instructions. As Experiment 3 did not assess the effect of minimal instructions (all participants were given elaborate instructions), it is not possible to directly draw any conclusions regarding the advantage of elaborate instructions from this study. However, examination of the graphical representations (Figures 10 and 11) of the acquisition of the multiple contingency for the four experimental groups in Experiment 3 shows that each of the four groups acquired the multiple contingency in a manner that was very similar to the groups that were given elaborate instructions in Experiments 1, 2, and 4 (cf. Figures 1, 2, 6, 7, 14, 15). Thus, the findings of Experiment 3 are consistent with the findings of the other three experiments in the series. The results of these four experiments also support previous findings showing the facilitative effects of elaborate instructions on the acquisition of behaviour (e.g., Ayllon & Azrin, 1964; Baron et al., 1969; Hayes, Brownstein, Haas, et al., 1986; Hayes, Brownstein, Zettle, et al., 1986; Lippman & Meyer, 1967; Rosenfarb et al., 1992). The findings of the current series of studies add to this literature by confirming this finding with adequate sample sizes and statistical analyses.

The findings from the Training phase of Experiments 1-4 also suggest that none of the independent variables studied (i.e., the warning and the salience of the social stimuli) had much of an impact on the acquisition of the multiple contingency. Although Experiment 3 did suggest that the salience of the social stimuli (presence of the experimenter and experimenter aware of the instructions) may have impeded acquisition, this effect was present for only a very short period of time (4 minutes) during Session 1, and this finding was not replicated in Experiment 4.

Long-Term Effects of Instructions: Schedule Sensitivity

The results of the Change phase are not as straightforward as the findings for the Training phase. The current series of studies only partially replicated the findings in the literature that showed that elaborately instructed behaviours are insensitive to the programmed contingencies in effect. In addition, the current series of studies suggests that other factors need to be taken into account when examining the schedule insensitivity induced by elaborate instructions.

Experiment 1 found that the groups that were provided with minimal instructions adjusted their behaviour more quickly compared to the groups that were provided with elaborate instructions, when the programmed schedule was changed from DRL6s/FR18 to EXT/EXT. That is, the groups that had been given only minimal instructions showed a greater decrease in their responding, as evidenced by the decrease in their Relative Change in Extinction Indexes, compared to the groups that had been given elaborate instructions. The findings of Experiment 2 were very similar to the findings of Experiment 1. Experiment 2 found that the groups that had been given minimal instructions changed their responding in accordance with the new contingency significantly more quickly than did the groups that had been given elaborate instructions, as evidenced by the decrease in their Modified Indexes of Response. Experiment 2 added to the literature by showing that this "insensitivity" also occurs when the change is other than to EXT/EXT (i.e., to FR18/FR18). These findings therefore appear to provide some support for the "insensitivity effect" reported in previous research and are thus at odds with Skinner's third hypothesis that elaborately instructed behaviours would be sensitive to their consequences on the environment.

However, the findings of Experiments 1 and 2 were far less dramatic than were the findings reported in the literature (e.g., Hayes, Brownstein, Haas et al., 1986; Rosenfarb et al.,

1992). Experiments 1 and 2 only found an "insensitivity effect" of elaborate instructions during the first six minutes of the Change phase, after which time most participants in each of the experimental groups modified their responding in accordance with the new contingency in effect. In contrast, previous studies (e.g., Hayes, Brownstein, Haas, et al., 1986; Rosenfarb et al., 1992) had found differences between minimally and elaborately instructed participants that persisted until the end of the Change phase. Thus, contrary to the literature, the findings of Experiments 1 and 2 suggested that the responding of elaborately instructed participants was insensitive for only a short period of time.

Effect of the salience of the social stimuli. A possible reason for this disparity between the findings of Experiments 1 and 2 and the findings in some of the previously published studies was traced to procedural differences between Experiments 1 and 2 and previous studies. Some of the earlier research involved participants being observed from behind a one-way mirror (Hayes, Brownstein, Haas, et al., 1986; Matthews et al., 1977; Shimoff et al., 1981). In contrast, in Experiments 1 and 2, participants were not being directly observed. The door to the room in which the participant was performing the task was at times wide open, and at other times completely closed, thus, some participants could see the experimenter, whereas others could not. The "experimenter" variable was therefore not controlled in Experiments 1 and 2.

This procedural discrepancy led to the question of whether there might be a social variable involved in producing the "insensitivity effect." The possibility that a social variable was playing an important role was consistent with the hypothesis put forth by Hayes and his colleagues (e.g., Hayes & Wolf, 1984; Rosenfarb & Hayes, 1984; Zettle & Hayes, 1982) that suggested that one of the functions of instructions is to establish a new set of contingencies that competes with the actual programmed contingencies. According to Hayes' analysis, identical

instructions could have different effects on behaviour, depending on whether they are functioning as "tracks" or as "plys." As indicated previously, tracks are instructions that are followed because of the apparent correspondence between the instructions and the natural, non-arbitrary, contingencies. Hayes, Brownstein, Zettle, et al. (1986) suggested that the behavioural effects of tracking are produced by the contingencies that are contacted by the person following the instructions. Plys, on the other hand, are followed because of the history that people have for following instructions. People have a long history for being socially reinforced for following instructions, and punished for failing to do so. People therefore follow plys because of socially mediated consequences for the behaviour of instruction-following, independent of the consequences delivered by the natural, non-arbitrary, contingencies themselves. Furthermore, Hayes suggested that the accompanying environmental cues would determine the likelihood that instructions will function as plys or as tracks. Instructions are more likely to function as plys if the instruction-following of the subject can be monitored by another person. As indicated previously, this social variable was not controlled for in Experiments 1 and 2, and it is therefore likely that pliance would have been weak and inconsistent in Experiments 1 and 2 because some subjects could see the experimenter, whereas other subjects could not. In comparison, it is possible that the social variable was a more salient factor for participants in some of the published research because the experimenter was monitoring the participants from behind a one-way mirror in those studies (i.e., Hayes, Brownstein, Haas, et al., 1986; Matthews et al., 1977; Shimoff et al., 1981).

Experiments 3 and 4 therefore investigated the effect of the salience of the accompanying social stimuli by comparing condition with a highly salient social stimulus to one in which attempts were made to decrease the salience of the social stimulus. In the High Social conditions,

the experimenter was aware of the instructions given and it was obvious to the participant that this was the case. In addition, the experimenter was present in the room during the experiment. In the Low Social conditions, participants were told that the experimenter was unaware of the experimental conditions, and the experimenter was not in the room during the experiment. Experiment 3 only investigated the effect of the salience of the social stimuli with elaborate instructions. Experiment 4 compared the effect of the salience of the social stimuli with elaborate versus minimal instructions.

The results of Experiments 3 showed that the salience of the social stimuli had a significant effect on the impact of the elaborate instructions on responding. A significantly greater number of participants who were provided with both elaborate instructions and very salient social stimuli continued to respond according to the contingency in effect during the Training phase, compared to the number of participants who were given elaborate instructions but for whom the social stimuli were much less salient. This finding suggested that the social stimuli were important in creating the "insensitivity effect." Experiment 4 confirmed and added to this finding by directly comparing participants who were provided with elaborate instructions to participants who received only minimal instructions. The results again showed that the impact of the elaborate instructions depended on the salience of the social stimuli. And, whereas the groups that had been given minimal instructions altered their responding very quickly, the group that had been given elaborate instructions and salient social stimuli showed significant schedule insensitivity until the end of the experiment. Furthermore, Experiments 3 and 4 showed that the Low Social (i.e., experimenter not in the room and unaware of the instructions) Elaborate Instructions groups did show schedule-insensitivity, but that this lasted for only the first part of the Change phase. During the second half of the Change phase, the responding of the Low

Social-Elaborate Instructions groups was very similar to the responding of the groups which had received only minimal instructions. The results therefore suggest that there is an "insensitivity effect" that is engendered by the elaborate instructions in and of themselves, but that this effect appears to be short-lived. The more persistent "insensitivity effect" appears to be due to the social aspect of instructions.

Effect of the warning. All three experiments that included the Warning versus No Warning manipulation condition (i.e., Experiments 1-3) showed that the warning that "conditions may change at any time" decreased the schedule insensitivity of elaborately instructed behaviours. In Experiments 1 and 2, the effects of the warning were investigated with elaborate and minimal instructions. Both of these studies found that providing elaborately instructed participants with a warning resulted in a rapid adaptation to the contingency change. The average responding of the elaborately instructed participants who had been given a warning adjusted to the contingency change as quickly as did the average responding of participants who had received only minimal instructions. The warning did not appear to affect the responding of the minimally instructed participants.

In Experiment 3, the effect of the warning was investigated with highly salient social stimuli and minimally salient social stimuli. All participants in this study had received elaborate instructions. In this study, the warning appeared to speed up the adaptation to the contingency change regardless of the salience of the social stimuli. That is, the two elaborately instructed groups (High and Low Social) that received a warning adapted more quickly to the contingency change than did the groups that did not receive the warning. These findings suggest that the warning is an effective factor for reducing, or perhaps even eliminating, the "insensitivity effect" of elaborate instructions.

Caveat

One important caution must be noted in the interpretation of this series of studies. Only the data for those participants who met the inclusion criterion (i.e., responding at Training Criterion for at least each of the last three blocks of Session 2), which was considered to be indicative of adequate schedule control, were included in the analyses. The number of discarded participants varied from study to study, and from experimental group to experimental group, both within and between studies. A decision was made to discard the participants who were not considered to be showing adequate schedule control because the major focus of the experiments was on schedule sensitivity as measured by an unannounced schedule change. It did not make sense to examine the Change phase for participants who were not initially responding according to the contingencies in effect during the Training phase. To examine the effect of the Change phase, it was important to ensure that all participants were responding similarly before the Change was instituted in order to be able to detect group differences. It is possible that rejecting some of the data based on this inclusion criterion resulted in a biased sample that possessed certain characteristics that are not representative of this population of participants as a whole.

It is noteworthy that despite this methodological caveat, the findings of the Change phase for the studies Hayes, Brownstein, Haas, et al. (1986), Rosenfarb et al. (1992), and Shimoff et al. (1981), as presented in the literature review of this thesis, also included only participants who met their inclusion criterion for the Training phase. Although the findings of Experiments 1-4 may apply only to a subset of participants, this subset is likely similar to the subset of participants used in previously published studies.

Implications and Directions for Future Research

Overall, the current series of studies provide only partial support for the contention that elaborate instructions induce schedule insensitivity, and suggest some explanations for the equivocal findings in the literature. In particular, the findings related to the importance of the salience of the social stimuli provide some clarification and have implications for both Skinner's and Hayes' analyses of instructions. However, the manner in which to interpret two of the findings of the current series of studies remains unclear. First, the findings of Experiments 1-4 showed some short-term schedule insensitivity with elaborate instructions that was not ameliorated by decreasing the salience of the social stimuli. Second, although Experiments 1-3 showed that the warning speeded up the adaptation of behaviour to the Change phase, these studies did not address the issue of the process through which this occurred. The implications of the salience of the social stimuli, of the short-term insensitivity effects, and of the warning will be reviewed next.

Salience of the Social Stimuli

The current series of studies suggests that the salience of the social stimuli is an important factor in producing the persistent schedule insensitivity that is seen with behaviours that are established with elaborate instructions. The findings are consistent with a radical behavioural framework because the process through which social stimuli come to gain control over behaviour can be explained by behavioural principles. The stimuli that are present at the time of the delivery of the social consequences to a person for following instructions become associated with the consequences for instruction following. With a history of social reinforcement for instruction following, these stimuli, when present in the environment, increase the probability that the person will follow instructions. For example, the presence of a person

who can deliver consequences to a participant for following instructions can become a discriminative stimulus (S^D) for the behaviour of instruction-following. When that S^D (person) is present on subsequent occasions there is an increased probability of the participant following instructions. Although Skinner's predictions regarding the effects of instructions did not address this issue of S^Ds for instruction-following, this analysis derives naturally from the behavioural viewpoint and the findings add to, rather than contradict, Skinner's predictions.

In addition, the results of the current series of studies may explain some of the findings in the literature which showed substantial and long-term differences between elaborately instructed and minimally instructed behaviours. Those studies that found substantial and long-term insensitivity for elaborately instructed behaviours (e.g., Hayes, Brownstein, Zettle, et. al., 1986; Hayes, Brownstein, Haas, et al., 1986; Kaufman et al., 1966; Lippman & Meyer, 1967; Rosenfarb et al., 1992) may have involved experimental conditions that emphasised the salience of the social stimuli. Unfortunately, only three studies were found that actually indicated that the participants were being observed (Hayes, Brownstein, Haas et al., 1986; Matthews et al., 1977; Shimoff et al., 1981). None of the other previously reviewed studies (e.g., Buskist & Miller, 1986; Hayes, Brownstein, Zettle, et al., 1986; Kaufman et al., 1966; Lippman & Meyer, 1967; Rosenfarb et al., 1992) indicated whether or not the participants were being observed. In support of the potential importance of the social stimuli is the fact that both of the studies that included elaborate instructions and that observed the participants (i.e., Hayes, Brownstein, Haas et al., 1986; Shimoff et al., 1981) showed long-term insensitivity of elaborately instructed behaviours. The study by Matthews et al. (1977) did not include a group of participants that received elaborate instructions. In addition, one might speculate that the studies that were conducted by the same group of researchers (i.e., Hayes, Brownstein, Haas, et al., 1986; Hayes, Brownstein,

Zettle et al., 1986; Rosenfarb et al., 1992) may have used very similar procedures. Because Hayes, Brownstein, Haas, et al. (1986) observed the participants, it is possible that Hayes, Brownstein, Zettle, et al. (1986) and Rosenfarb et al. (1992) had also observed the participants in their studies. All three of these studies showed long-term insensitivity effects that were present until the end of the experiments.

The importance of the social stimuli might also explain why other studies failed to show the "insensitivity effect" when the instructions produced behaviours that contradicted the instructions (e.g., Buskist & Miller, 1986; Hackenberg & Joker, 1994). It is possible that these studies may have involved experimental situations that minimised the salience of the social stimuli. Unfortunately, this is only conjecture because none of these studies specified whether or not the subjects were being observed.

The current series of studies also provide support for Hayes' hypothesis that instructions establish an additional contingency that is social in nature. However, Hayes (1987) went on to say that this socially mediated contingency would compete with the natural contingencies in effect. The "competing" nature of the contingencies has not been directly addressed in the current studies. This could be investigated by examining the effect of varying the relative strength of the programmed contingency and of the social contingency. If the contingencies do compete with one another, one would expect that behaviour would come under control of the more salient, or stronger, contingency.

One could increase the strength of the programmed contingency by altering the value of the reinforcer for the participants. For example, a more valued reinforcer (such as money, rather than simply a 'beep' indicating a win, or points) could be used. In addition, a response-cost procedure, in which unnecessary responses would be punished by the loss of reinforcement,

could also be employed to strengthen the programmed contingency. In both of these cases, there would be a more significant cost to subjects for failing to come under control of the programmed contingency. The consequences of following instructions that do not correspond to the contingencies would likely be much more salient and significant for participants if responding resulted in the loss of a reinforcer such as money.

Changing the value of the social contingency could be done by varying the strength of the specific S^Ds for instruction-following within the experimental situation. For example, if the S^D for instruction-following is the experimenter, one could strengthen this association by pairing instruction-following in the presence of the experimenter with reinforcement for instruction-following per se. This manipulation would not involve any programmed contingency. Rather, participants would be required to follow written instructions to perform a task (e.g., to press the buttons in a specific sequence) and would be socially reinforced directly by the experimenter for following the instructions (e.g., saying the word 'good' after the subject complies with the instructions). Following this training in which the association between instruction-following and the experimenter as an S^D would be strengthened, one could then investigate, using a task similar to that used in Experiments 1-4, whether an S^D that had been socially conditioned for instruction-following would result in responding that would be more resistant to changing according to the contingencies in effect. One could then vary the relative strength of the social contingency by varying the degree to which the experimenter provided reinforcement for following instructions.

Short-Term Insensitivity of Elaborate Instructions

The results of the current series of studies suggest that the instructions have an effect on responding that is separate from the effect of the salience of the social stimuli. On average, elaborately instructed participants were found to adapt more slowly during the initial few

minutes following a change in the contingencies, compared to minimally instructed participants. This "insensitivity effect" was found to last only approximately 6 minutes, on average. The results of the current series of studies do not provide any explanations for this short-term insensitivity. However, Skinner's analysis of instructions, in addition to the findings of some of the previously published research, suggest some possible explanations.

If one re-examines Skinner's (1976) assertions regarding the long-term effect of instructions, one notices that he had not indicated that instructed behaviours would instantly come under schedule control. Rather, he had hypothesised that instructed behaviours would initially be different from behaviours that had been established by the natural contingencies. Instructed behaviours would differ from non-instructed behaviours because the instructions could never specify all of the subtleties of the natural contingencies. It would therefore take a certain additional amount of time for the natural contingencies to shape the instructed behaviour to the final form. This specific hypothesis was not addressed in the current series of studies because the literature review suggested that the tasks that had been used in the laboratory were too simplistic to show this difference between instructed and non-instructed behaviours. This conclusion had been based on the assumption that the difference would take the form of gross topographical differences that would be easily detected. Certainly, one would expect to find such significant topographical differences in the case of complex tasks, such as a golf swing. However, in the case of the relatively simplistic tasks used in the laboratory, it is possible that the difference would have been subtler and less easily detected. The question that then arises is "what form could this hypothesised difference take?" One of the explanations that had been proposed in the literature to explain the "insensitivity" effect provides a potential answer. As was indicated earlier, some researchers (e.g., Buskist & Miller, 1986; Galizio, 1979; Hackenberg & Joker,

1994) had suggested that one of the effects of instructions might be to narrow the range of behaviours emitted by individuals. In other words, it was suggested that elaborate instructions engender behaviours that are very similar to one another. This would result in less variability in responding (i.e., fewer different behaviours produced) with elaborate instructions compared to minimal instructions. If this hypothesis is correct, one could argue that a "narrowed range of behaviours" could constitute a different version of the more varied range of behaviours produced by minimal instructions. Furthermore, a narrowed range of behaviours could potentially explain the short-term effects of instructions. If elaborate instructions result in a narrowed range of behaviours, and therefore fewer behaviours are being emitted, this would result in fewer behaviours available from which one (or a few) are selected out by the contingencies in operation. This potential explanation would be consistent with Skinner's second hypothesis regarding the effect of instructions on non-verbal behaviour.

As neither the published literature reviewed above nor the current series of studies measured the variability of responding, it is not possible to determine whether the instructions did in fact reduce the range of behaviours available to make contact with the contingencies. Future research using a finer-grained analysis that would measure the variability of behaviours emitted would be necessary to make this determination. It would be important to measure responding over shorter periods of time to be able to observe the patterns of responding. Merely measuring the total number of responses for each minute in which each component contingency was in effect (as was done for Experiments 1-4) overlooks the various patterns of responding emitted. For example, the total number of responses during the one-minute DRL period may have been 12 responses, but these could have included 3 fast responses followed by 6 slow responses, and then another 3 fast responses. Alternatively, all 12 responses could have been

emitted slowly. When examining whether the instructions affected variability, one would want to determine whether one sees more variability in responding when behaviours are minimally instructed compared to when behaviours are elaborately instructed.

Another issue that arises out of the finding of short-term schedule insensitivity with elaborate instructions is the question of whether this short period of time during which the insensitivity is present would be significant in "real life" situations. The question remains as to whether the additional time that it takes for elaborately instructed behaviours to adapt to contingency changes is a hindrance in allowing human subjects to adapt to their environment. Perhaps this question could be best answered by using more complex tasks in which the difference between instructed and non-instructed behaviours, if it exists, would be more apparent and easily measured.

Effect of the Warning

The current series of studies has clearly shown that the warning served to speed up the adaptation to the contingency change for elaborately instructed behaviours. However, the experiments did not address the issue of how the warning produces this effect. If one extends the previously proposed explanations to the warning, one could hypothesise that the warning may have altered the function of the elaborate instructions from a "ply" to a "track." If this were the case, one would expect that a High Social-Elaborate Instructions group that was given a warning would adjust to the contingency change at the same rate as a Low Social-Elaborate Instructions group that was not given a warning. Both of these groups should also show short-term "insensitivity effects." This possibility would need to be investigated in future studies.

Another potential explanation for the effect of the warning that would be in line with the hypothesis presented for the finding of short-term schedule insensitivity in this thesis would be

the possibility that the warning could have increased the variability in responding. This could have resulted in the responding of the Elaborate Instructions groups being more similar to the responding of the Minimal Instructions groups. It is possible that alerting participants that the fact that contingencies may not always be the same led participants to try out a greater variability of responses. Again, a finer-grained analysis that would detect variability in responding would be necessary to determine whether the warning does increase variability.

Conclusion

The current series of studies have confirmed that elaborate instructions are advantageous because they allow for the rapid acquisition of new behaviours. These studies have also shown that elaborate instructions only engender long-term schedule insensitivity when they are accompanied by salient social stimuli. Elaborate instructions do, however, appear to engender short-term schedule insensitivity. The results also suggest that it may be possible to override both the short-term and long-term insensitivity by providing participants with a warning that the conditions may change at any time. All of these findings were shown to apply to the specific case of the tasks used in the behavioural laboratory with University undergraduates. It would now be important to begin to investigate these findings in more naturalistic settings with more complex and meaningful tasks to determine how these findings apply to "real life" situations.

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Table 1

Analysis of Variance of Session 1 for Experiment 1

Source	Df	df GG	F
	Between subjects		
Instruction (I)	1		6.947**
Warning (W)	1		.109
I x W	1		1.693
S within-group error	54		(.146)
	Within subjects		
2-Blocks (2-B)	5	3.313	41.443***
2-B x I	5	3.313	12.846***
2-B x W	5		.420
2-B x I x W	5		1.721
2-B x S within-group error	270	178.880	(.009)

Note. Values enclosed in parentheses represent mean square errors. S = subjects. df GG = Greenhouse-Geisser adjusted degrees of freedom. Where df GG is indicated, the reported significance levels are based on the adjusted degrees of freedom.
** $p < .01$. *** $p < .001$.

Table 2

Analysis of Variance of Session 2 for Experiment 1

Source	df	df GG	F
	Between subjects		
Instruction (I)	1		.698
Warning (W)	1		.000
I x W	1		1.086
S within-group error	54		(.008)
	Within subjects		
2-Blocks (2-B)	4	1.400	5.251*
2-B x I	4		.285
2-B x W	4		.248
2-B x I x W	4		2.296
2-B x S within-group error	216	75.586	(.002)

Note. Values enclosed in parentheses represent mean square errors. S = subjects. df GG = Greenhouse-Geisser adjusted degrees of freedom. Where df GG is indicated, the reported significance levels are based on the adjusted degrees of freedom.
* $p < .05$.

Table 3

Analysis of Variance of Session 3 (Change Phase) for Experiment 1

Source	df	df GG	F
	Between subjects		
Instruction (I)	1		.387
Warning (W)	1		.541
I x W	1		.110
S within-group error	54		(.189)
	Within subjects		
'3-Blocks' ('3-B')	3	2.733	68.146***
'3-B' x I	3	2.733	15.329***
'3-B' x W	3	2.733	3.773*
'3-B' x I x W	3		1.289
'3-B' x S within-group error	162	147.566	(.014)

Note. Values enclosed in parentheses represent mean square errors. S = subjects. df GG = Greenhouse-Geisser adjusted degrees of freedom. Where df GG is indicated, the reported significance levels are based on the adjusted degrees of freedom.
* $p < .05$. *** $p < .001$.

Table 4

Analysis of Variance of Session 1 for Experiment 2

Source	df	df GG	F
	Between subjects		
Instruction (I)	1		8.993**
Warning (W)	1		1.141
I x W	1		.155
S within-group error	56		(.104)
	Within subjects		
2-Blocks (2-B)	5	3.316	59.526***
2-B x I	5	3.316	16.934***
2-B x W	5		.650
2-B x I x W	5		.385
2-B x S within-group error	280	185.715	(.008)

Note. Values enclosed in parentheses represent mean square errors. S = subjects. df GG = Greenhouse-Geisser adjusted degrees of freedom. Where df GG is indicated, the reported significance levels are based on the adjusted degrees of freedom.
** $p < .01$. *** $p < .001$.

Table 5

Analysis of Variance of Session 2 for Experiment 2

Source	df	df GG	F
	Between subjects		
Instruction (I)	1		.134
Warning (W)	1		1.090
I x W	1		.712
S within-group error	56		(.036)
	Within subjects		
2-Blocks (2-B)	4	2.206	15.785***
2-B x I	4	2.206	6.146**
2-B x W	4		.340
2-B x I x W	4	2.206	3.118*
2-B x S within-group error	224	123.548	(.002)

Note. Values enclosed in parentheses represent mean square errors. S = subjects. df GG = Greenhouse-Geisser adjusted degrees of freedom. Where df GG is indicated, the reported significance levels are based on the adjusted degrees of freedom.
*p < .05. ** p < .01. *** p < .001.

Table 6

Analysis of Variance of the Entire Change Phase for Experiment 2

Source	df	df GG	F
	Between subjects		
Instruction (I)	1		6.220*
Warning (W)	1		1.070
I x W	1		3.838
S within-group error	56		(.180)
	Within subjects		
'Block' ('B')	11	3.553	12.101***
'B' x I	11	3.553	4.052**
'B' x W	11		1.149
'B' x I x W	11	3.553	2.240
'B' x S within-group error	616	198.978	(.009)

Note. Values enclosed in parentheses represent mean square errors. S = subjects. df GG = Greenhouse-Geisser adjusted degrees of freedom. Where df GG is indicated, the reported significance levels are based on the adjusted degrees of freedom.
*$p < .05$. ** $p < .01$. *** $p < .001$.

Table 7

Analysis of Variance of the First Half of the Change Phase for Experiment 2

Source	df	df GG	F
	Between subjects		
Instruction (I)	1		10.034**
Warning (W)	1		1.781
I x W	1		5.032*
S within-group error	56		(.135)
	Within subjects		
'Block' ('B')	5	1.931	11.594***
'B' x I	5		.836
'B' x W	5		.357
'B' x I x W	5		1.749
'B' x S within-group error	280	108.145	(.009)

Note. Values enclosed in parentheses represent mean square errors. S = subjects. df GG = Greenhouse-Geisser adjusted degrees of freedom. Where df GG is indicated, the reported significance levels are based on the adjusted degrees of freedom.
*$p < .05$. ** $p < .01$. *** $p < .001$.

Table 8

Analysis of Variance of the Second Half of the Change Phase for Experiment 2

Source	df	df GG	F
	Between subjects		
Instruction (I)	1		1.389
Warning (W)	1		.213
I x W	1		1.557
S within-group error	56		(.078)
	Within subjects		
'Block' ('B')	5	2.450	3.465*
'B' x I	5		1.345
'B' x W	5		1.646
'B' x I x W	5		1.588
'B' x S within-group error	280	137.208	(.004)

Note. Values enclosed in parentheses represent mean square errors. S = subjects. df GG = Greenhouse-Geisser adjusted degrees of freedom. Where df GG is indicated, the reported significance levels are based on the adjusted degrees of freedom.
*$p < .05$.

Table 9

Analysis of Variance of Session 1 for Experiment 3

Source	df	df GG	F
	Between subjects		
Social (Soc.)	1		3.384
Warning (W)	1		1.970
Soc. x W	1		3.338
S within-group error	56		(.054)
	Within subjects		
2-Blocks (2-B)	5	3.016	20.435***
2-B x Soc.	5	3.016	4.311**
2-B x W	5		1.652
2-B x Soc. x W	5		.718
2-B x S within-group error	280	168.915	(.003)

Note. Values enclosed in parentheses represent mean square errors. S = subjects. df GG = Greenhouse-Geisser adjusted degrees of freedom. Where df GG is indicated, the reported significance levels are based on the adjusted degrees of freedom.
**$p < .01$. ***$p < .001$.

Table 10
Analysis of Variance of Session 2 for Experiment 3

Source	df	df GG	F
	Between subjects		
Social (Soc.)	1		.005
Warning (W)	1		.485
Soc. x W	1		1.457
S within-group error	56		(.001)
	Within subjects		
2-Blocks (2-B)	4	2.200	5.618**
2-B x Soc.	4		1.545
2-B x W	4		.610
2-B x Soc. x W	4		1.092
2-B x S within-group error	224	123.223	(.000)

Note. Values enclosed in parentheses represent mean square errors. S = subjects. df GG = Greenhouse-Geisser adjusted degrees of freedom. Where df GG is indicated, the reported significance levels are based on the adjusted degrees of freedom.
**$p < .01$.

Table 11

Analysis of Variance of the Entire Change Phase for Experiment 3

Source	df	df GG	F
	Between subjects		
Social (Soc.)	1		1.248
Warning (W)	1		1.611
Soc. x W	1		1.158
S within-group error	56		(.494)
	Within subjects		
'Blocks' ('B')	11	3.021	16.817***
'B' x Soc.	11		.919
'B' x W	11		.554
'B' x Soc. x W	11		1.359
'B' x S within-group error	616	169.174	(.011)

Note. Values enclosed in parentheses represent mean square errors. S = subjects. df GG = Greenhouse-Geisser adjusted degrees of freedom. Where df GG is indicated, the reported significance levels are based on the adjusted degrees of freedom.
***$p < .001$

Table 12

Analysis of Variance of the First Half of the Change Phase for Experiment 3

Source	df	df GG	F
	Between subjects		
Social (Soc.)	1		.676
Warning (W)	1		1.239
Soc. x W	1		1.472
S within-group error	56		(.270)
	Within subjects		
'Blocks' ('B')	5	2.015	17.753***
'B' x Soc.	5		1.362
'B' x W	5		1.146
'B' x Soc. x W	5	2.015	3.125*
'B' x S within-group error	280	112.840	(.009)

Note. Values enclosed in parentheses represent mean square errors. S = subjects. df GG = Greenhouse-Geisser adjusted degrees of freedom. Where df GG is indicated, the reported significance levels are based on the adjusted degrees of freedom.
*p < .05. ***p < .001

Table 13

Analysis of Variance of the Second Half of the Change Phase for Experiment 3

Source	Df	df GG	F
	Between subjects		
Social (Soc.)	1		1.703
Warning (W)	1		1.704
Soc. x W	1		.703
S within-group error	56		(.273)
	Within subjects		
'Blocks' ('B')	5	1.879	6.493**
'B' x Soc.	5		.730
'B' x W	5		.442
'B' x Soc. x W	5		.458
'B' x S within-group Error	280	105.215	(.006)

Note. Values enclosed in parentheses represent mean square errors. S = subjects. df GG = Greenhouse-Geisser adjusted degrees of freedom. Where df GG is indicated, the reported significance levels are based on the adjusted degrees of freedom.
**$p < .01$

Table 14

Analysis of Variance of Session 1 for Experiment 4

Source	df	df GG	F
	Between subjects		
Social (Soc.)	1		3.227
Instruction (I)	1		52.975***
Soc. x I	1		.977
S within-group error	56		(.051)
	Within subjects		
2-Blocks (2-B)	5	3.107	48.735***
2-B x Soc.	5		.988
2-B x I	5	3.107	13.640***
2-B x Soc. x I	5		1.279
2-B x S within-group error	280	173.986	(.007)

Note. Values enclosed in parentheses represent mean square errors. S = subjects. df GG = Greenhouse-Geisser adjusted degrees of freedom. Where df GG is indicated, the reported significance levels are based on the adjusted degrees of freedom.
*** $p<.001$.

Table 15

Analysis of Variance of Session 2 for Experiment 4

Source	df	df GG	F
	Between subjects		
Social (Soc.)	1		.125
Instruction (I)	1		17.719***
Soc. x I	1		.201
S within-group error	56		(.004)
	Within subjects		
2-Blocks (2-B)	4	1.729	12.720***
2-B x Soc.	4		.561
2-B x I	4	1.729	11.069***
2-B x Soc. x I	4		.497
2-B x S within-group error	224	96.834	(.002)

Note. Values enclosed in parentheses represent mean square errors. S = subjects. df GG = Greenhouse-Geisser adjusted degrees of freedom. Where df GG is indicated, the reported significance levels are based on the adjusted degrees of freedom.
*** $p<.001$.

Table 16

Analysis of Variance of the Entire Change phase for Experiment 4

Source	df	df GG	F
	Between subjects		
Social (Soc.)	1		9.899**
Instruction (I)	1		68.386***
Soc. x I	1		12.734***
S within-group error	56		(.182)
	Within subjects		
'Blocks' ('B')	11	2.921	11.844***
'B' x Soc.	11	2.921	2.721*
'B' x I	11	2.921	4.275**
'B' x Soc. x I	11		.412
'B' x S within-group error	616	163.573	(.009)

Note. Values enclosed in parentheses represent mean square errors. S = subjects. df GG = Greenhouse-Geisser adjusted degrees of freedom. Where df GG is indicated, the reported significance levels are based on the adjusted degrees of freedom.
*p<.05. ** p<.01. *** p<.001.

Table 17

Analysis of Variance of the first half of the Change phase for Experiment 4

Source	df	df GG	F
	Between subjects		
Social (Soc.)	1		5.087*
Instruction (I)	1		80.596***
Soc. x I	1		9.335**
S within-group error	56		(.103)
	Within subjects		
'Blocks' ('B')	5	2.601	11.418***
'B' x Soc.	5	2.601	3.093*
'B' x I	5		1.977
'B' x Soc. x I	5		.221
'B' x S within-group error	280	145.666	(.010)

Note. Values enclosed in parentheses represent mean square errors. S = subjects. df GG = Greenhouse-Geisser adjusted degrees of freedom. Where df GG is indicated, the reported significance levels are based on the adjusted degrees of freedom.
*p<.05. ** p<.01. *** p<.001.

Table 18

Simple simple effects of Instruction at Low Social across each level of 'Block:' First half of the Change phase for Experiment 4

'Block'	MS Effect	MS Error	F
'block' 23	.523	.020	26.433***
'block' 24	.338	.033	10.189**
'block' 25	.322	.031	10.509**
'block' 26	.370	.022	16.593***
'block' 27	.195	.024	8.145**
'block' 28	.132	.021	6.215*

Note. The degrees of freedom associated with each Block are: 1, 56.
*p < .05. ** p < .01. *** p < .001.

Table 19

Analysis of Variance of the second half of the Change phase for Experiment 4

Source	df	F
	Between subjects	
Social (Soc.)	1	12.180***
Instruction (I)	1	39.315***
Soc. x I	1	12.144***
S within-group error	56	(.113)
	Within subjects	
'Block' ('B')	5	1.258
'B' x Soc.	5	.325
'B' x I	5	1.146
'B' x Soc. x I	5	.801
'B' x S within-group error	280	(.002)

Note. Values enclosed in parentheses represent mean square errors. S = subjects.
*** $p<.001$.

Figure Captions

Figure 1. Experiment 1: Mean Index of Response of the Minimal Instructions-Warning (MW), Minimal Instructions-No Warning (MNW), Elaborate Instructions-Warning (EW), and Elaborate Instructions-No Warning (ENW) groups for each two consecutive blocks of Session 1.

Figure 2. Experiment 1: Mean Index of Response of the Minimal Instructions-Warning (MW), Minimal Instructions-No Warning (MNW), Elaborate Instructions-Warning (EW), and Elaborate Instructions-No Warning (ENW) groups for each two consecutive blocks of Session 2.

Figure 3. Experiment 1: The distribution of the number of participants in the Minimal Instructions-Warning (MW), Minimal Instructions-No Warning (MNW), Elaborate Instructions-Warning (EW), and Elaborate Instructions-No Warning (ENW) groups on the number of 'blocks' during which they responded at Modified Training Criterion during the Change phase.

Figure 4. Experiment 1: Relative Change in Extinction of the Minimal Instructions-Warning (MW), Minimal Instructions-No Warning (MNW), Elaborate Instructions-Warning (EW), and Elaborate Instructions-No Warning (ENW) groups for each three consecutive 'blocks' of the Change phase.

Figure 5. Experiment 1: Relative Change in Extinction of the Warning and No Warning groups for each three consecutive 'blocks' of the Change phase.

Figure 6. Experiment 2: Mean Index of Response of the Minimal Instructions-Warning (MW), Minimal Instructions-No Warning (MNW), Elaborate Instructions-Warning (EW), and Elaborate Instructions-No Warning (ENW) groups for each two consecutive blocks of Session 1.

Figure 7. Experiment 2: Mean Index of Response of the Minimal Instructions-Warning (MW), Minimal Instructions-No Warning (MNW), Elaborate Instructions-Warning (EW), and Elaborate Instructions-No Warning (ENW) groups for each two consecutive blocks of Session 2.

Figure 8. Experiment 2: Number of participants in the Minimal Instructions-Warning (MW), Minimal Instructions-No Warning (MNW), Elaborate Instructions-Warning (EW), and Elaborate Instructions-No Warning (ENW) groups responding at Change Criterion in each quartile of the Change phase. Also includes the number of participants responding at Change Criterion during the first 'block' of the Change phase ('block' 23), and the number of participants who never achieve the Change Criterion. Each quartile includes 3 consecutive 'blocks.'

Figure 9. Experiment 2: Modified Index of Response of the Minimal Instructions-Warning (MW), Minimal Instructions-No Warning (MNW), Elaborate Instructions-Warning (EW), and Elaborate Instructions-No Warning (ENW) groups for each 'block' of the Change phase.

Figure 10. Experiment 3: Mean Index of Response of the Low Social-Warning (LW), Low Social-No Warning (LNW), High Social-Warning (HW), and High Social-No Warning (HNW) groups for each two consecutive blocks of Session 1.

Figure 11. Experiment 3: Mean Index of Response of the Low Social-Warning (LW), Low Social-No Warning (LNW), High Social-Warning (HW), and High Social-No Warning (HNW) groups for each two consecutive blocks of Session 2.

Figure 12. Experiment 3: Number of participants in the Low Social-Warning (LW), Low Social-No Warning (LNW), High Social-Warning (HW), and High Social-No Warning (HNW) groups responding at Change Criterion in each quartile of the Change phase. Also includes the number of participants responding at Change Criterion during the first 'block' of the Change phase ('block' 23), and the number of participants who never achieve the Change Criterion. Each quartile includes 3 consecutive 'blocks.'

Figure 13. Experiment 3: Modified Index of Response of the Low Social-Warning (LW), Low Social-No Warning (LNW), High Social-Warning (HW), and High Social-No Warning (HNW) groups for each 'block' of the Change phase.

Figure 14. Experiment 4: Mean Index of Response of the Low Social-Minimal Instructions (LM), Low Social-Elaborate Instructions (LE), High Social-Minimal Instructions (HM), and High Social-Elaborate Instructions (HE) groups for each two consecutive blocks of Session 1.

Figure 15. Experiment 4: Mean Index of Response of the Low Social-Minimal Instructions (LM), Low Social-Elaborate Instructions (LE), High Social-Minimal Instructions (HM), and High Social-Elaborate Instructions (HE) groups for each two consecutive blocks of Session 2.

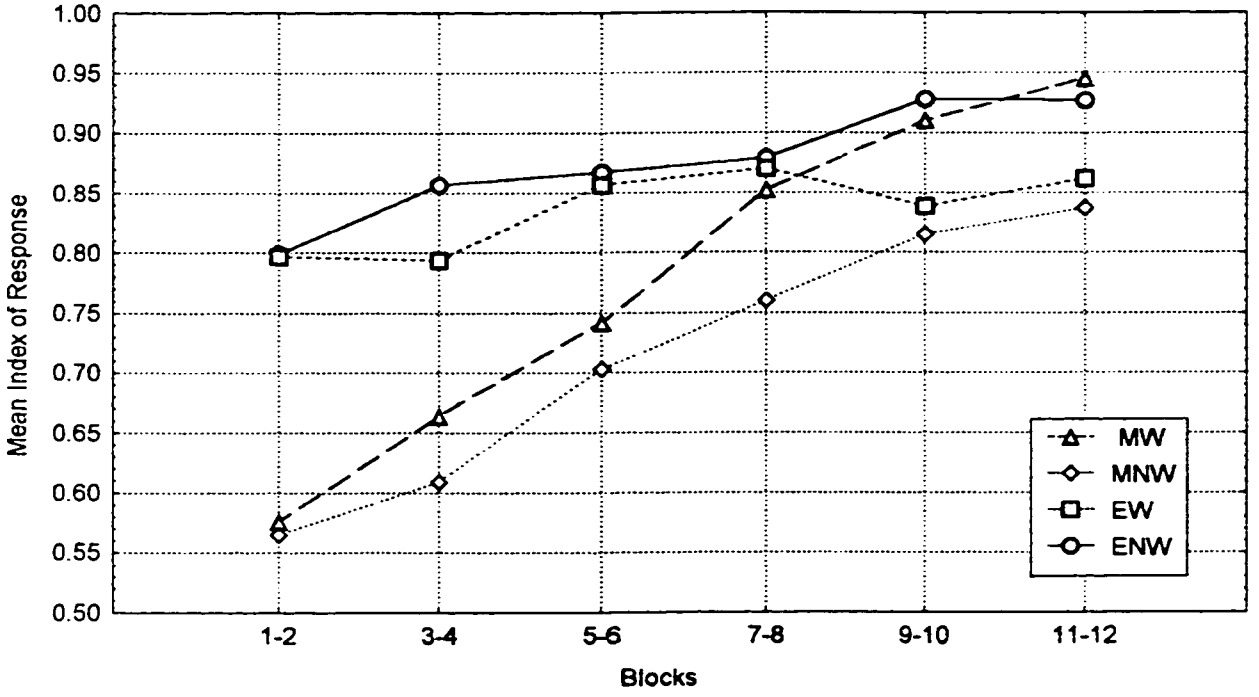
Figure 16. Experiment 4: Number of participants in the Low Social-Minimal Instructions (LM), Low Social-Elaborate Instructions (LE), High Social-Minimal Instructions (HM), and High Social-Elaborate Instructions (HE) groups responding at Change Criterion in each quartile of the Change phase. Also includes the number of participants responding at Change Criterion during the first 'block' of the Change phase ('block' 23), and the number of participants who never achieve the Change Criterion. Each quartile includes 3 consecutive 'blocks.'

Figure 17. Experiment 4: Modified Index of Response of the Low Social-Minimal Instructions (LM), Low Social-Elaborate Instructions (LE), High Social-Minimal Instructions (HM), and High Social-Elaborate Instructions (HE) groups for each 'block' of the Change phase.

Figure 18. Experiment 4: Modified Index of Response of the Low Social and High Social groups at Minimal Instructions and at Elaborate Instructions, for the first half of the Change phase.

Figure 19. Experiment 4: Modified Index of Response of the Low Social and High Social groups for each 'block' of the first half of the Change phase.

Figure 20. Experiment 4: Modified Index of Response of the Low Social and High Social groups at Minimal Instructions and at Elaborate Instructions, for the second half of the Change phase.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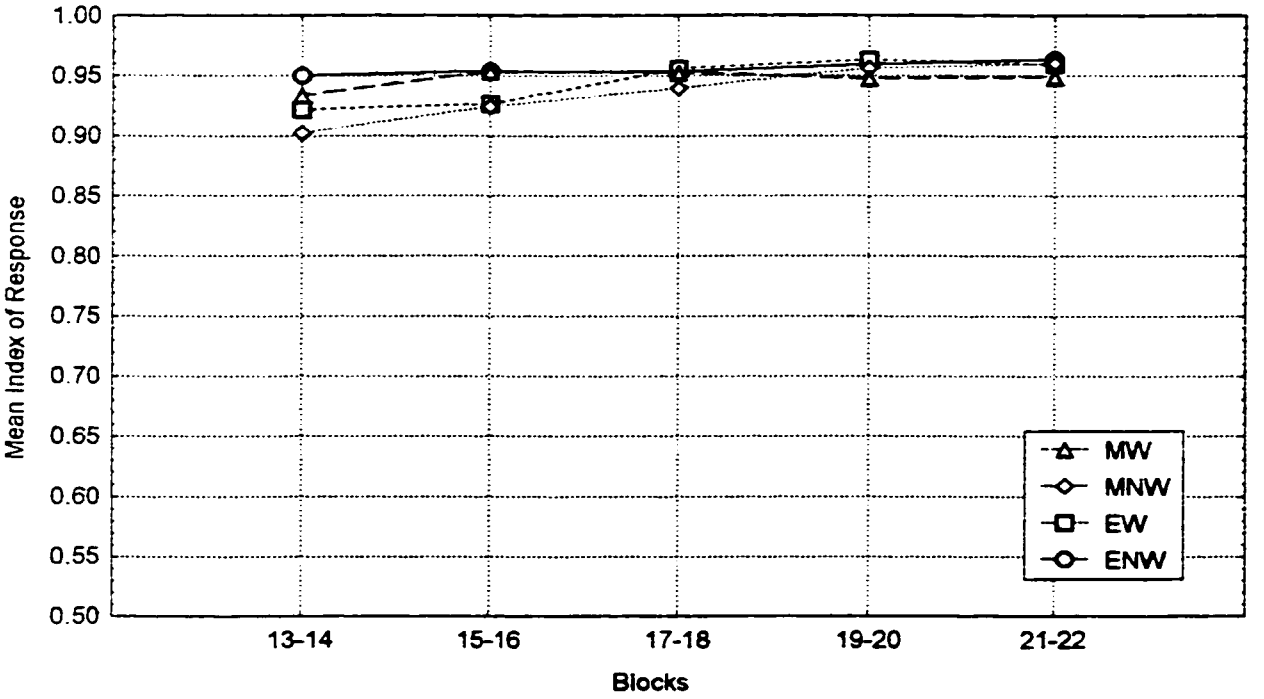
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
Mean Index of Response
1-2
3-4
5-6
7-8
9-10
11-12
Blocks
MW
MNW
EW
ENW


1.00
0.95
0.90
0.85
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0.70
0.65
0.60
0.55
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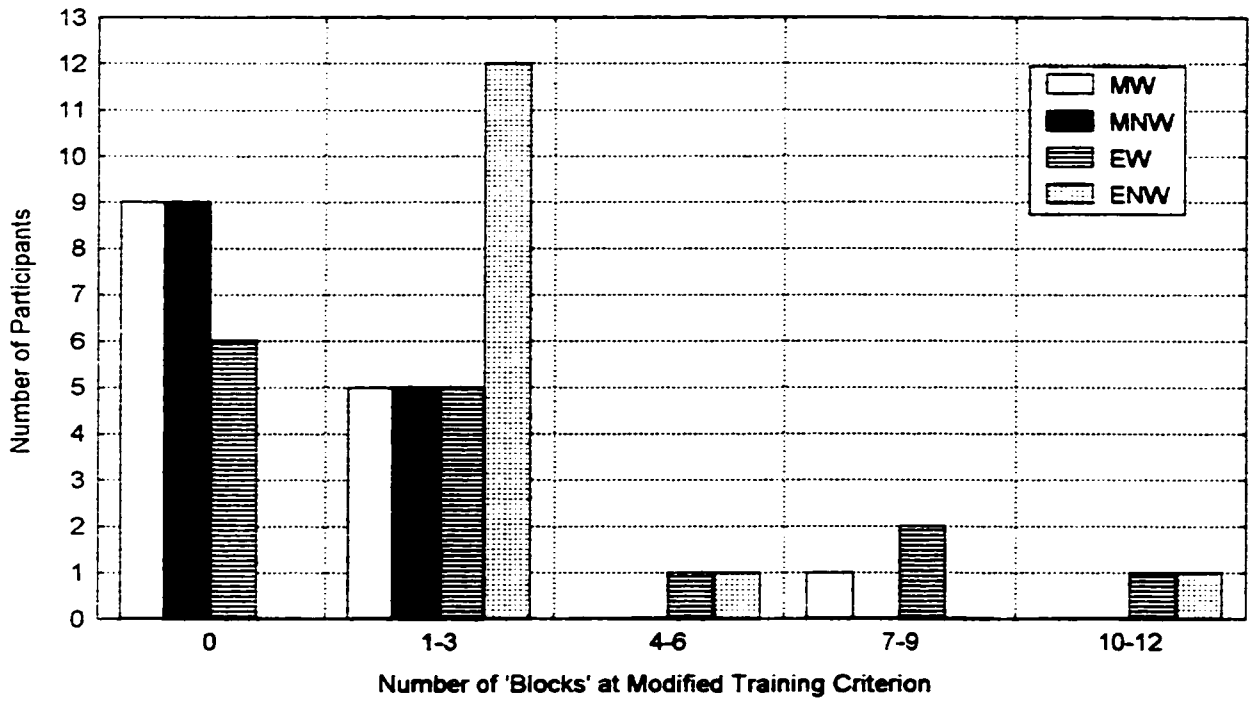
Mean Index of Response
13-14
15-16
17-18
19-20
21-22
Blocks
MW
MNW
EW
ENW


13
12
11
10
9
8
7
6
5
4
3
2
1
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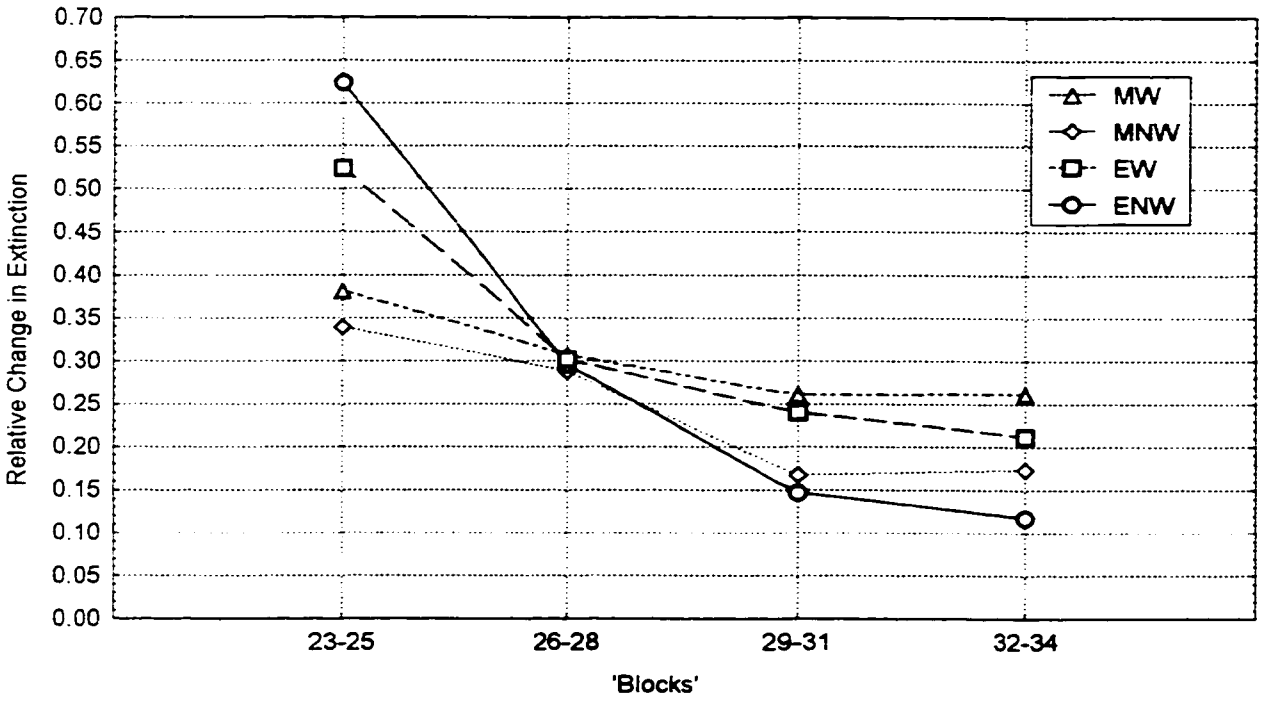
Number of Participants
MW
MNW
EW
ENW
0
1-3
4-6
7-9
10-12
Number of 'Blocks' at Modified Training Criterion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0.45
0.40
0.35
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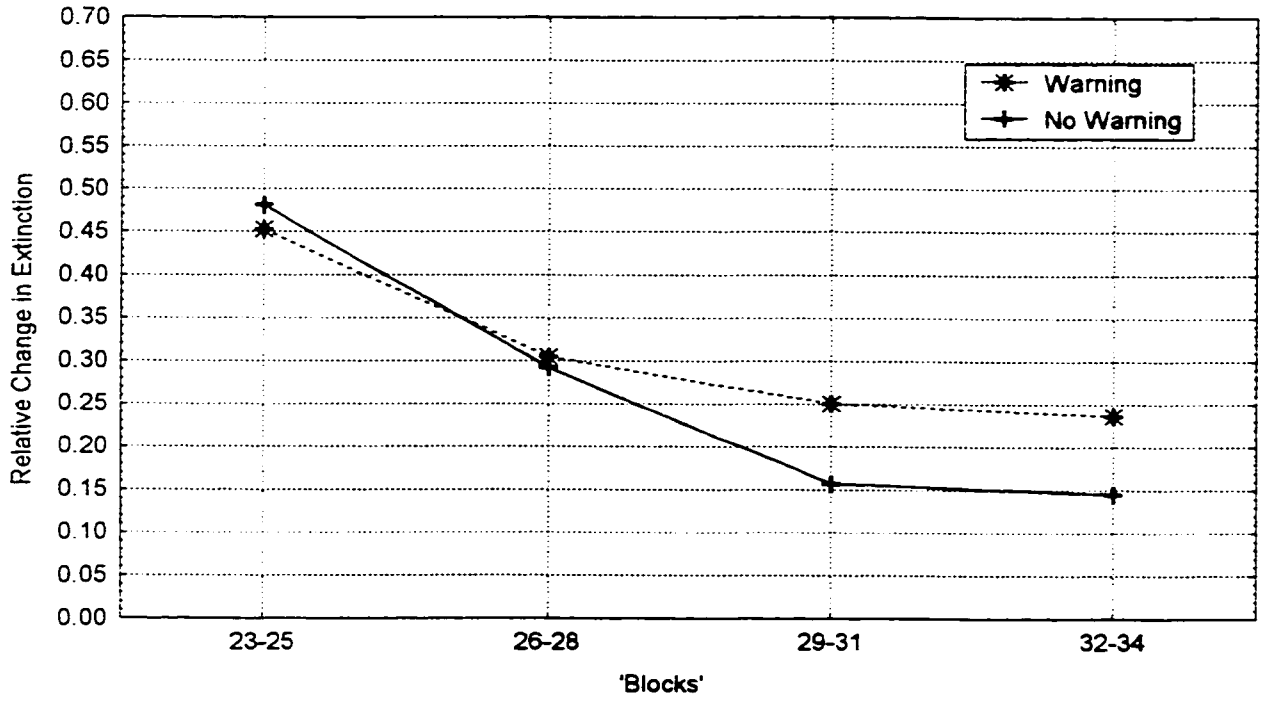
0.25
0.20
0.15
0.10
0.05
0.00
Relative Change in Extinction
23-25
26-28
29-31
32-34
'Blocks'
MW
MNW
EW
ENW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0.60
0.55
0.50
0.45
0.40
0.35
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0.25
0.20
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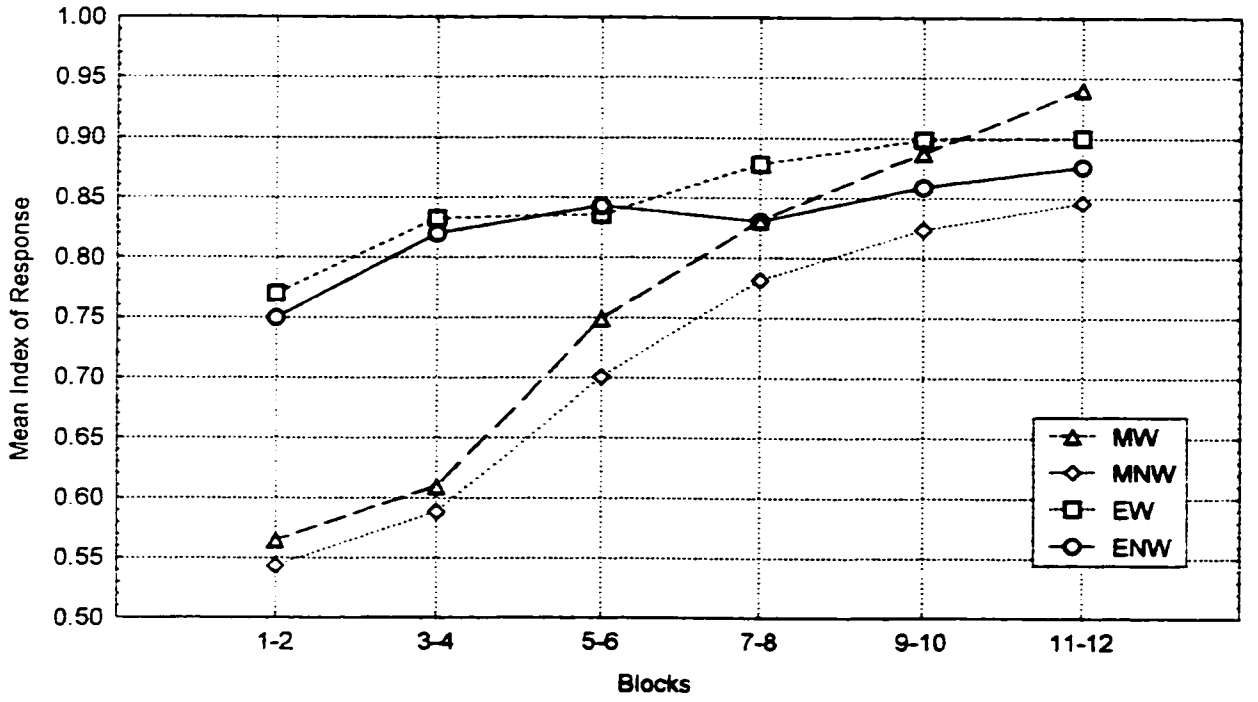
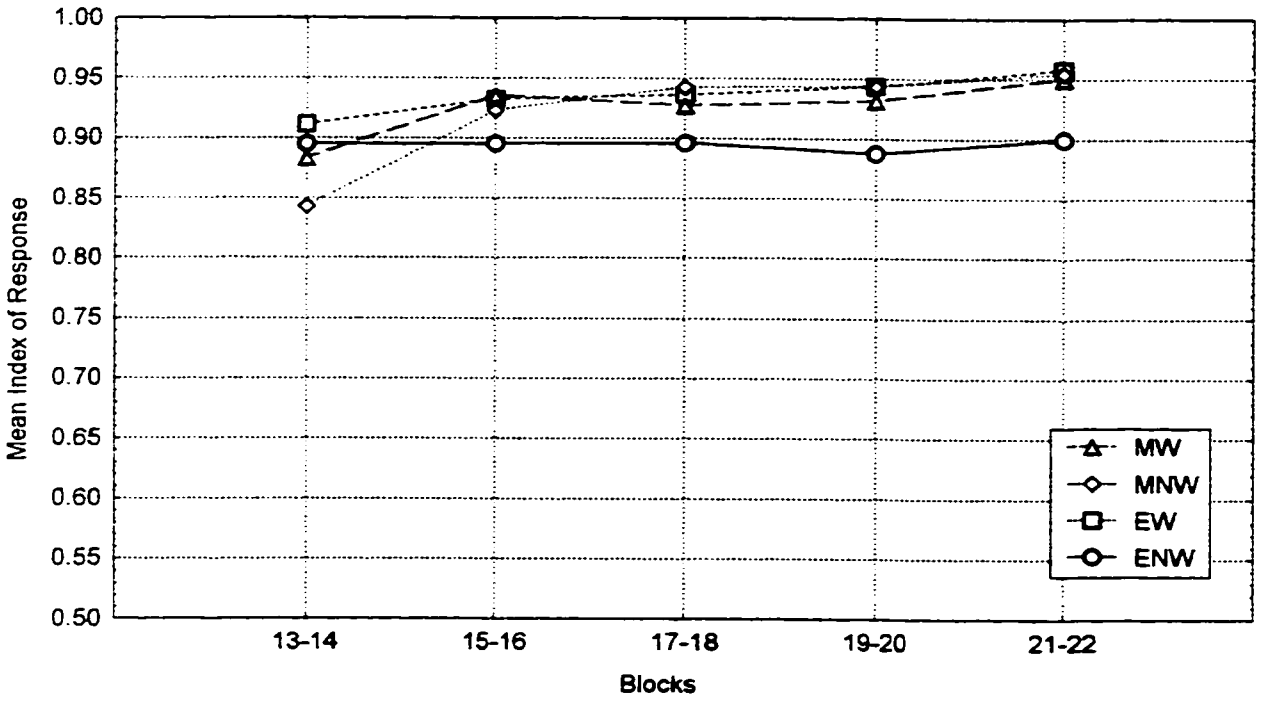
0.10
0.05
0.00
Relative Change in Extinction
23-25
26-28
29-31
32-34
'Blocks'
Warning
No Warning


1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
Mean Index of Response
1-2
3-4
5-6
7-8
9-10
11-12
Blocks
MW
MNW
EW
ENW


1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
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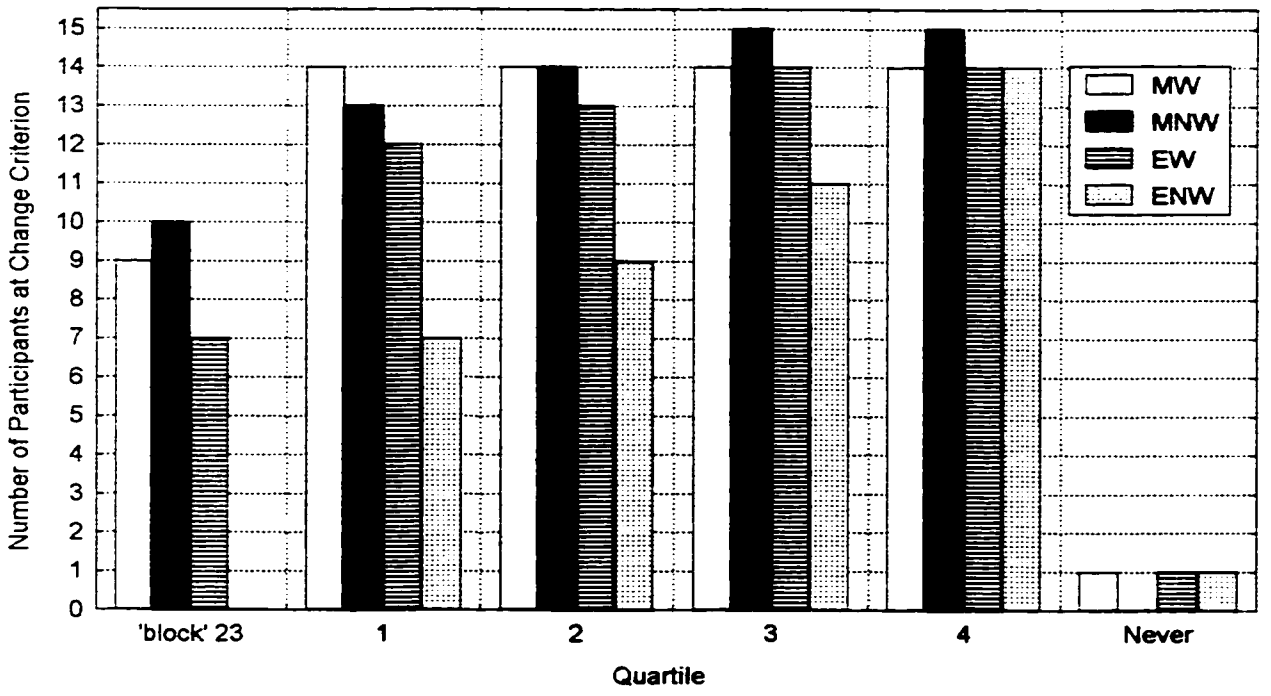
0.50
Mean Index of Response
13-14
15-16
17-18
19-20
21-22
Blocks
MW
MNW
EW
ENW


Number of Participants at Change Criterion
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11
10
9
8
7
6
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2
1
0
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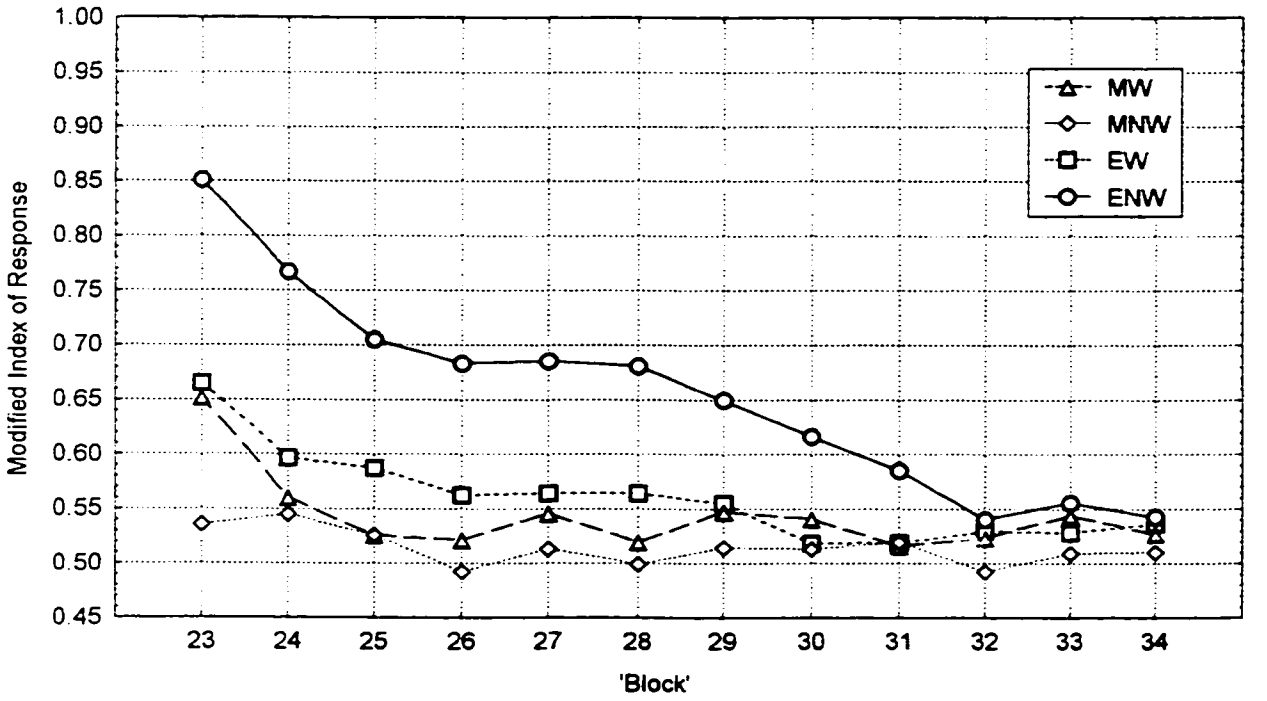
1
2
3
4
Never
Quartile
MW
MNW
EW
ENW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0.90
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0.65
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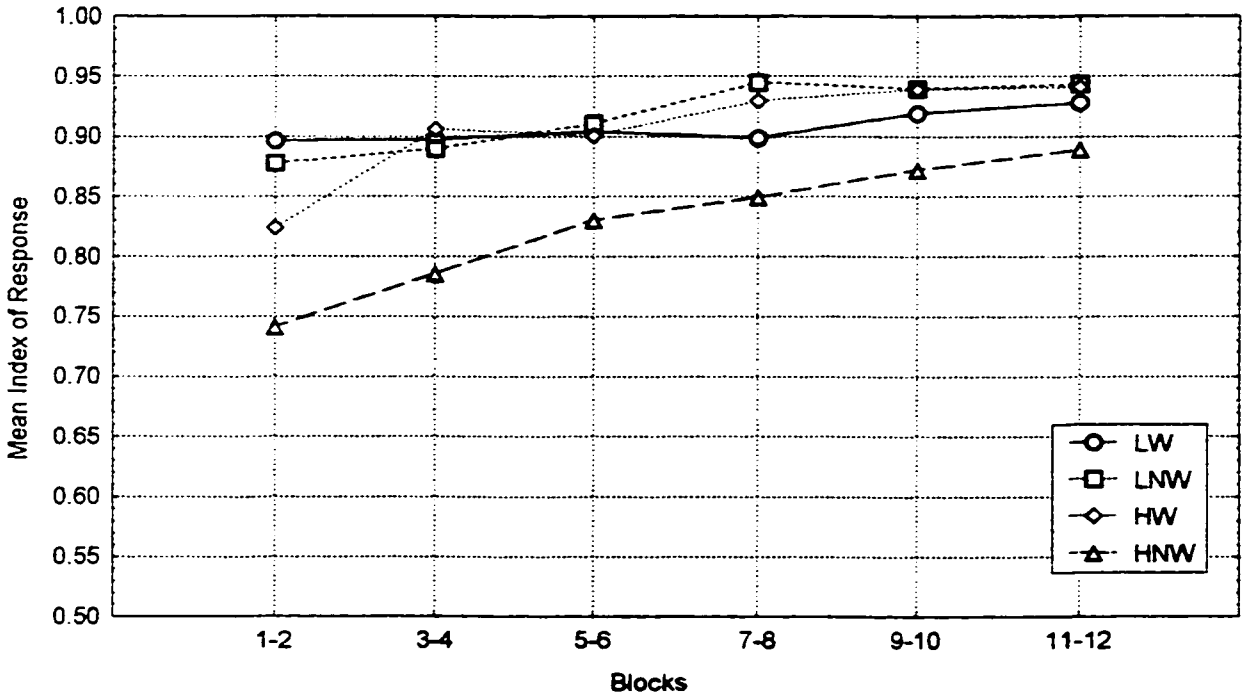
0.55
0.50
0.45
Modified Index of Response
23
24
25
26
27
28
29
30
31
32
33
34
'Block'
MW
MNW
EW
ENW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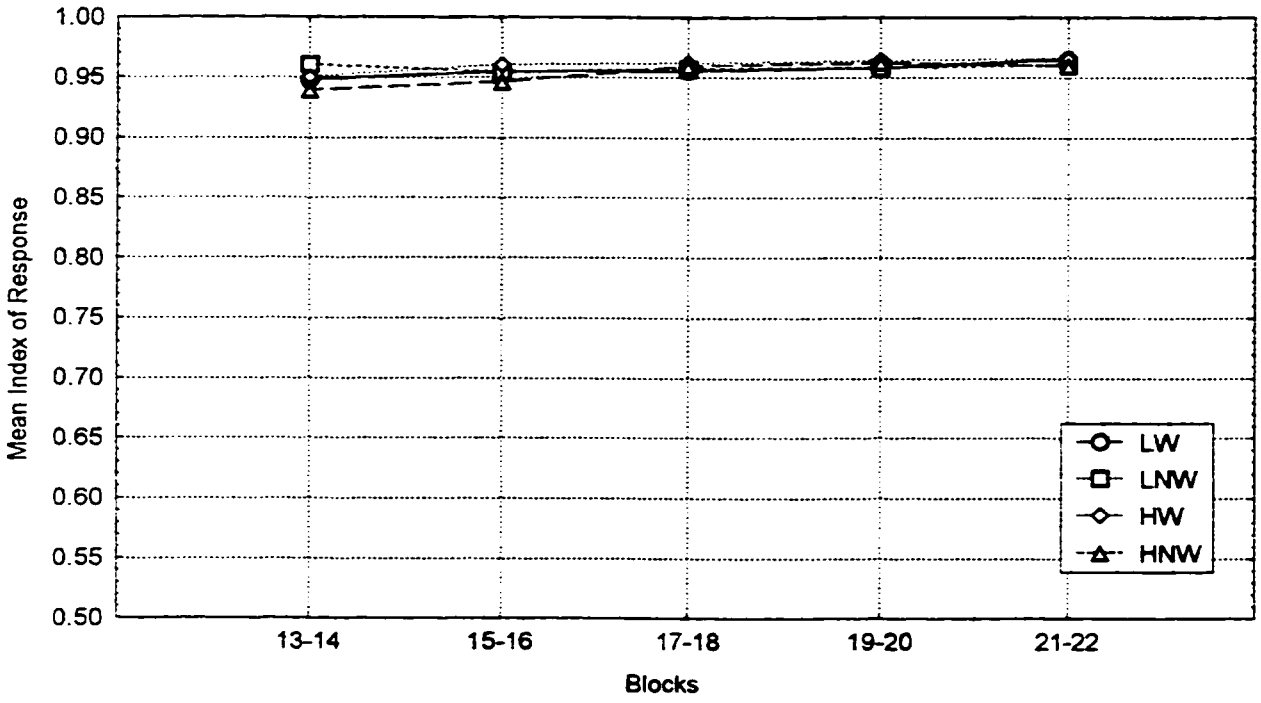
Mean Index of Response
1-2
3-4
5-6
7-8
9-10
11-12
Blocks
LW
LNW
HW
HNW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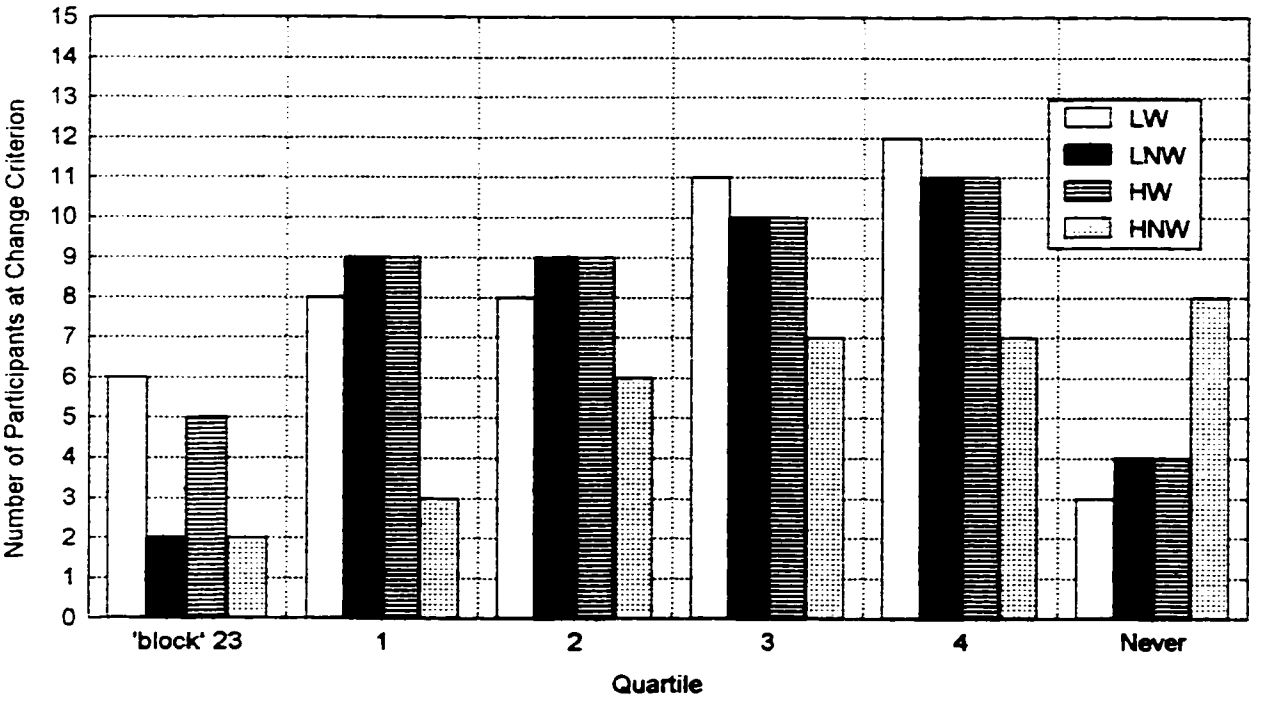
Mean Index of Response
13-14
15-16
17-18
19-20
21-22
Blocks
LW
LNW
HW
HNW


Number of Participants at Change Criterion
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9
8
7
6
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0
LW
LNW
HW
HNW
'block' 23
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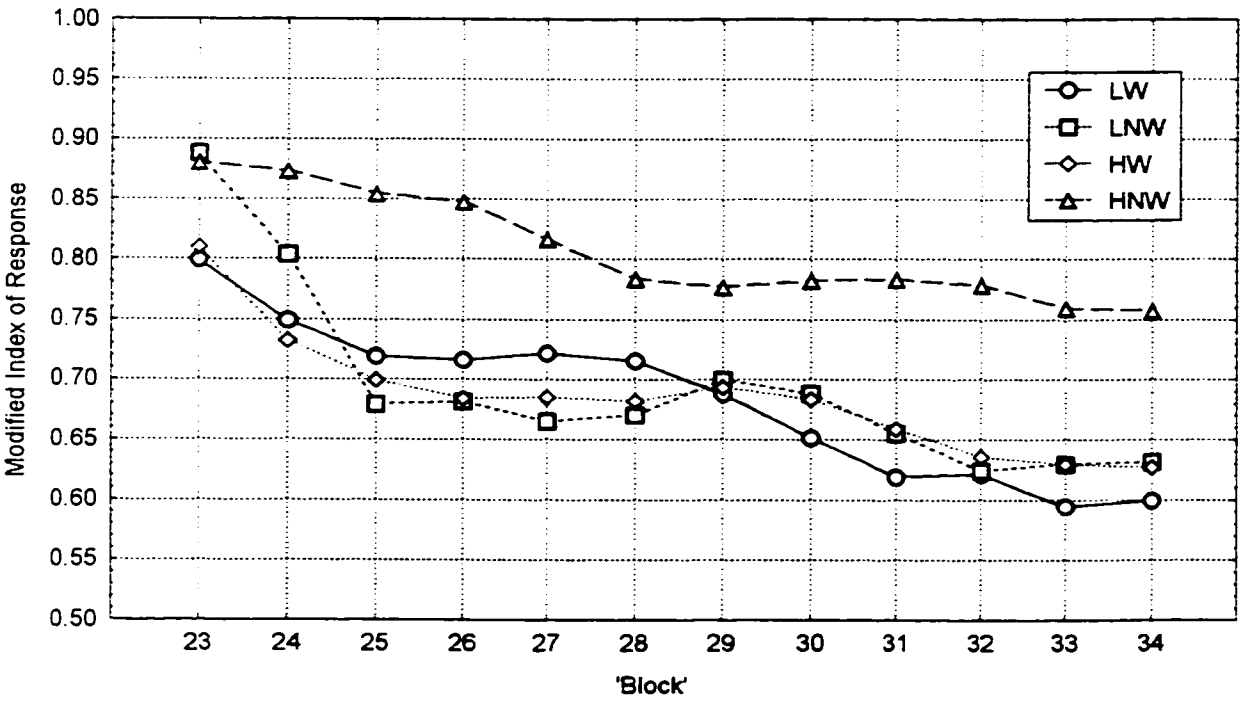
2
3
4
Never
Quartile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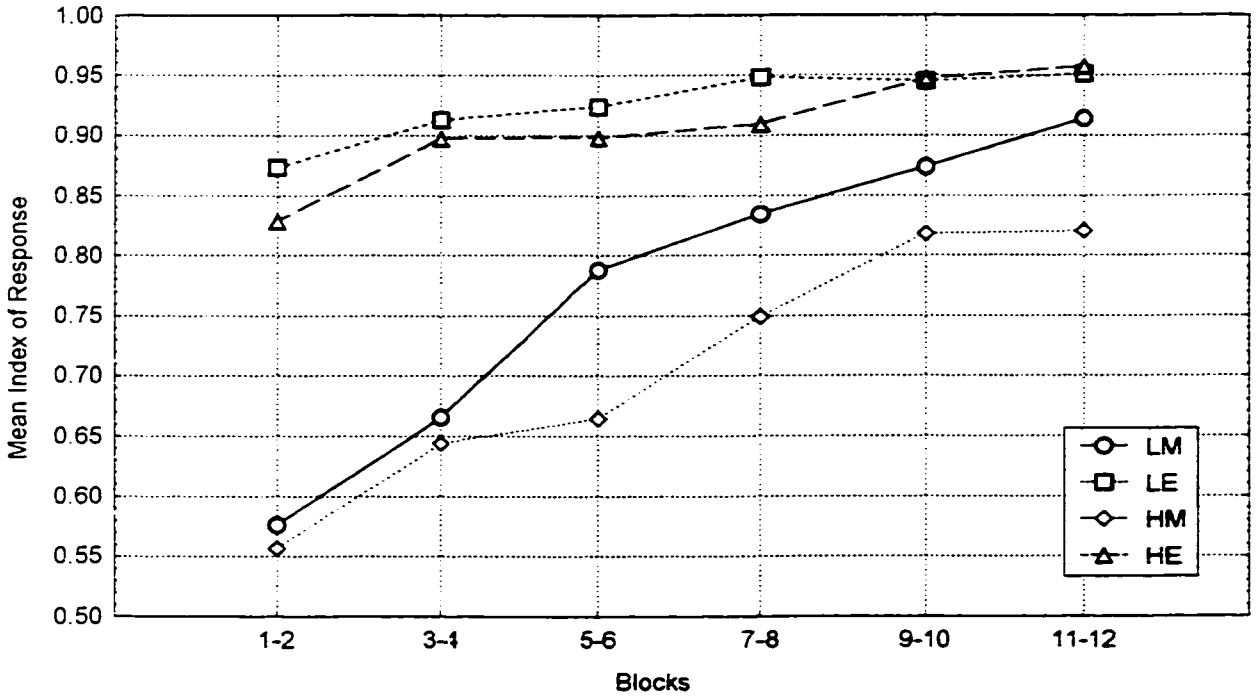
0.50
Modified Index of Response
23
24
25
26
27
28
29
30
31
32
33
34
'Block'
LW
LNW
HW
HNW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Mean Index of Response
1-2
3-4
5-6
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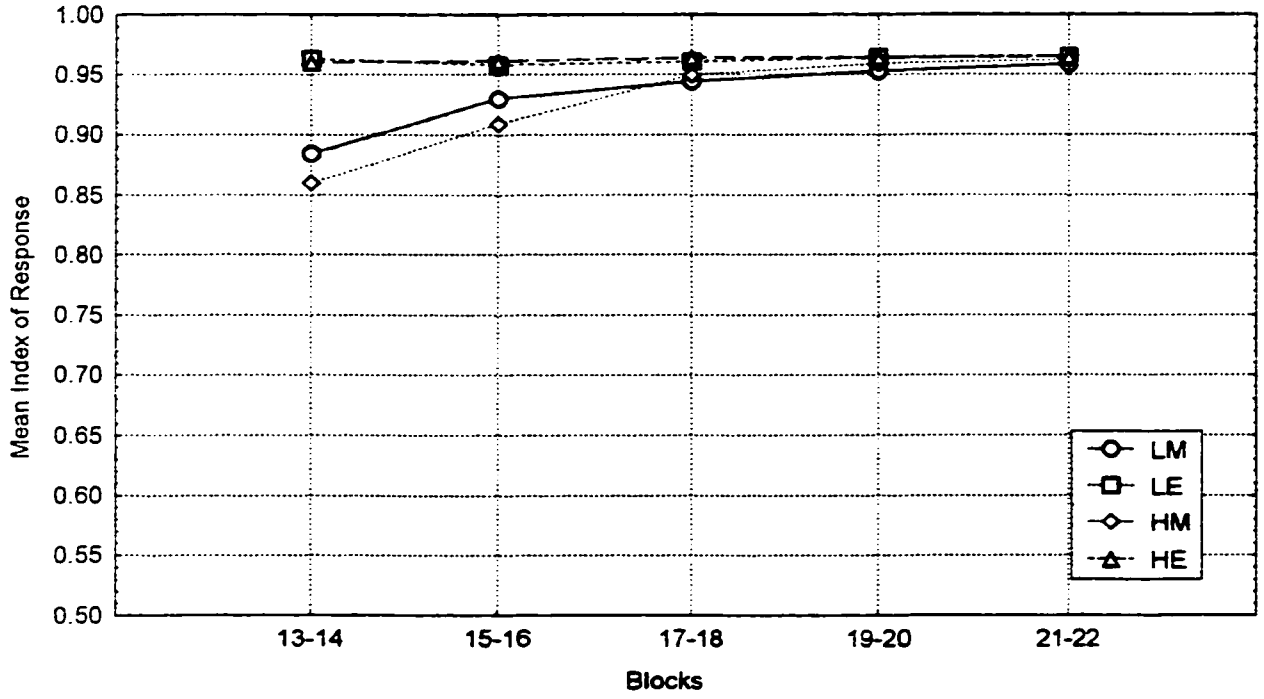
9-10
11-12
Blocks
LM
LE
HM
HE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Mean Index of Response
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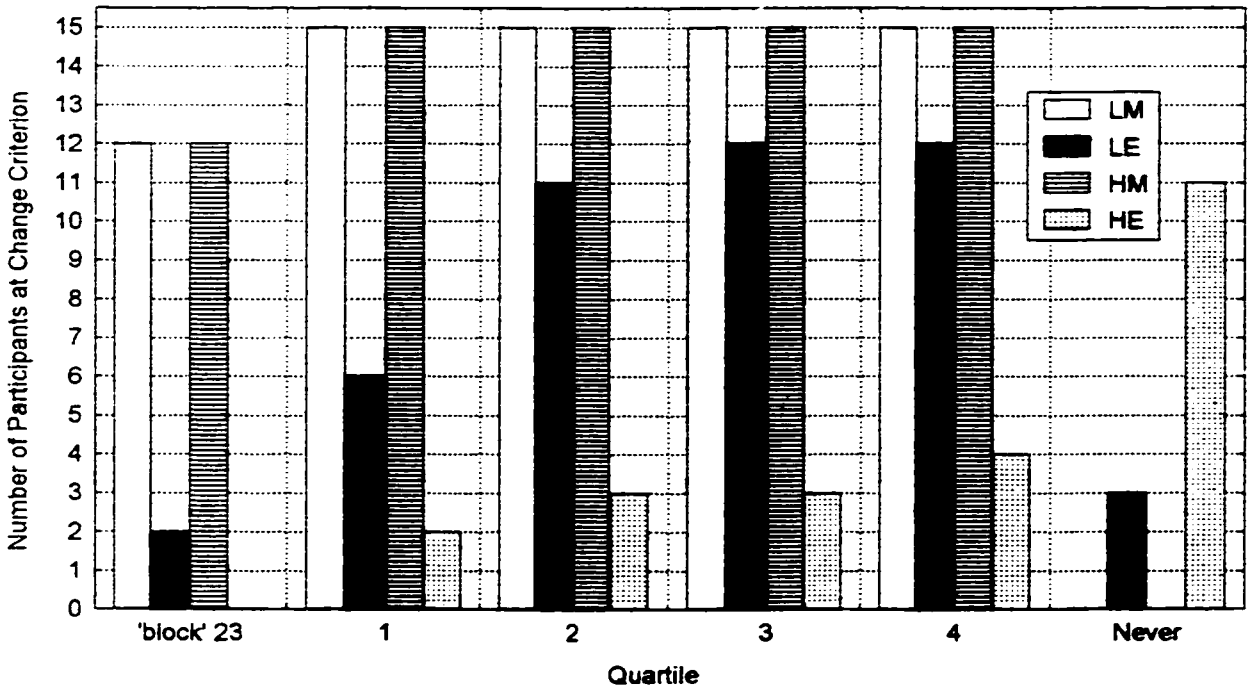
15-16
17-18
19-20
21-22
Blocks
LM
LE
HM
HE


Number of Participants at Change Criterion
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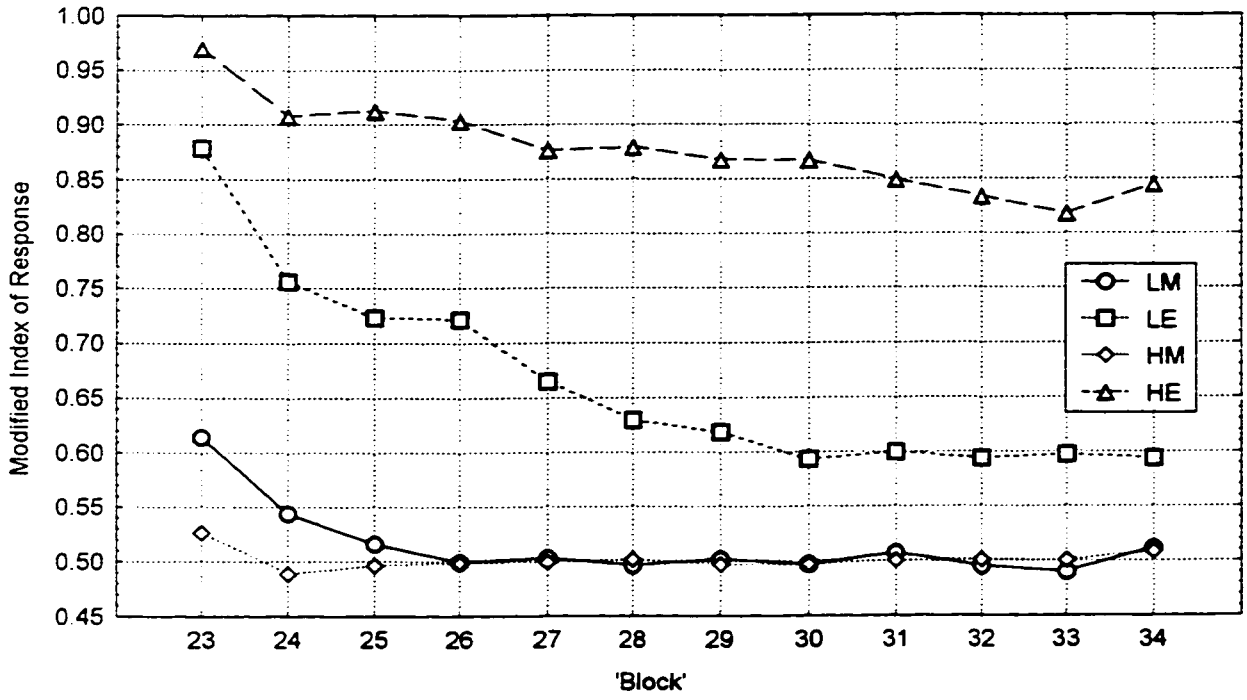
3
4
Never
Quartile
LM
LE
HM
HE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Modified Index of Response
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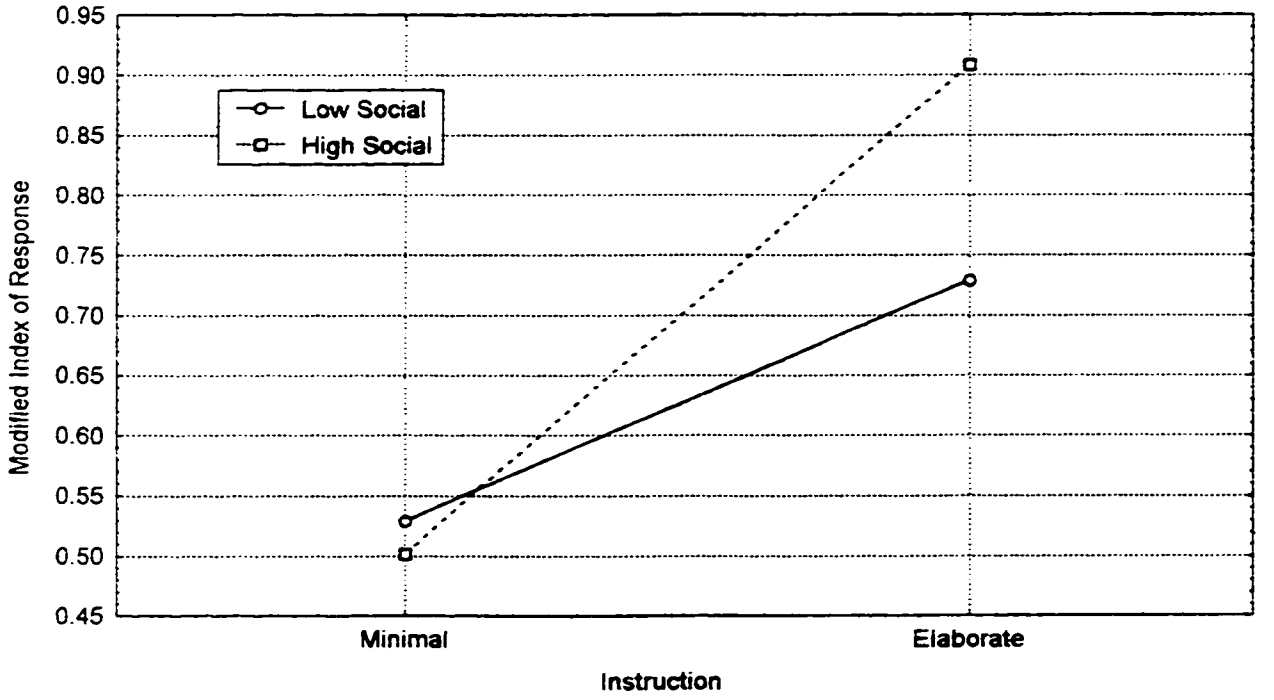
33
34
'Block'
LM
LE
HM
HE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0.50
0.45
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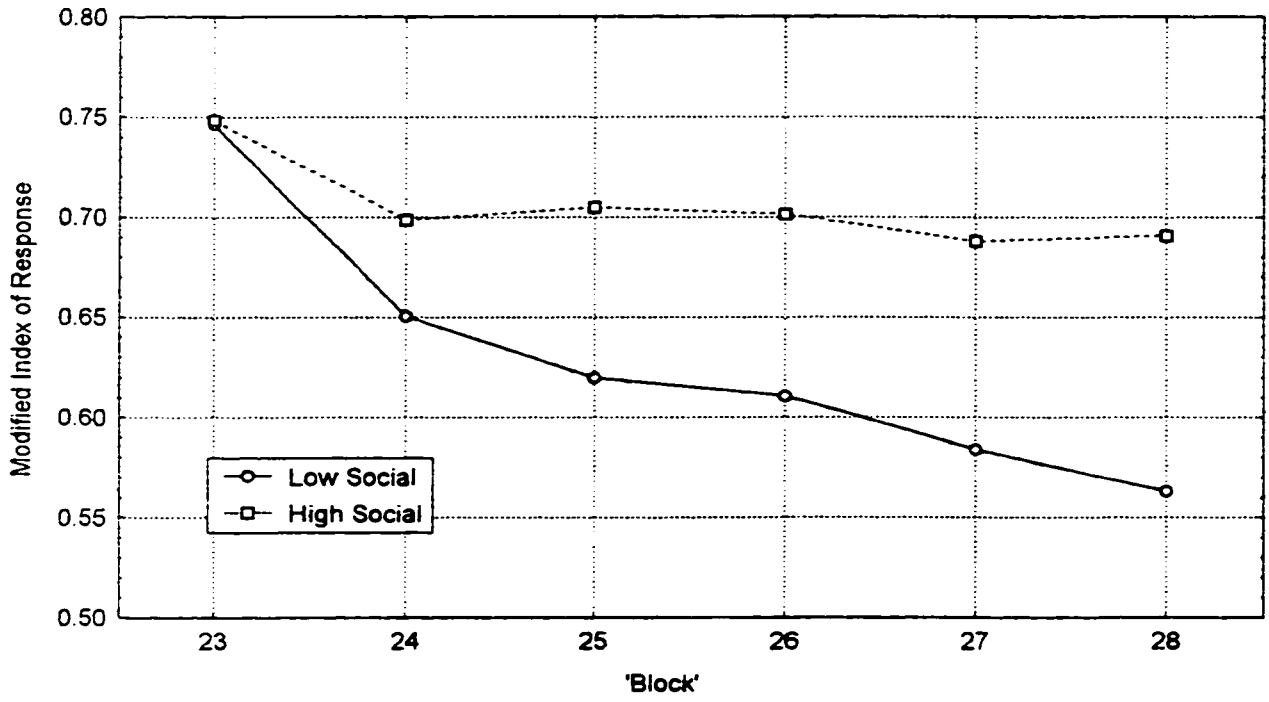
Low Social
High Social
Minimal
Elaborate
Instruction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Modified Index of Response
Low Social
High Social
23
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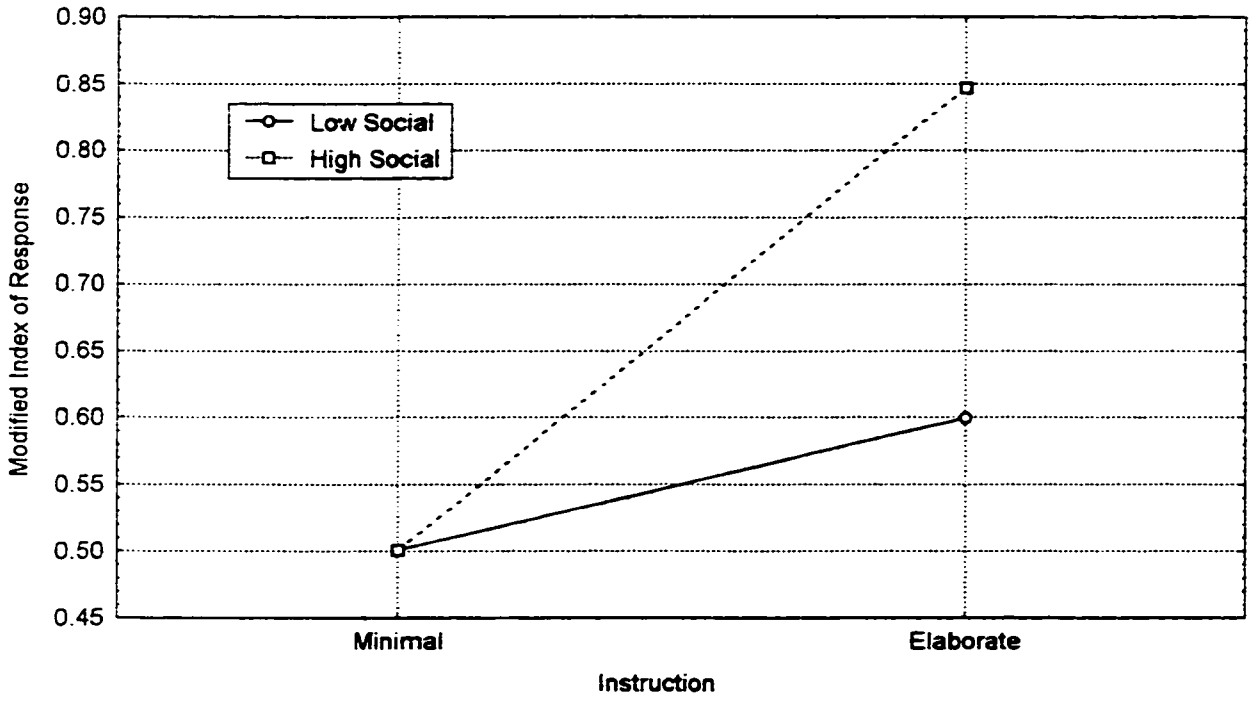
26
27
28
'Block'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0.55
0.50
0.45
Modified Index of Response
Low Social
High Social
Minimal
Elaborate
Instruction