Levels of self and external influence in self-reward

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Levels of self and external influence in self-reward

by

Frederick J. Firrell

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INTRODUCTION

Traditional laws of learning suggest that a person's behavior is a function of contingencies which are paired with that behavior, and which are usually applied by an external agent or a natural event in the environment. Notably absent from this formulation was an explanation of self-control until Skinner (1953) suggested that one controls one's own behavior the same way someone else would control the behavior; by manipulating the contingencies which influence the behavior. Recently, the theoretical formulation of behavioral self-control has led to laboratory and applied investigations of various methodologies including self-monitoring, self-reward, and self-punishment.

Introduction to Behavioral Self-Control

Strategies of behavioral self-control. Several behavioral strategies have developed to help people gain control over their own behavior. The first group of strategies has been called environmental planning (Thoresen & Mahoney, 1974), wherein the person constructs the environment in ways which will facilitate the execution of the target behavior (e.g., setting an alarm clock to facilitate rising promptly). The second group of strategies has been called behavioral programming, wherein the individual self-administers treatment or consequences contingent on a specific behavior. Mahoney and Thoresen (1974) offer the following procedures for behavioral programming: self-observation, positive self-reward, negative self-reward,
positive self-punishment, negative self-punishment, cognitive procedures, self-desensitization, self-instruction, self-modeling, and covert sensitization.

**Applied and laboratory studies in self-control.** Behavioral programming procedures have been examined in both laboratory analogue and applied studies. Although there are several studies which may not fit neatly into either category, the dichotomy between laboratory and applied research has been present through psychology's development. As a composite definition of each term (English & English, 1958; Harriman, 1947; Heller, 1971), laboratory analogue studies are conducted in a place allocated for scientific research, in order to examine the effects of one or more variables on another variable or set of variables. Laboratory analogue studies characteristically attempt to replicate a natural event in an analogous way in order to derive general principles or laws. Applied studies are typically conducted in practical situations, and examine the effects of one set of variables on another set of variables. Applied studies may or may not test the utility of the principles and laws derived in laboratory analogue studies, and the results of applied studies are usually of limited generalizability.

In both laboratory analogue and applied studies, the most frequently examined procedures of behavioral self-control have been self-reward and self-punishment (Goldfried & Merbaum, 1973; Kazdin, 1975; Thoresen & Mahoney, 1974).
Preliminary definitions of self-reward and self-punishment. Traditionally, a reward is any consequence of a response which increases the frequency of that response, and a punishment is any consequence which decreases the frequency of the target response. Some authors have delineated reward and punishment into both positive (contingent application of a stimulus) and negative (contingent removal of a stimulus) varieties (see Tirrell & Peters, 1976). Unfortunately, the present literature review has not found a single laboratory analogue study examining either negative self-reward or negative self-punishment. In addition, no consistent definition of self-reward or self-punishment has been used across the various laboratory analogue studies. Hence, in the following review, self-reward and self-punishment are defined as the application of an appetitive or aversive stimulus following a response. The stimulus may be self-selected, self-administered, or self-managed (e.g., Bass, 1972; Skinner, 1953; Thoresen & Mahoney, 1974; Weiner & Dubanoski, 1975).

Self-applied consequences in laboratory analogue studies have included tangible (e.g., candy), conditioned (e.g., a green light), and covert (e.g., self-commendation and self-criticism) stimuli (Weiner & Dubanoski, 1975; Dorsey, Kanfer & Duerfeldt, 1971; Haynes & Kanfer, 1971; respectively). In the present review, the terms reinforcer and reward are used synonymously.

The purpose of the present review. Thoresen and Mahoney (1974, p. 12) have proposed that people demonstrate self-control when "in the relative absence of external constraints," they participate in
behavior whose previous probability has been less than that of alternatively available behaviors." This definition is presented here because the present review will focus on self-reward and self-punishment as methods of self-control.

The major purpose of this review and investigation is to examine the results and procedures which have been called self-reward in laboratory analogue studies. The review will present the current theoretical interpretations of self-control, and the findings of the laboratory analogue studies in self-reward and self-punishment. Then, several methodological considerations will be discussed in light of the literature review, and the methodological dimensions of self-reward will be examined for their relevance and generalizability. Finally, a brief review of the literature on improving reading speed will be presented, since that is the target behavior used in the present study.

**Theoretical Interpretations of Self-Control**

Prior to reviewing the results of empirical studies in behavioral self-control research, the present section will look at ten recent theoretical formulations in the area.

**Historical interpretations.** The topics of self-control and self-reinforcement are clearly among the oldest found in civilized society, and have been shown to be the topics of Biblical scripture (e.g., Adam and Eve), Greek mythology (e.g., Homer's account of Ulysses' resistance to the allurement of the Sirens), Zen meditation
as an ancient art of body and mind control, and more recently, the writings of Williams James (1890) and Sigmund Freud (1956) (see Ainslie, 1975; Rachlin & Green, 1972; Shapiro & Zifferblatt, 1976). However, these early accounts relied on various explanations of the phenomenon which were difficult to measure, such as will power, the reality principle, transcendence, and effort.

The following ten sections will each present one recent theoretical interpretation of behavioral self-control.

I. Skinner's view of self-control. According to Skinner (1953, p. 228), when people control their own behavior, they do so in exactly the same way they would control someone else's behavior, "through the manipulation of variables of which behavior is a function." This interpretation underscores the importance of self-reinforcement as a method of self-control.

Skinner (1953, pp. 237-238) indicated that self-reinforcement of one's behavior "presupposes that the individual has it in his power to obtain reinforcement but does not do so until a certain response has been emitted." And, that "the individual may at any moment drop the work in hand and obtain the reinforcement." An examination of the self-reinforcement phenomenon must account for the fact that the individual does not indulge in the reinforcement. And, the prevailing question is whether freely available self-reinforcement does, in fact, increase the operants which precede it (Skinner, 1953).

II. Self-commitment as self-control. Self-commitment strategies are simply those which allow the person to select one of two or
more courses of action, where one course yields large delayed rewards and other courses lead to smaller immediate rewards. In self-commitment strategies, once one course of action has been selected by the individual, all other courses become unavailable. Ainslie (1975) and Rachlin and Green (1972) have discussed the situation where pigeons were allowed to select either small immediate or large delayed rewards. Typically the pigeons chose the small immediate rewards. However, when allowed to commit themselves to a course of action which later precluded the small immediate reward, the pigeons did so. Thus, they preferred to be presented only with a large delayed reward rather than to be given a choice between a small immediate and a large delayed reward. These authors (Ainslie, 1974, 1975; Baum & Rachlin, 1969; Rachlin & Green, 1972) have suggested that a major method of behavioral self-control is self-commitment by avoiding choice situations.

III. The feedback loop model of self-control. A well known interpretation of the self-control phenomenon, the feedback loop model, has been proposed by Kanfer (1970, 1971; Kanfer & Karoly, 1972). This model contains three theoretical components: Self-monitoring, self-evaluation, and self-consequences.

According to Kanfer and Karoly (1972), one's attention can be drawn to one's own behavior by events in the environment. This precipitates self-monitoring. Self-monitoring consists of observing one's own behavior, affect, or thoughts, and may include charting or displaying information relevant to the observed response. According to the feedback loop model, self-monitoring gives the person enough
information to evaluate his or her performance, and it is proposed to precede a discrimination or judgement in the form of self-evaluation, which determines how the person's performance compares with a subjectively held standard. Self-reward may occur next, and may be either tangible or cognitive (e.g., self-commendation). Self-reward is proposed to occur when the person's behaviors exceed the standard. Similarly, tangible or cognitive self-punishment occurs when the subjective standard has not been met.

The feedback loop model of self-regulation suggests that self-monitoring may lead to self-consequences, and the process may occur independently of external control. Thus, the model is hypothesized to explain a naturally occurring phenomenon.

IV. A cognitive interpretation. Meichenbaum (1975) proposed a three stage interpretation of self-control in which the person is hypothesized to first, self-monitor; second, generate thoughts which are incompatible with previous unsatisfactory behaviors; and third, develop new self-statements which maintain and generalize the new adaptive behaviors. A similarity between Meichenbaum's (1975) interpretation and Kanfer's (1970) feedback loop model may exist; both authors suggest a three stage model which includes self-monitoring, self-intervention, and generation of self-consequences.

V. Self-reinforcement as secondary reinforcement. Rachlin (1974) has suggested that self-reinforcement typically occurs in conjunction with already present environmental contingencies, and has claimed that self-reinforcement alone is not able to maintain
behavior if other, external consequences of the target behavior are removed (e.g., self-reinforcement of studying in the absence of improved grades, social reinforcement, and increased knowledge). Thus, Rachlin (1974) has proposed that self-reinforcement is actually a form of secondary reinforcement. And, self-reinforcement works, "not because of its reinforcing properties, but because of its stimulus properties" (Rachlin, 1974, p. 101). Rachlin substantiated this proposal by indicating that neutral stimuli (e.g., nonredeemable poker chips) have been used for self-reinforcers. Thus, self-reinforcement is likened to a click which tells an animal it has just pressed a bar.

VI. Self-reinforcement as self-discrimination. Catania (1975) presented a critical review of several attempts to demonstrate self-control in animals, including a study by Mahoney and Bandura (1972), who trained pigeons to approach a food hopper only after key pecking. When the animal did not abide by the contingency, food was withdrawn. Thus, the pigeons learned to peck the key first, then "self-reinforced" for key pecking by eating some food. Catania (1975) criticized this methodology, and said that it only teaches the organism to discriminate food availability by whether its approach was preceded by pecking. Catania (1975, p. 197) said "for this reason, the essential component of self-reinforcement is not the involvement of a reinforcement process. Rather, it depends on the establishment of self-discrimination or self-awareness; the organism must discriminate its own behavior." Therefore, Catania asserted, the active component
of self-reinforcement is self-discrimination, and the other components of effective operation and process are mythical.

VII. Self-reinforcement and modeling. While the work of the theorists discussed thus far has been couched in a stimulus response framework, other research has been conducted by Bandura (e.g., Bandura & Perloff, 1967) and has investigated the utility of modeling procedures in the acquisition of self-reinforcement strategies. Bandura and his co-workers have proposed that one's self-rewarding patterns and self-selected standards of reinforcement are developed through the influence of models. A model is simply another person, whose behavior is observed by the subject. As a result of exposure to the model, the subject's behavior is observed to evaluate whether the subject imitates the model.

VIII. Self-control as rule acquisition. Premack and Anglin (1973) have suggested that most rudimentary motivational procedures involve two organisms. One is the subject or person, the other is a supervisory organism who controls the contingencies, including the experimenter, mother, peers, machines, or natural events (e.g., a hot stove). The second organism may observe, judge, and subsequently operate on the first. Premack and Anglin (1973) have suggested that although self-reinforcement appears to be a one organism procedure, it involves a subjective criterion for the organism's own behavior which is acquired by past experience with supervisory organisms. Further, the individual learns to internalize rules which in the past have aided in avoiding aversive operations from the supervisory
organism, including mother's withdrawal of affection, presentation of punishment, and social constraints (e.g., jail). Premack and Anglin (1973) and Lopatto and Williams (1976) have hypothesized that in self-control, general rules are internalized, so the individual begins each new situation with the ability to apply old rules to the new situation.

**IX. A drive reduction interpretation of self-control.** A controversial report (Logan, 1973) interpreted self-control as an instance of drive reduction, including habit and incentive constructions. Logan's formulation posited that self-control responses are a subset of the learned drives of fear and frustration. Specifically, the human learns from infancy to associate fear or frustration with the lack of self-control. Although Logan (1973) proposed a self-control drive, he did not provide any data to support this interpretation.

**X. The role of attribution and self-perception in self-control.** Recently, Kopel and Arkowitz (1975) have reviewed the social psychological theories of self-perception and attribution, and have suggested that these two variables partly account for the success of self-control procedures. They have suggested that self-control procedures work most effectively when the clients are persuaded that the treatment success and responsibility for change are clearly their own. Once behavior change has occurred, self-perception would lead to concomitant changes in attitudes and beliefs. Unfortunately, Kopel and Arkowitz (1975) presented no data to support this claim.
Theoretical interpretations and the present dissertation. Although the present study did not directly test any of the above theoretical interpretations, it relates to each of them. One theme which will be developed herein is that external and self-control would best be viewed on a continuum of self and external influence, rather than dichotomously. The above theoretical interpretations all have discussed external and self-control in a dichotomous manner. Hence, the present research relates to each theory.

In the following sections, the empirical results which directly relate to the explanations of self-reward and self-control will be presented. Since the present experiment was a laboratory analogue study, analogue studies will be examined primarily.

Three Research Approaches in Self-Reinforcement

Laboratory analogue research efforts in self-reinforcement and self-punishment mainly fall into three distinct approaches (directed learning, social learning, and animal studies), and have been examined by several groups of experimenters including Kanfer, Bandura and Ainslie, and their co-workers. In the following several sections research from these three groups of researchers will be reviewed. These three research approaches to self-reinforcement are important in the present review, because they will be cited later during discussions of the issues and methodological considerations in self-reinforcement. In addition, these three approaches have been used in most of the self-reinforcement laboratory analogue research to date, and thus, have importance to both consumers and producers of this research.
Kanfer's directed learning paradigm. Kanfer's directed learning paradigm typically has presented the participant with a two phase treatment. Phase one consists of an externally administered reward history, and during phase two, the person self-administers the reward. Kanfer (1970) has suggested that we typically monitor ongoing behaviors only when those behaviors are creative, undergoing acquisition, or deviate from their expected performance level. In our daily lives, self-monitoring can lead to self-reward (e.g., self-commendation) or self-punishment (e.g., self-criticism).

Kanfer's research has found that one's rate and accuracy of self-reward tends to be similar to the rate and accuracy of external reward one has previously received (Bartol & Duerfeldt, 1970; Kanfer, Bradley & Marston, 1962; Kanfer & Duerfeldt, 1967b; Dorsey, Kanfer & Duerfeldt, 1971; Sinkins & Kingery, 1970). Self-reward rates tend to be either unrelated or negatively related to self-punishment rates in the same person (Kanfer & Duerfeldt, 1967b; Kanfer, Duerfeldt & LePage, 1969). The self-reward rate one displays may be modified by social constraints which foster or inhibit self-reward indulgence (Bellack & Tillman, 1974; Kanfer & Marston, 1963a,b; Oziel & Berwick, 1974). Finally, one's level of self-evaluation may either be positively related or not related to self-reward rates (Bellack, 1975; Kanfer & Duerfeldt, 1967a), and one study found that boys and girls differentially relate self-reward to self-evaluation (Brady, Rickards & Felker, 1975).
Kanfer's research has been reviewed by Kanfer (1970) and Kanfer and Phillips (1970).

The social learning paradigm in self-reinforcement. While the above studies are representative of Kanfer's directed learning paradigm in self-reinforcement investigations, a second research approach to the area has been developed by Bandura and his co-workers. This latter approach has been termed the social learning paradigm and the vicarious learning paradigm (Bartol & Duerfeldt, 1970; Masters & Mokros, 1974; Thoresen & Mahoney, 1974).

Of primary importance to the social learning paradigm are questions regarding how people acquire and maintain self-reinforcement standards in daily living. Hence, a substantial research effort has evaluated the acquisition of self-reinforcement standards when subjects observe a model (other person) self-reward after performing a target task in the laboratory.

An early study (Bandura & Kupers, 1964) clearly demonstrated that children can learn either lenient or stringent self-reinforcement standards after observing models use lenient or stringent standards of self-reinforcement. The same study found that peer models were less likely to be imitated by the children than adult models. Subsequently, several studies have investigated the relationship between modeling and the acquisition of self-reinforcement patterns (e.g., Mischel & Grusec, 1966; Rosenhan, Frederick & Burrowes, 1968).

Briefly, it has been found that poor transmission of modeled self-reinforcement standards tends to occur when the models are
either greatly superior or inferior to the subject in their task competence or ability to perform the target task (Bandura & Whalen, 1966). Models who have a high degree of social power (potential to reward the subject) are highly imitated, and continue to be imitated even after that social power has been removed (Mischel & Liebert, 1966). Surprisingly, adult models who have had a highly nurturant experience with a child were less frequently imitated in their self-reinforcement standards than were models with no prior nurturant experience (Bandura, Grusec & Menlove, 1967). Bandura et al. (1967) had operationally defined a nurturant experience as one in which the adult played with the child in a warm and generous manner. Further, Mischel and Grusec (1966) found that nurturant models' self-reinforcement standards were frequently imitated when the target task involved socially neutral behaviors, but not when the target task was aversive to the subjects.

Laboratory analogue investigations of self-reward in the social learning paradigm have been further reviewed by Masters and Mokros (1974) and Bandura (1971).

Animal studies of self-control. The third distinct research approach to be discussed herein focuses on two paradigms which have been developed to examine self-control possibilities using animal subjects.

First, several investigators (Ainslie, 1974, 1975; Baum & Rachlin, 1969; Rachlin & Green, 1972) have examined the situation in which a participant is placed at a choice point and may select either a small
immediate reward, and thereby demonstrate impulsiveness, or a larger
delayed reward, and thereby demonstrate self-control. As the long-
term reinforcer becomes more potent, the tendency to accept it in-
creases. Likewise, as the time of delay for reinforcement increases
for the short-term reinforcer and decreases for the long-term rein-
forcer, the tendency to accept the larger, long-term reinforcer in-
creases. These authors have suggested that self-control is actually
control over the availability, delay, and saliency of the rewards
available to the subject.

Second, several studies have examined whether pigeons and mon-
keys are capable of demonstrating accurate self-reward behavior
(Bandura & Mahoney, 1974; Bandura, Mahoney & Dirks, 1976; Mahoney &
Bandura, 1972; Mahoney, Bandura, Dirks & Wright, 1974), and all of
these studies have used variations of the same paradigm. In one ex-
periment conducted by Mahoney and Bandura (1972) pigeons pecked a
response key to obtain food reinforcement. During training, if the
animal attempted to obtain the food before pecking the key, the food
was removed until the next trial. This procedure was maintained un-
til the birds always pecked prior to approaching the food. Then,
during the test phase, both the key and food were freely available to
the pigeons. It was found that during the test phase the birds dis-
played nearly perfect self-reinforcement, and one bird persisted for
1,000 trials. The present author suggests there is a distinct simi-
liarity between the above procedure (where food removal is designed to
be aversive) and extinction in the classic avoidance paradigm in the
animal literature. Clearly, there was no new information, or signal, to inform the birds that the food would not be removed during the test phase if they approached it without first pecking the key. Bandura (1971) and Bandura and Mahoney (1974) have suggested that it is precisely by the avoidance paradigm that we learn to appropriately self-reinforce. And, the above results would support a rule learning interpretation of self-reinforcement acquisition (e.g., Lopatto & Williams, 1976).

While the present studies have introduced the concept of self-control processes in animals, firm conclusions can only be made after the current paradigms have been replicated and expanded.

Three Issues in Self-Reinforcement

In the following three sections, three issues in self-reinforcement research which relate to the present thesis will be discussed. Each issue has been examined by several researchers, and each merits close attention by researchers in the area.

Task difficulty and ambiguity and self-management. If self-reward and self-punishment freely occur in our daily environments, questions arise whether self-applied consequences occur more efficiently following performance on discrete versus ambiguous tasks and easy versus difficult tasks. Several studies have found that self-management efficiency can be influenced by the nature of the target behavior.
Marston (1964b) conducted a factorial study which examined the effects of task ambiguity and the type of reinforcer employed. Five ambiguous tasks were used, and subjects' self-reinforcement rates were found to be related to the level of task ambiguity, such that increased rates of self-reinforcement accompanied decreased rates of task ambiguity. The type of reinforcer employed (light, chips, self-rate) did not influence self-reinforcement rates.

Reschly (1973) suggested that most laboratory analogue experiments of self-reinforcement have used ambiguous tasks, and that the experimental manipulations of the independent variable (e.g., modeling, type of instructions, amount of training) tend to give the participants more information about the task and, hence, reduce its ambiguity. Reschly (1973) administered three tasks, varying in their amount of ambiguity, to adolescent subjects. A significant relationship was found, indicating that self-reinforcement rates increased as level of task ambiguity diminished. Reschly (1973) also examined several individual difference variables, including sex, intellectual ability, and task success, but none was found to relate to self-reinforcement rates.

Reschly's (1973) finding that there is a negative relationship between task ambiguity and self-reinforcement rates was subsequently replicated by Reschly and Mittman (1973), who suggested that increments in task ambiguity produce concomitant increments in task difficulty. This suggestion is important, especially in light of the
findings presented by Dorsey, Kanfer, and Duerfeldt (1971), that increments in task difficulty yield decrements in self-reinforcement rates.

Although no applied investigations of task ambiguity have been conducted, the present line of research suggests that when target behaviors present equivocal feedback and elements, their subcomponents might be separately monitored to give the participants less ambiguous feedback, and better enable them to accurately self-reinforce.

The above studies suggest that self-reinforcement processes accurately increase in frequency as the feedback the person receives from the target behavior becomes less ambiguous and as the target behavior becomes less difficult. These studies relate to the present experiment, because an important methodological concern in the present experiment is to give each subject accurate performance feedback following each trial at performing the target behavior, in order to maximize the efficiency and accuracy of self-reinforcement.

Motivational values of self-administered consequences. Recently Bandura (1974) proposed that experimental investigations of self-reinforcement be divided into those which investigate acquisition of performance standards of self-reinforcement, and those which evaluate its motivational properties. Certainly the former category could be expanded to include not only acquisition of self-reinforcement standards, but also acquisition of all self-reinforcement behaviors, the influence of external feedback on self-reinforcement standards, the relationship between self-reinforcement and self-evaluation, and all
other issues discussed thus far which help explicate the nature of self-reinforcement, regardless whether it effectively changes behavior. If this is done, then Bandura's (1974) two categories reduce to the familiar topics of process and outcome.

Thus far, the present discussion has examined the self-reinforcement process. Now, the focus will change to outcome parameters of self-reinforcement.

The present discussion will examine two related issues. First, what are the effects of increasing the size (incentive) of the self-applied reward? Second, does self-reinforcement effectively modify the person's behavior?

It would seem that increasing the value of a self-reinforcer would increase the probability that the person would self-administer undeserved rewards, even if that entailed rule violation.

Several studies have made unsuccessful attempts to find increased rule violation following an increase in the incentive value of self-reward. Peskay and Masters (1971) found that first grade children who self-administered washers performed no differently than those who self-administered pennies. Similarly, Kozma and Kerwin (1975) found that the incentive of gaining 25¢ for every deserved self-reward and losing 25¢ for every undeserved self-reward had no effect on the accuracy of self-reward of university students. Kanfer (1966) studied preschoolers, and found that candy rewards yielded no greater rule violation than did a reinforcement system using simple point rewards. Kanfer (1970) suggested that participants do not seem to inappropriately
self-administer excess self-rewards at higher incentive levels, as might be expected, because of life-long conditioning in which we have learned to exercise caution when the stakes are high.

Other studies have found a direct relationship between incentive level and self-reward behavior in an unexpected direction. Marston and Kanfer (1963) found that increased incentive led to more accurate self-reinforcement behavior. And Marston (1964a) observed that subjects receiving fewer reinforcements (i.e., 50% reinforcement schedule) self-rewarded with less accuracy than subjects receiving more frequent reinforcement (75% and 100%) schedules.

Liebert and Ora (1968) have cast some serious doubt on the simplicity of the above results. Rewards used in the above studies have included washers and pennies (Peskay & Masters, 1971), quarters (Kozma & Kerwin, 1975), and signal lights (Marston & Kanfer, 1963). Poker chips, redeemable for unidentified prizes have also been used (Liebert & Allen, 1967). However, Liebert and Ora (1968) used rewards ranging from a 10¢ pencil to a small camera worth $12.45, which were redeemable by tokens, and found that increasing the incentive led to greater rule violation and incorrect applications of self-reward. It may be that these results are simply due to the material value of the rewards used. However, this conclusion awaits replication and further elaboration.

Several studies have questioned whether self-reinforcement possesses motivational qualities. Although the present review will temporarily defer questions of the external validity of the laboratory
analogue examinations of self-reinforcement, it can be summarily reported that self-reinforcement has been shown to enhance performance of target behaviors in both laboratory analogue (e.g., Bandura & Perloff, 1967; Kanfer & Duerfeldt, 1967b; Marston & Kanfer, 1963; Montgomery & Parton, 1970) and applied studies (e.g., Bellack, Glanz & Simon, 1976; Felixbrod & O'Leary, 1974; Romanczyk, Tracey, Wilson & Thorpe, 1973).

The above studies suggest that increments in the value of rewards used in self-reward studies yield increased rule compliance with symbolic or token reinforcers, but the reverse is true when using tangible reinforcers of high material value. However, this research does not answer the question whether increasing the reward value concomitantly increases performance of the target behavior.

The above studies also suggest that self-reward procedures may lead to increased performance motivation, when compared to no reward procedures. These investigations relate to the present research, because the present study allowed subjects to select their own rewards (to equate reward values), and tested whether various modes of self-reward actually fostered increased performance motivation. The next section will compare the efficiency of self-reward and external reward.

The relative efficacy of external and self-reinforcement strategies. A controversial issue of long standing has questioned whether external and self-reward systems are equally effective in fostering behavior change in both laboratory and applied studies. Several experiments found that self-reward demonstrated greater performance
motivation than external reward (Jeffrey, 1974; Johnson & Martin, 1973; Kanfer & Duerfeldt, 1967b; Marston, 1967), but opposing results have displayed the superiority of external reward to self-reward (e.g., Marston & Kanfer, 1963). Surprisingly, one study (Kanfer & Duerfeldt, 1967b) reported that both external and self-reward procedures were less efficient than no reward. However, the most frequent finding is that self-reward and external reward are relatively equally efficient, and more efficient than no reward (Bandura & Perloff, 1967; Bolstad & Johnson, 1972; Fredericksen & Fredericksen, 1975; Felixbrod & O'Leary, 1973, 1974; Hall, 1973; Jeffrey, 1974; Johnson, 1970; Johnson & Martin, 1973; Speidel, 1974).

One possible source of confusion when comparing self and external reward stems from variations in the methodological procedures used in different laboratory studies. Since the self-reward procedure is multifaceted, many studies have focused on only one or a few of its aspects. For example, Unmacht and Obitz (1974) directly compared self-applied versus externally applied reward strategies, while Speidel (1974) allowed subjects to self-manage the reward procedure (e.g., rate, scheduling, and frequency of reward), and Weiner and Dubanoski (1975) included rewards which were both self-managed and self-chosen. Hence, many of the comparisons of external and self-reward have used non-comparable procedures. The present study attempted to clarify the procedures used in self-reinforcement.

Second, it is misleading to compare external and self-reward procedures in a dichotomous manner. Examination of the above studies
reveals that the various methodological dimensions lend themselves to
greater or lesser amounts of self-influence. Thus, a procedure where-
in subjects self-applied rewards, but the rewards were externally man-
aged (scheduled) by the experimenter would allow less self-influence
than a procedure in which all facets were under the control of the
person. Absent from the above studies is a comparison of external
and self-reward which allows for various degrees of self and external
influence. The study which accompanies this review not only compared
external and self-reward procedures, but also compared procedures
which contained a mixture of both self and external influences.

Methodological Considerations in Laboratory Studies of Self-Reward

Since Skinner's (1953) discussion of self-control included the
method of self-reward, and since every major review of self-reward has
indicated that self-reward is a method of self-control (Bandura, 1971;
Goldfried & Merbaum, 1973; Kanfer, 1970; Kazdin, 1975; Masters &
Mokros, 1974; Thoresen & Mahoney, 1974), it is evident that the the-
oretical and practical value of the laboratory analogue studies re-
viewed rests on their relevance to the self-control process. It is
important to note that a permeating assumption in this literature has
been that people use self-reward in the form of self-praise and self-
applied tangible and symbolic stimuli without ever receiving treatment
from a behavior therapist or experimental psychologist. That is,
self-reward is one of several methods of self-control, and it occurs
naturally in our daily lives.
The following discussion will highlight the characteristics of laboratory analogue research, provide definitional considerations of self-reward as a self-control method, and comment on the external validity of the methods used in the studies of self-reward.

**Characteristics of laboratory analogue studies.** Recent advances in experimental methodology have enabled researchers to closely approximate causal relationships in psychotherapy, behavior therapy, and their elements (Paul, 1969). Therapy analogues are typically categorized into two types; those which examine therapist variables, subject variables, and procedural variables, called process analogue studies, and those which examine the relative usefulness of therapeutic procedures, called outcome analogue studies (Zytowski, 1966).

Heller (1971, p. 126) has defined laboratory analogue studies as methods of "building and testing laboratory models that are abstractions or analogies of natural events." Hence, the purpose of a laboratory analogue is to establish an experimental setting which replicates that of the natural event, then isolate and manipulate specific variables. In short, the characteristics of a laboratory study are most meaningful when they are analogous to, or simulate, the characteristics of the natural event.

Laboratory analogue studies of behavior therapy have been criticized regarding the relevance of their procedures, lack of use of clinically relevant target behavior, and limited generalizability to therapeutic procedures and populations (Borkovec & O'Brien, 1976;
Cooper, Furst & Bridges, 1969), in addition to the problems of subject roles and demand characteristics which generally may impair laboratory analogue research (Weber & Cook, 1972).

To date no critical evaluation of the laboratory analogue procedures used in self-reward and self-punishment as self-control has been published.

**Definitional considerations of self-reward and self-punishment as self-control.** Along with the growth of self-control research in the past decade has come some confusion about its definition, since no single definition has been used. Thoresen and Mahoney (1974) and Lopatto and Williams (1976) have defined self-control as the performance of low probability behaviors, in the absence of external constraints, when alternative behaviors are available to the person. Note that this definition agrees with Skinner's (1953) conceptualization that whatever contingencies are applied are applied without external restriction. Thoresen and Mahoney (1974) have also suggested that in order to demonstrate self-control, the person must engage in self-deprivation, abstinence, or endurance. That is, the person must do something difficult or arduous. Bandura and Perloff (1967) have suggested that the person prescribe the performance standard used.

**Changing meaningful behaviors in laboratory analogue studies.** As mentioned, the relevance of laboratory studies has recently been questioned. The definitions of self-control and external control to be proposed herein will bear this criticism in mind. Hence, whether
attempting to display self-control or external control, it is sug-
gested that laboratory analogue procedures display greatest practical
relevance when they demonstrate deprivation, abstinence, or endurance
(Thoresen & Mahoney, 1974), using a low probability target behavior
(Lopatto & Williams, 1976), the change of which is a goal of the sub-
ject. In addition, it is suggested that the procedures are most
clearly performed when the person receives accurate performance feed-
back and when any reward or punishment used is either tangible or pre-
tested for its motivational qualities.

**Reward procedures: A continuum of self and external influence.**

In the studies reviewed previously which compared the efficacy of self
and external reward procedures, those procedures were contrasted di-
chotomously. However, no consistent definition of self-reward and
external reward was used across the studies. Examination of those
procedures yields several components which may lend greater or lesser
amounts of self-influence or external influence.

A reward or punishment procedure can be either self or exter-
nally managed (e.g., rate and scheduling), chosen, or applied. In
addition, in self-reward procedures, the reward may or may not be
freely-available to the person. As control of each of these func-
tions is given to the person, the level of self-influence tends to
increase and external influence tends to decrease. This proposal is
consistent with the suggestion by Kanfer, Cox, Greiner, and Karoly
(1974) that self and external influence of reinforcers occurs on a
continuum, rather than dichotomously. And, other researchers have suggested that self-reinforcement procedures are most generalizeable to self-control when the reward is self-managed (Bass, 1972), freely available (Bass, 1972; Skinner, 1953), self-applied (Thoresen & Mahoney, 1974), and self-chosen (Weiner & Dubanoski, 1975).

Lopatto and Williams (1976) have suggested that not all self-reward is self-control. Various studies have proposed that self-reward demonstrates self-control only when the procedure involves self-assessment; self-recording; self-selection, self-management, and self-application of reinforcers (see Glynn & Thomas, 1974) and an awareness of the benefits of changing the target response (Champlin & Karoly, 1975).

To date, although several self-reward procedures have been identified as components of self-control in isolated studies, no study has combined the components. The present study will attempt to do so.

A comprehensive definition of self-reward as self-control. The present discussion has restricted self-control to a narrow range of behaviors, the first five of which may be used to enhance the applied relevance of both external and self-control laboratory procedures:
1. The target behavior demonstrates deprivation, abstinence, or endurance; 2. Changing the target response is a goal of the person; 3. The target response is a low probability behavior; 4. Accurate performance feedback is given to the person; 5. If a reward is used the reward is tangible or has demonstrated its motivational value.
In addition, four characteristics of self-rewards have been suggested: The reward may be self-managed, self-applied, self-chosen, and freely available. Each of these characteristics adds to the level of self-influence. Removal of any of these latter four categories also increases the level of external control.

The question arises whether any procedure can demonstrate all of the above characteristics, if the procedure is intended to demonstrate maximal self-control. Although no such procedure has been developed in a laboratory analogue study to date, it may not be unusual in applied settings. A prototypical example is the student who has come to therapy to improve his or her study habits. Problematically, the student would rather drink beer than study, has been studying one to two hours per week, and has had no success at changing this behavior on his or her own. The client is instructed about self-reward procedures and chooses to allow himself or herself three cans of beer (kept in his refrigerator) contingent on three hours of study each day.

A comparison reveals that this simple procedure is consonant with the present conditions of maximal self-control since modification of the target behavior is low probability, a goal of the person, and involves endurance. Accurate feedback, by a clock, may be available to signal completion of the performance requirements. The reward is tangible, self-chosen, self-managed (essentially FR-1), and self-applied. Free availability of the reward is ensured, because the student owns
the beer in the refrigerator, and may take some whether or not it is deserved.

**Procedures used in laboratory studies of self-reward.** In part, the theme of this literature review is that the laboratory analogue studies of self-reward have not demonstrated the characteristics described above. Several procedures typically used in the literature will be described below, especially those used by Kanfer and Bandura.

Table 1 presents the methods used in laboratory analogue studies of self-reward. While compiling the table, in several cases, subjective judgment by the author was required to determine whether or not a reward or punishment was freely available or self-managed. If the subject was instructed to use a particular reinforcement schedule (e.g., FR-1), and was instructed when to self-reward or self-punish; the categories were marked "no". For example, Dorsey et al. (1971, p. 327) instructed subjects as follows: "From now on we'll use this light to keep score. I want you to take over the responsibility of..." In this case both categories were marked "no".

A laboratory study of self-reward was done by Karoly and Kanfer (1974), who proposed that if self-regulatory processes invoke three phases (monitoring, evaluation, and reinforcement), then self-reward will occur when a person's performance is perceived as exceeding his or her own standards, and self-punishment occurs when the performance is perceived as substandard. In order to test this hypothesis, they
had participants view nonsense syllables via an unfocused slide projector. In fact, the projector was purposely set so far out of focus that the words and letters were virtually unrecognizable. Three nonsense syllables were presented in rapid succession. The subject was also given three buttons to press in order to judge whether these syllables were all the same; all different, or one different. One hundred trials with false feedback about the accuracy of the participant's responses represented the history period. All subjects received an average of 50% accuracy feedback, but some were given consistent feedback, that is, all of their feedback from the experimenter indicated that they were performing at or near 50% correct, while other subjects were given 50% variable feedback, that is, on some trials they were told that they were performing at 10% accuracy, on others at 90% accuracy. Then, during the test phase, the participants were instructed to position a marker to the right to self-reward and to the left to self-punish. It was found that the consistent history group increased self-reward and self-punishment more than the variable history group as their scores deviated from 50% accurate during the test phase. This study emphasized the importance of situational and historical aspects of self-reinforcement and punishment. Notice, however, that the subjects were asked to perform this task, the appetitive stimulus was non-redeemable and chosen by the experimenter, and while the reward was self-administered it was not self-selected. It is also important to note that the subjects never knew whether
their guesses were actually correct, but rather, had to depend totally on the experiment's bogus feedback. This is at variance with our hypothetical student, who does know whether he has met his self-reward criterion by studying three hours.

According to Bandura (1971), Kanfer's laboratory studies typically have not given the subjects clear feedback regarding their accuracy of performance. One basic paradigm (Kanfer & Marston, 1963a) asked subjects to guess the correct one among four nonsense syllables typed on 6 x 8-inch cards, and then correctly spell it. Their reward was a green light. This reward was first administered by the experimenter, during the training phase, and then the experimenter said (p. 246), "I want to see how well you can do when you take over my job.... After you have spelled the syllable, press the switch if you think you were correct. Do not press the switch unless you are pretty sure, that is, unless you are fairly confident you are correct." Notice that during the self-reward phase, subjects may not have been sure whether they had met the criterion, yet they were required to decide whether or not to self-administer the reward. Again the "reward" was nonredeemable, and selected by the experimenters. It is doubtful that guessing nonsense syllables was actually a goal of the subjects prior to (or perhaps even during) the experimentation. And, although the reward was self-applied, it was not self-chosen.

Another paradigm was used by Kanfer and Marston (1963b), wherein subjects sat at a table facing a 6 x 8-inch milk glass window. Nonsense
syllables were flashed behind the milk glass for .05 second. These nonsense syllables were purposely "altered beyond recognition by deletions of portions of each letter." Eventually, the subject was required to self-reward with chips for guessing syllables. A confederate was introduced who either socially rewarded the subject for self-rewarding, "Don't be afraid to take chips," or socially punished the subject for self-rewarding, "Be careful...don't ask for any you don't deserve." Among other conclusions, it was found that subjects receiving the former treatment self-rewarded more than subjects receiving the later treatment (58% vs. 0.2%). This study embodies many of the same shortcomings as the previous studies. However, it should be noticed that the confederate held the chips, even during the self-reward condition, when the subject had to ask for a chip. Other experiments by Kanfer required subjects to guess nonsense syllables and tachistoscopically presented geometric figures (Kanfer, Bradley & Marston, 1962; Kanfer & Duerfeldt, 1967b).

Several procedures used by Kanfer were: 1) Subjects monitored three rows of blinking lights (red, green, and blue), and had to indicate when a particular row went out (Kanfer & Duerfeldt, 1967a). Self-punishment consisted of self-stimulation with a noxious noise. A similar task was used by Kanfer and Duerfeldt (1968). 2) Subjects estimated the time duration of a tone (Kanfer, Duerfeldt & LePage, 1969). A word association task was used in the same study. 3) Kanfer (1966) asked subjects to guess numbers from 0-100, and also used a
four choice visual discrimination task, requiring subjects to guess the correct geometric figure shown by a slide projector. It can be seen that these and other procedures typically do not meet the proposed ideal characteristics of self-control (see Table 1).

Paradigmatically, Kanfer's research has used an ambiguous task, coupled with non-redeemable or symbolic rewards, such as knowledge of results or simply a score. Kanfer (1971) has supported knowledge of results as a reward, basing his argument on the work of Locke, Cartledge, and Koeppel (1968), who have indicated that knowledge of results influences behavior, goal setting, and standards of evaluation. Kanfer (1970) has supported the use of ambiguous stimuli in laboratory studies of self-reward, claiming that self-reward occurs most frequently in the environment following ambiguous stimuli which require the person to subjectively judge the adequacy of his or her own response. It is important to note that Kanfer's directed learning paradigm was developed prior to the wide-spread use of self-reward in therapeutic settings, where the client is typically trained to discriminate objectively which behaviors do and do not merit self-reward (Thoresen & Mahoney, 1974). Hence it seems that Kanfer's paradigms which used ambiguous feedback were attempts to replicate self-reward under natural conditions, while the present suggestion that correct feedback be given in the laboratory would be analogous to self-reward as it is frequently used in therapy and as it is occasionally found in natural conditions.
While the critical reader may question whether receiving a score or a green light is analogous to applied self-reward procedures, a more salient shortcoming is the fact that these rewards were not freely available. That is, when Kanfer and Marston (1963b) used non-redeemable poker chips, they did not say to the subject: "Here, these are your poker chips, keep them, take them home. If you would like to learn to self-reward you can use these chips, but if not, keep them, and thanks for coming to the experiment." This may seem to be a silly thing to say, but the therapist who helps a student find a suitable reward (e.g., can of beer) does say just that. "Buy some beer. Keep it in your refrigerator. Now, if you want to self-reward, use this beer." Here both the therapist and the client know that the reward (beer) is a freely available stimulus in the client's environment, which may or may not eventually be used for purposes other than reward.

As discussed earlier, a substantial amount of research has been conducted by a second group of researchers, including Bandura. Bandura and Kupers (1964) explored the transmission of self-reward patterns through modeling. The task was a miniature bowling game. The children who participated in the study were given a bowl of M & M candies, and told to help themselves whenever they wished. In fact, they were told that if they didn't want all of the candies at that time, they could take them home when the experiment was over. Bandura and Kupers even provided special containers for this purpose. The
M & M's were truly freely available. In a similar experiment, Bandura and Whalen (1966) also used a freely available reward.

A well-known laboratory study was conducted by Bandura and Perloff (1967). Children were asked to test some game equipment which involved a wheel turning task with token rewards. Subjects in the self-reward condition were allowed to choose their own performance standards. Thus, the children could elect to receive tokens after 8, 16, or 24 turns, and were allowed to change their reinforcement ratio only once. The results indicated that self-reward and external reward were superior to no reward or noncontingent reward, but self and external reward were not different from each other. Interestingly, one third of the children subsequently altered their initial standard to a higher work ratio, requiring more wheel turns per reinforcement.

Bandura (1971) has indicated that this line of research was designed, keeping in mind several of the shortcomings of Kanfer's paradigms which were discussed above. Nevertheless, one difficulty with Bandura's design may be that it does not test the effectiveness of self-reward using a low probability behavior. That is the subjects do not appear to have been engaging in behavior whose previous probability was less than that of alternately available behaviors. It seems as though the children liked the wheel turning and bowling games. This interpretation of the phenomenon is supported by the experimental results of Bandura and Perloff (1967). For example, while the self and external
reward groups were superior to the other groups, it can be seen (Bandura & Perloff, 1967) that the noncontingent reward and no reward control groups averaged approximately 600 wheel turns. In addition, since some subjects increased their work ratio, thereby requiring more turns per token, it could be interpreted that wheel turning was actually more reinforcing than was receiving tokens. This gives no indication of performing a difficult or arduous task. In addition, several more recent applied studies have allowed subjects to alter their work-to-reinforcement ratio, and have found subjects to require less work for more reward, contrary to Bandura and Perloff's (1967) findings (Felixbrod & O’Leary, 1973, 1974; Santogrossi et al., 1975).

Bandura (1971) has defended the target behaviors in his paradigms, claiming that effortful behavior was maintained and that this is perhaps the most useful function of a reward procedure.

Thus far, the discussion has been limited to the research of Bandura, Kanfer, and their colleagues. Several other studies have been conducted, including those which have examined self-observation or self-monitoring.

Mahoney, Moore, Wade and Moura (1973) conducted a study of self-observation which has met the present characteristics of self-control. Students prepared for the Graduate Record Examination by self-observing verbal and quantitative practice problems. However, Table 1 indicates that studies of self-observation achieve the present criteria for self-control more frequently than do studies of self-reward or
self-punishment, perhaps partly because fewer criteria apply to self-observation procedures.

A question of validity. According to Campbell and Stanley (1963), there are two basic modes of validity: Internal and external validity. Internal validity ensures that the changes in a dependent measure are, in fact, due to the manipulations of the independent variables and are not confounded or artifacts of uncontrolled variables. It seems clear that the findings of the basic paradigms of Kanfer, Bandura and others have relatively high internal validity.

External validity refers to the generalizability of the results found in an experimental procedure. It is the generalizability of these studies to therapy which is questioned herein. If a laboratory analogue study is intended to replicate all aspects of a natural phenomenon, except perhaps the manipulated one, then a self-control analogue study would be best when it replicates all of the procedural dimensions which occur when a student self-rewards with beer for studying, when a smoker self-punishes for indulging, or when a schizophrenic self-observes the frequency of hallucinations. This precision has generally not been established in the self-control laboratory.

In light of the above, it seems that a new type of laboratory study of self-control is needed. Specifically, the study of operant self-control developed first in laboratory analogue studies, then subsequently in applied studies. Now it is evident that the laboratory analogue studies are dissimilar to the applied studies in most ways.
The present study will attempt to construct an experiment which is highly analogous to one applied use of behavioral self-control methods.

The next section will review reading speed as a target behavior in the present study.

Reading Speed as a Target Behavior

Reading speed has been chosen as the dependent measure and target behavior in the present study. Reading speed offers the advantages of being a discrete, measurable behavior which occurs with a high frequency in a short time (e.g., 1 minute trials). In addition, it has been found to be easily influenced by motivation levels (Brandt, 1975), and, in this regard, the present study will compare the motivational value of several types of self and external reward methods.

Typical reading rates. Although reading norms generally have little generalizability beyond their own material (Harris & Sipay, 1975), it is important to know what are the estimates of average adult reading ability. Various estimates of the average words per minute reading rate for adults range from 250 (Harris & Sipay, 1975) to 300 (Cory, 1974). It has been proposed that rates which exceed 900 words per minute demonstrate skimming rather than reading (Miller, 1973; Spache, 1962; Tinker, 1958).

Why some people read slowly. The history of reading improvement is rich with physiological and psychological explanations of poor reading ability (see Pugh, 1972). Most recent explanations have
demonstrated that poor readers show more frequent fixations (sudden eye stops), regressions (reading a line of print, then skimming it again before proceeding to the next line), poor word recognition, and lip movements while reading. However, in spite of these characteristics, there is still no adequate explanation for why some people read more rapidly than others (Pugh, 1972), though there is some evidence that reading rates are correlated with intelligence (Reed, 1970) and cognitive skills (Vernon, 1971).

**Methods of improving reading speed.** In a recent review of the area, Harris and Sipay (1975) suggested that there are five major methods of increasing reading speed: Tachistoscopic exercises (to decrease word recognition time), controlled reading (which uses machines to force faster reading), timed reading (a rapid reading practice method), the dynamics method (founded by Evelyn Wood), and simply extensive reading. Although there has been much research comparing the usefulness of these methods, Harris and Sipay (1975) concluded that no method has demonstrated superior efficiency to the other methods. While some of the methods have used tachistoscopes and projectors which pace the reader's rates, Berger (1966) concluded that machines offer no advantage over methods which do not use machines. In fact, Berger (1966) suggested that all of the machines' functions can be performed by non-mechanical methods. This suggestion is particularly relevant since in the present investigation the subjects self-paced their reading rates by using their hands rather than a machine.
The dynamic method of reading improvement. Perhaps the most controversial method of reading improvement has been the dynamic method, developed by Evelyn Wood. In this approach the reader previews a section of pages, then uses the right hand to pace his or her reading rate. The readers are first taught to use three fingers to underline each line on the page in order to set the reading pace. Then the hand-reading pace is increased to a rapid rate. Eventually, the readers are taught to use an F pattern, and a Z pattern which involves moving one's hand across, backward, and down the page. Finally, readers are instructed to move their hand down the middle third of the page rapidly to achieve very high reading rates.

The dynamics method of reading improvement has been highly commercial and has claimed to promote reading speeds as high as 2,500 to 6,000 words per minute (Carver, 1971). The controversial criticisms of this method have claimed that it does not teach speed reading at 2,500 words per minute, but rather, it teaches skimming (Carver, 1971, 1972; Erhlich, 1963; Graf, 1973). One report suggested that the method not only reduces comprehension, but does not allow any comprehension to occur at all (Erhlich, 1963). However, other evidence has suggested that final comprehension rates range from 32% to 52%, using the method, depending on the difficulty of the material (Graf, 1973).

Evidence supporting the use of the dynamic method comes from several researchers. Foremost, it is clear that its critics are
generally not critical of all uses of the method, but simply claim that the method promotes skimming rather than efficient reading (Cory, 1974). McLaughlin (1969) has suggested that whether the method is termed reading or skimming is primarily semantic, and the method allows the reader to ascertain the most important messages in the material. Smith (1975) proposed that dynamic speed reading scores are valid for the material used in the course itself, but have not been tested for generalizability. Miller (1973) claimed that this and several other methods have demonstrated adequate results, and should be included in public school instruction. Finally, Maxwell (1972) posited that skimming and scanning are legitimate reading methods and should be taught to both poor and good readers.

**Reading speed in the present study.** The present study used a component of the dynamic method of reading improvement, simple hand pacing. Subjects used three fingers of one hand to underline each printed line as they read. Then they were instructed to increase their hand pacing rate. In a pilot study this method was found to increase mean reading speeds to rates ranging from 514.6 to 862.2 words per minute, using four groups of subjects.

The hand pacing method was used simply to allow subjects to force their eyes to read more rapidly, and as such, is very similar to several other methods which use machines. No attempt was made to teach subjects patterns (Z or F) or rates in excess of 900 words per minute. However, whether the exercise produced reading or skimming
is immaterial to the present laboratory study: As stated above, reading exercises were selected because they have been shown to yield observable, discrete, and modifiable behaviors.

The Present Study

The first purpose of the present laboratory analogue study was to provide a systematic comparison of the effectiveness of self-reward and external reward methods in speed reading. Self and external influences of control were treated as if they were operating on a continuum with self-influences and external influences being somewhat inversely related. Thus, a procedure which demonstrated maximal self-influence would also demonstrate minimal external influence, and vice versa. Theoretically, as self-influence increases, external influence decreases, and an increase in external control marks a decrease in self-control.

The second purpose of the present study was to establish a methodology which would allow the manipulation of levels of self and external influence in reward procedures. The procedures used in other laboratory studies which have compared self and external reward were examined, and it was found that a reward procedure may be self or externally applied, managed (rate and scheduling), and chosen, and it may or may not be freely available to the person (see the previous section on self vs. external reward strategies).

In light of these two purposes, subjects repeatedly practiced one minute speed reading exercises and received one of six motivational
treatments, with words per minute as the dependent measure (see Table 2). The six groups were:

Group 1: Subjects used a tangible reward which was self-applied, self-chosen, self-managed, and freely available.

Group 2: Subjects used a tangible reward which was self-applied, self-chosen and self-managed, but not freely available.

Group 3: Subjects used a tangible reward which was self-applied and self-chosen, but externally managed, and not freely available.

Group 4: Subjects used a tangible reward which was self-applied but externally chosen and managed and not freely available.

Group 5: Subjects used a tangible reward which was externally applied, chosen, managed, and not freely available.

Group 6: These subjects, like all of the above, received accurate performance feedback following each trial. They did not use a reward.

In addition, for subjects in all groups, the target behavior (practicing speed reading exercises) was a goal of the subject, demonstrated deprivation, abstinence or endurance, and was a low probability behavior.

The theoretical and practical uses of this study are twofold. First, comparisons of self and external reward efficacy have traditionally used various portions of the above characteristics and have
found inconsistent results. The present methodology was designed to more effectively compare the relative efficacy of self and external reward procedures, and to investigate the efficacy of various levels of self and external influence. Second, to date, no laboratory analogue study found by the present author has employed a self-reward procedure which was self-applied, self-managed, and self-chosen, and freely available.
METHOD

Pilot Studies

Two pilot studies were conducted. In the first (N=5), subjects were taught a hand pacing exercise to increase reading speed and were told that the experimenter was primarily interested in the first three one-minute trials, but that they could continue practicing as long as they wished. These subjects were not given feedback or rewards after trials. Mean number of practice trials was 7.4. Confidence intervals were calculated and it was found that most subjects would voluntarily practice less than 9.5 trials (p < .01). Hence, in the present study, endurance was demonstrated only when subjects practiced more than 9.5 trials. Practicing beyond 9.5 trials was considered a low probability behavior.

The second pilot study used a self-reward group (N=10) in which a reward was self-applied, self-managed, self-chosen, and freely available, and was found to lead to significant changes in speed reading exercise rates (mean rate changed from 405.5 to 667.6 wpm in 18 trials).

Subjects

Initially, 175 subjects volunteered to participate in the experiment. However, due to the various exclusion criteria, data from 97 subjects were not included in this report. (Each exclusion criterion will be presented in the appropriate sections of the Method section.) Hence, the present usable data are from 78 subjects (26 male, 52
female) who met individually with the experimenter and were randomly assigned to one of six groups. Subjects were elementary level undergraduates who received course credit for participating. Preliminary screening eliminated subjects who had previously participated in a speed reading program or whose native language was not English. This resulted in elimination of data from 6 of the 97 excluded subjects.

Materials

Goal assessment. Before participating in the experiment, subjects were administered a nine item questionnaire to assess whether reading improvement was a desired goal (Appendix A). Subjects responded to each item on a five point scale from (-2) disagree strongly, to (+2) agree strongly. Subjects who answered in a negatively keyed direction to any item or (0) to more than one item were excluded from the data analysis. This resulted in the disqualification of 41 subjects.

Speed reading materials. Twenty selections from Brown (1976), a reading improvement manual, were used as speed reading materials. These selections were used because they were rated as similar in reading difficulty by the Flesch (1960) formula, multiple choice comprehension items with known item analysis validity coefficients were available, and each selection was presented in the same format.

Pretests. Subjects were given two reading rate pretests. The first was a standardized reading test (Nelson & Benny, 1960) and
the second was a one minute segment from Brown (1976). Reading rates for both pretests were averaged to give an accurate measure of reading rates. Based on this (averaged) estimate of the person's reading rate, and reading norms for college students (Harris & Sipay, 1975), subjects were classified as fast (more than 325 wpm), medium (225-325), and slow (less than 225) readers and were randomly assigned to the six treatment groups.

**Reward materials.** In two groups the rewards were self-chosen by the subjects. Rewards present were: A stack of lottery tickets to win five dollars, twenty index cards with one positive self-statement typed on each (e.g., I'm doing a good job), and a ledger sheet to self-administer points for improving reading speed (see Appendix A).

**Procedure**

When they entered the experiment room, subjects signed written informed consent forms to participate in an experiment and were given the goal assessment questionnaire. Those who did not indicate personal interest in increasing their reading speed were not informed their results would not be included in the study, and participated for the entire session. Subjects were given the reading rate pretests and categorized (fast, medium, slow), then randomly assigned to each group, based on a table of random numbers.

**The hand pacing exercise.** All subjects were instructed by tape recorder on the hand pacing exercise, as follows:
"During the past 30 years several well-known methods of reading improvement have been developed. Some have used machines, eye cameras, and rapid projectors to improve reading speed. All successful methods have one common element: They force the person's eyes to move rapidly during practice. In the past few years it has been found that we can avoid the use of expensive and sometimes clumsy machinery simply by using the person's hand to pace eye movement as reading occurs. This method has been found to at least equal the reading improvement rates found with machines, and has the added advantage of being able to be practiced at home or in the library where machines may not be available.

To use the hand pacing exercise, cup the thumb and forefinger of your right hand, and extend the remaining three fingers. Place your hand on the page so that your middle finger is just under the first word on the page, as the experimenter is now demonstrating. Next, slowly move your hand across the page so you underline the line you are reading. Try reading several lines in this manner. (Thirty-second pause while experimenter signals the subject to begin.)

The hand pacing exercise will increase your reading speed if you force your eyes to move rapidly by moving your hand
across the lines more rapidly each time you practice. In this experiment, you will be practicing this exercise during several one-minute trials. Practice the first few trials at your typical, comfortable pace, then increase your speed as you begin to feel comfortable with the exercise. There will be several brief comprehension checks during this experiment."

After receiving hand pacing instructions, subjects were given a one-minute practice trial to learn the technique. Their speed was not recorded on this trial.

After one practice trial, subjects were told that the remainder of the experiment would consist of one minute, hand paced, reading exercises from the experimental materials. Both the subject and the experimenter had a copy of the materials. However, the experimenter's copy had precounted words marked on the specific pages. Thus, the experimenter gave the subject immediate, accurate feedback regarding reading speed following each trial.

Treatment Groups

The present paper has proposed several characteristics of self-reward as a self-controlling response. The target behavior, reading speed, was chosen to demonstrate endurance, a low probability behavior, and to be a goal of the subject. Also, accurate feedback regarding reading speed was given to each subject following each trial. Hence, four of the nine characteristics of laboratory studies (above) have been met in all groups.
The remaining five characteristics concern the reward. It may or may not be present, self-applied, self-selected, self-managed (e.g., rate, scheduling), or freely available. The first five groups below tested the effect of one of the reward characteristics. The sixth group was a control group which received accurate feedback only.

In two groups, subjects decided how to manage the reward procedure. Since all subjects were matched on the type of reward schedule, only those who selected an FR-1 schedule were included herein, hence, 7 subjects were excluded. All subjects received a maximum of fifteen rewards.

Group 1: Reward present, self-applied, self-chosen, self-managed, freely available. In order to meet these characteristics, the following taped directions were given:

"During the rest of this session, you are free to practice the hand paced reading exercise you have learned. In addition to self-pacing, researchers have found that specific behaviors can be increased if they are followed by a reward. You see around you several objects: A ledger sheet to give points for increasing reading speed, a stack of index cards with one self-compliment on each, such as "I'm doing a good job" (this was openly displayed), and a stack of lottery tickets to win five dollars. (Next to the lottery tickets, a new five dollar bill was mounted on a wooden plaque.) Only one participant in the study will actually
win the five dollars. If you wish to self-reward for increasing your reading speed, you may select one of these objects. However, you may want to select a reward which is not present in the room, such as treating yourself to a movie for increasing your speed by 50%. What you choose as a reward is up to you. (Pause until selection is made.) (Only those subjects who selected lottery tickets were included in the present data.)

Since you have chosen the lottery tickets, here, take these. (E gives S a stack of 15 lottery tickets.) These tickets are yours to keep. Now, if you wish to use them to self-reward you can, but first, it is important that you decide how to manage the reward procedure. Some people give themselves one ticket each time they equal or surpass their prior reading speed (FR-1). Some give themselves a ticket every second or third time they equal or surpass their prior reading speed (FR-2, FR-3). And, some people give themselves more than one ticket at a time. But in any event, these tickets are already yours. It's best if you decide how to reward yourself before you begin. (Pause until S decides how to manage the reward procedure.)

Accurate feedback will be given to you after each trial. Now, in order for me to see that you understand the reward procedure, can you explain it to me?"
The subject was seated in front of the tickets, and self-rewarded for surpassing or equaling his or her performance on the trial immediately preceding the present trial. The experimenter never handled or influenced the use of the tickets during the remainder of the experiment.

**Group 2: Reward present, self-applied, self-chosen, self-managed, not freely available.** The following taped instructions were given:

"During the rest of this session, you are free to practice the hand paced reading exercise you have learned. In addition to self-pacing, researchers have found that specific behaviors can be increased if they are followed by a reward. You see around you several objects: A ledger sheet to give points for increasing reading speed, a stack of index cards with one self-compliment on each, such as "I'm doing a good job" (this was openly displayed), and a stack of lottery tickets to win five dollars. (Next to the lottery tickets, a new five dollar bill was mounted on a wooden plaque.) Only one participant in the study will actually win the five dollars. If you wish to self-reward for increasing your reading speed, you may select one of these objects. However, you may want to select a reward which is not present in the room, such as treating yourself to a movie for increasing your speed by 50%. What
you choose as a reward is up to you. (Pause until selection is made.) (Only those subjects who selected lottery tickets were included in the present data.)

Since you have chosen the lottery tickets, these will be used. You may take tickets from my desk top to reward yourself. All of the tickets you take during the experiment will be yours to keep. I will only stop you from practicing if you take an undeserved reward, run out of tickets, or when the experiment is over. Before you begin to self-reward, it is important that you decide how to manage the reward procedure. Some people give themselves one ticket each time they equal or surpass their prior reading speed (FR-1). Some give themselves a ticket every second or third time they equal or surpass their prior reading speed (FR-2, FR-3). And, some people give themselves more than one ticket at a time. But in any event, once you earn each ticket, it will be yours to keep. It's best if you decide how to reward yourself before you begin. (Pause until $S$ decides how to manage the reward procedure.)

Accurate feedback will be given to you after each trial. Now, in order for me to see that you understand the reward procedure, can you explain it to me?"

The subject was seated in front of the tickets, and self-rewarded for surpassing or equaling his or her performance on the trial
immediately preceding the present trial. The experimenter observed
the subject's self-reward behavior, and corrected it when undeserved
rewards were taken.

Group 3: Reward present, self-applied, self-chosen, externally
managed, not freely available. The following taped instructions were
given:

"During the rest of this session, you are free to prac­tice the hand paced reading exercise you have learned. In
addition to self-pacing, researchers have found that specific
behaviors can be increased if they are followed by a reward.
You see around you several objects: A ledger sheet to
give points for increasing reading speed, a stack of in­
dex cards with one self-compliment on each, such as "I'm
doing a good job" (this card was openly displayed), and a
stack of lottery tickets to win five dollars. (Next to the
lottery tickets, a new five dollar bill was mounted on a
wooden plaque.) Only one participant in the study will ac­
tually win the five dollars. If you wish to self-reward for
increasing your reading speed, you may select one of these
objects. However, you may want to select a reward which is
not present in the room, such as treating yourself to a
movie for increasing your speed by 50%. What you choose as
a reward is up to you. (Pause until selection is made.)
(Only those subjects who selected lottery tickets were
included in the present data.)

Since you have chosen the lottery tickets, these will be used. You may take tickets from my desk top to reward yourself. Manage the reward procedure by giving yourself only one ticket each time your reading speed on a trial equals or surpasses your speed on the trial before it. All of the tickets you take during the experiment will be yours to keep. I will only stop you from practicing if you take an undeserved reward, run out of tickets, stop practicing, or when the experiment is over.

Accurate feedback will be given to you after each trial. Now, in order for me to see that you understand the reward procedure, can you explain it to me?"

The subject was seated in front of the tickets, and self-rewarded for surpassing or equaling his or her performance on the trial immediately preceding the present trial. The experimenter observed the subject's self-reward behavior, and corrected it when undeserved rewards were taken and when the subject deviated from an FR-1 schedule.

Group 4: Reward present, self-applied, externally chosen, externally managed, not freely available. The following taped instructions were given:

"During the rest of this session, you are free to practice the hand paced reading exercise you have learned. In addition
to self-pacing, researchers have found that specific behaviors can be increased if they are followed by a reward. You see here I have a stack of lottery tickets. These tickets are to win five dollars. Only one participant in the study will actually win the five dollars. You may take tickets from my desk top to reward yourself. Manage the reward procedure by giving yourself only one ticket each time your reading speed on a trial equals or surpasses your speed on the trial before it. All of the tickets you take will be yours to keep. I will only stop you from practicing if you take an undeserved reward, run out of tickets, stop practicing, or when the experiment is over.

Accurate feedback will be given to you after each trial. Now, in order for me to see that you understand the reward procedure, can you explain it to me?"

The subject was seated in front of the tickets, and self-rewarded for surpassing or equaling his or her performance on the trial immediately preceding the present trial. The experimenter observed the subject's self-reward behavior, and corrected it when undeserved rewards were taken and when the subject deviated from an FR-1 schedule.

**Group 5: Reward present, externally applied, externally chosen, externally managed, not freely available.** The following taped instructions were given:
"During the rest of this session you are free to practice the hand paced reading exercise you have learned. In addition to self-pacing, researchers have found that specific behaviors can be increased if they are followed by reward. You see here I have a stack of lottery tickets. These tickets are to win five dollars. Only one participant in the study will actually win the five dollars. As you practice the self-paced reading exercise, I will give you a lottery ticket each time your reading speed equals or surpasses your speed on the prior trial. I will do this on a one to one ratio, and will only stop if I run out of tickets, if you stop exercising, or when the experiment is over. Accurate feedback will be given to you after each trial.

Now, in order for me to see that you understand the reward procedure, can you explain it to me?"

Group 6: No reward present, subjects received accurate feedback. Since subjects in the above groups received accurate feedback, in addition to a reward procedure, this group received no explicit rewards, but did receive knowledge of results, along with the following taped instructions:

"During the rest of the session, you are free to practice the hand paced reading exercise you have learned. In addition to self-pacing, researchers have found that small amounts of massed practice can lead to increased reading
speed. Therefore, you are asked to practice at least twenty one-minute trials. After the twentieth trial you may stop or continue practicing. If you decide to continue practicing, please feel free to do so for as long as you like. Accurate feedback will be given to you after each trial."

Comprehension

Since it is possible to move one's hand across the page at an extremely rapid rate, without bothering to read, or even skim the words, three unannounced comprehension tests were included following trials five, ten, and fifteen. These questions were taken from Brown (1976) and were not intended to provide an accurate measure of reading comprehension in the present experiment, but were intended to prevent subjects from faking the exercises. Each test contained three questions, and tested the material contained in a single trial. Fifty-three subjects were eliminated from the data analysis, because they answered all three questions on any one test incorrectly.
RESULTS

One hundred seventy five (175) subjects volunteered to participate in the present study, and 97 (55.4%) were excluded from the data analysis for various reasons. Two experimenters conducted the experimentation, conducting 143 and 32 subjects each. Table 3 presents each of the disqualification criteria and the frequency of subjects who violated each criterion, by experimenter. It is important to note that the categories are not mutually exclusive. Hence, any one subject may have violated several criteria, and the categories sum to more than 100%.

Preliminary Assessment

Before receiving either speed reading training or instructions for an experimental condition, each subject's reading speed was assessed by three one-minute pretests. Scores on the three pretests were averaged by subject, and the groups were compared for pretreatment differences in reading ability. No difference between groups was found by a one-way analysis of variance, $F(5,72) = 0.74$.

Evaluating Treatment Effects

Following the three reading rate pretests, subjects were classified as fast, medium, and slow, then randomly assigned to one of six groups in which subjects received speed reading training and experimental instructions. Each subject's reading speed was then observed during seventeen one-minute reading trials (Figure 1). No
difference between groups was observed based on a one-way analysis of variance on raw scores on the first of the seventeen trials, \( F(5, 72) = 0.63 \). The remaining data analyses were performed on change scores by subtracting the subject's reading rate during each trial from his or her reading rate on trial one. Although subjects were allowed to practice up to twenty trials, the data were observed on 17 trials, because most terminated upon receiving their last (fifteenth) reward. Two subjects earned all fifteen rewards in seventeen trials, and comparisons of group means on trials beyond trial seventeen would exclude observations from these two subjects. Finally, four of the 78 subjects included achieved all fifteen rewards in less than 20 trials.

The analysis of variance comparing groups. To evaluate an overall difference between groups, each participant's change scores were obtained for trial fifteen (value = trial 15 minus trial 1), sixteen (trial 16 minus trial 1), and seventeen (trial 17 minus trial 1). Then the change scores in trials 15, 16 and 17 were averaged to increase the stability of the comparisons, and a one-way analysis of variance was performed. A significant difference between groups was found, \( F(5, 72) = 2.59, p < .05 \), and group means and variances are presented in Table 4. A posteriori, between group comparisons by Tukey's HSD procedure found that participants in Group 2 read significantly faster than those in all other groups (\( p < .01 \)). Similarly, while the mean improvement rate in Group 1 was less than that of Group 2, it was significantly greater than those observed in Groups
3, 4, and 6 (p < .01) and Group 5 (p < .05). The mean improvement rate for Group 5 was greater than that of Group 6 (p < .05). No other pair-wise comparisons were significant (Table 5).

Examination of Table 3 reveals some difficulty with the above data analysis. The variances observed for each of the six groups were not homogeneous, \( F_{\text{max}} (6,12) = 15.91, p < .01 \). Thus, two additional forms of data analysis were conducted. First, a Behrens-Fisher revision of Tukey's post-hoc analysis, with Welch degrees of freedom, was performed (see Keselman and Rogan, 1977). This test adjusted the pair-wise comparisons for nonhomogeneous variances and found the mean of Group 2 to be superior to the means of Group 4 (p < .05), Group 3 (p < .01) and Group 6 (p < .01). Group 1 was superior to Groups 3 and 6 (p < .01). No other comparisons were significant (Table 7). Then, several chi square analyses were conducted.

The chi square comparison of groups. Each subject's mean change score on trials 15, 16 and 17 was rank ordered, and the median rank for all 78 subjects was calculated (median = 39.5). Then, chi square tests were performed to compare pairs of groups on the frequency of subjects whose reading rates fell above and below the median. Group 1 was found to have significantly more scores above the over-all median than Group 6, \( X^2(1) = 5.41, p < .02 \), and Group 2 was also found to have higher rankings than Group 6, \( X^2(1) = 6.63, p < .01 \). However, the comparison between Group 5 and Group 6 was not significant, \( X^2(1) = 2.60 \). Finally, a chi-square test comparing Groups 3, 4, and 6 was not significant, \( X^2(2) = 1.95 \). This data analysis partly
replicates the results of the primary analysis of variance by yielding significant comparisons of Groups 2 vs. 6 and 1 vs. 6, and by finding no significant comparison between Groups 3, 4, and 6.

It is important to note that although two transformations (square root, log) were attempted on the averaged change scores on trials 15, 16, and 17, none was found which would meet the assumptions of analysis of variance without also removing the significance of the F test. In addition, an analysis of covariance was performed on the mean difference scores on trials 15, 16, and 17 with the means of the three pretests as the covariate, without finding a significant difference between groups, F (5,71) = 2.23, p = .06. These findings draw attention to the potential instability of the results of the analysis of variance.

Comprehension

On trials 5, 10, and 15, subjects received unannounced comprehension tests of five items. The tests were constructed so that most subjects would have read the material covered in the first three items, and subjects were disqualified if they failed the first three items on any of these tests. The six groups were compared by summing each participant's scores on the first three items across the three comprehension tests (maximum score is nine). The means for groups one through six, respectively, were: 5.07, 4.84, 5.38, 5.38, 5.15 and 5.00. A one-way analysis of variance found no significant difference between the groups, F (5,72) = 0.40. Similarly, no difference
between groups was found when the sums of all five items on the three tests were compared, \( F(5, 72) = 1.00 \).

Finally, a third approach to the comprehension tests was taken. Each subject was evaluated on comprehension, based on the number of words he or she had read during that trial. All three comprehension tests were evaluated in this manner. Then, the total number of correct items on all three tests was divided by the total number of items for which the subject was responsible, and the dividend was multiplied by 100 to yield a percentage score. No difference between groups was found using this method, \( F(5, 72) = 0.11 \). The results of these three approaches to the comprehension tests suggest the groups did not differ with regard to comprehension.

The Reading Goal Questionnaire

All participants in the present study completed the Reading Goal Questionnaire, which consisted of nine items to be scored from (-2) to (+2). To compare the six groups on this questionnaire (Appendix), the two negatively keyed items (2 and 7) were reverse keyed and the item responses were summed. The maximum possible range of scores on the nine item questionnaire was -18 to +18 before subjects were screened, and 8 to 18 after screenings. Means for groups one through six, respectively, were: 14.92, 15.38, 14.61, 15.00, 13.92, and 14.69. An analysis of variance did not find significant differences between these means, \( F(5, 72) = 0.59 \), suggesting that the groups did not differ regarding the Reading Goal Questionnaire.
The Reading Goal Questionnaire, in the present study, was interpreted as a self-report instrument to indicate a subject's desire to learn and use reading improvement methods. Of interest, then, is whether subjects who were excluded from the data analysis based on their responses to the Reading Goal Questionnaire actually performed at different reading rates than the included subjects during the experiment. To assess this possibility, thirteen subjects who had been given the same instructions as subjects in Group 6 (control group), but whose results had been excluded from the present data because of their responses on the Reading Goal Questionnaire, were compared with subjects in Group 6. A t test found no between-group difference in reading rates for these two groups t (24) = 0.15.

To facilitate the screening of subjects based on the Reading Goal Questionnaire, sign-up sheets were made available to the University students, and large groups of students were given the Reading Goal Questionnaire - Form II (Appendix). Using this method, 243 students were prescreened. Of these, 129 later were told that they were eligible to participate in another study if they so chose. Of the 129 eligible subjects, 93 eventually participated in the present study.

**Experimenter Influence**

Experimenter 1 administered procedures to 143 subjects, 74 of which violated one or more of the exclusion criteria, and 69 of which were included in the data analyses, yielding an inclusion ratio of 69/143, or 48.25%. Experimenter 2 administered procedures to 32
subjects, 23 of which were excluded and 9 of which were included in the analyses, yielding an inclusion ratio of 9/32, or 28.12%. Stated differently, for Experimenter 1, the exclusion to inclusion ratio was 2.07 to 1, whereas for Experimenter 2 this rate was 3.55 to 1. A chi square test compared the number of subjects included and excluded by Experimenter 1 and Experimenter 2, and was found to be significant, $X^2 (1) = 4.28, p < .05$. This suggests that the inclusion to exclusion ratios differed significantly for each experimenter.

Since Experimenter 1 was male and Experimenter 2 was female, the question of influence of sex of experimenters on subjects' exclusion rates was raised. However, no conclusive findings were possible regarding this question, since the participation of only two experimenters necessarily confounds experimenter sex with all other experimenter characteristics. Nevertheless, 74 subjects were excluded by Experimenter 1, 24 of which were male and 50 of which were female. Of the 23 subjects excluded by Experimenter 2, 7 were male and 16 were female. Hence, for both experimenters the ratio of female to male subjects excluded was approximately two to one.

Further understanding of the differential inclusion rates can be given by examining the group prescreening procedure. As mentioned above, 93 subjects were prescreened by the Reading Goal Questionnaire - Form II, and then invited to volunteer for the present experiment. Of these 93, 82 subjects were administered procedures by Experimenter 1, and 11 were administered procedures by Experimenter 2. Thus 82/143, or 57.34%, of the subjects administered procedures by Experimenter 1
were prescreened, and 11/32, or 34.37%, of the subjects administered procedures by Experimenter 2 were prescreened. This finding is supported by information in Table 5, which indicates that during the experiment, 28 of the 74 subjects (or 37.83%) excluded by Experimenter 1 had violated the inclusion criteria of the Reading Goal Questionnaire, whereas for Experimenter 2, who had prescreened fewer subjects, a larger number, 13 of 23 excluded subjects (or 56.16%) failed to pass the Reading Goal Questionnaire. This suggests that the differential exclusion rates, per experimenter, may have been partly due to differential prescreening rates by the experimenters.

In addition to inclusion rates, the influence of each experimenter is evaluated in Table 6. This table presents two noteworthy points. First, there were unequal subjects from each experimenter per group, and Group 2 had no subject administered procedures by Experimenter 2. The present author suggests this is because subjects were assigned to groups according to a table of random numbers. Second, some of the scores obtained by subjects who were administered by Experimenter 2 were the extreme scores for the group (Group 1, high; Groups 3 and 4, low).

Assessment of experimenter effect was performed by a chi square comparing the frequency of subjects above and below the sample median for each experimenter. No significant difference between experimenters was found, $\chi^2 (1) = 2.00$. This suggests that the effects of experimenter influence on group distributions was minimal. Finally, to evaluate experimenter influence again, a one-way analysis of variance
was conducted, excluding all nine subjects who were administered procedures by Experimenter 2. As in the analysis of variance which included subjects from both experimenters, a significant difference between groups was found, $F(5,63) = 2.41, p < .05$. A posteriori, Tukey's, pair-wise comparisons of means found Group 2 superior to all other groups ($p < .01$). The mean for Group 1 was superior to the means for Groups 6, 4, and 3 ($p < .05$). No other significant comparisons were found. This analysis also suggests that there were minimal effects of experimenters.
DISCUSSION

Preliminary Considerations

Prior to discussing the findings of the present experiment, several comments about the data analysis are required. First, in the preliminary data analysis of change in reading speed over seventeen trials, the groups were found to differ significantly when trials 15, 16, and 17 were averaged by subject and compared by a one-way analysis of variance. However, the use of analysis of variance warrants discussion, because the groups were found to have nonhomogeneous variances. In spite of the claim that the F-test is robust with regard to the assumption of homogeneous variances (Kirk, 1968), and the claim that disparate variances do not usually bias the results of analysis of variance procedures (Norton, 1956), the present discussion is based on a conservative interpretation of these analyses of variance.

Second, it is important that the reader be informed that two data transformations were attempted, one of which (log) equated the group variances, and one of which (square root) did not equate the variances. However, no data transformation subsequently yielded a significant analysis of variance. Finally, each group was dichotomized into scores which fell above and below the sample grand median, and significant comparisons were found by chi-square statistics. Nevertheless, the reader may wish to bear in mind that although the chi-square
approach to the analysis was successful, it was found only after sev­
eral other data analyses were unsuccessfully attempted.

Outcome and Interpretation

Findings of the primary analysis. In light of the above consid­
erations, the findings of the study are discussed below. In the an­
alysis of variance on change scores, Group 2 (self-reward which was
self-chosen, self-applied, and self-managed, but not freely available)
was superior to all other groups. This data analysis also indicated
that while Group 2 was superior to Group 1 (self-reward which was
self-chosen, self-applied, self-managed, and freely available), Group
1 was superior to all remaining groups. Finally, Group 5 (external
reward) was found to be superior to Group 6 (feedback only, no reward).
Interestingly, only two self-reward procedures (Groups 1 and 2) were
more successful than the control group.

These findings suggest that self-reward is only more effective
than simple performance feedback in improving performance when the
person has maximal control over the reward procedure (e.g., the reward
is self-applied, and self-chosen, and self-managed, and/or freely
available). The results also suggest that free availability of re­
wards diminishes the efficacy of the procedure. And, since Groups 3
and 4 (self-reward which is self-applied, but not freely available,
not self-chosen, and/or not self-managed) were not greater than the
control group, the results imply that giving the person only partial
control over the reward procedure (e.g., self-applied and self-chosen,
but externally managed, and not freely available) is detrimental to
the usefulness of the procedure. The findings of the analysis of variance also supported the general efficacy of external reward, and placed it between maximal self-control conditions (Group 1 and 2) and conditions with a greater mixture of self and experimenter influence (Groups 3 and 4).

The Behrens-Fisher analyses. The Behrens-Fisher revision of Tukey's post-test with Welch's degrees of freedom found the mean for Group 2 (self-reward which was self-chosen, self-applied, self-managed, but not freely available) to be superior to the mean of Group 4 (self-reward which was self-applied, externally managed, externally chosen, and not freely available), Group 3 (self-reward which was self-applied, self-chosen, externally managed, and not freely available), and Group 6 (no reward was present). Performance for subjects in Group 1 was found to be superior to that of subjects in Groups 3 and 6. However, no other pair-wise comparisons were significant. This includes the finding that Group 5 (external reward) was not found to be superior to Group 6 (no reward).

The chi-square analysis. Since the analysis of variance was performed on nonhomogeneous variances, several chi-square analyses were performed to evaluate the replicability of the findings by comparing the frequency of observations in each group above and below the sample grand median. First, the nonsignificant differences of Groups 3, 4 and 6 also occurred in the chi-square analysis. Second, Group 2 was found to be superior to the control group (Group 6), but not significantly greater than any other group. Third, Group 1, like Group 2,
was found to be superior to the control group (Group 6) but not significantly different from other groups. And fourth, Group 5 (external reward) was not found to be superior to the control group.

The chi-square comparison of group distributions supports the absence of significant differences between Groups 3, 4, and 6. The chi-square approach also found self-reward procedures in which the person was given maximal control over the reward procedure (Groups 1 and 2) to have shown significant treatment effects when compared with the control group. However, the significant difference between Group 2 and Group 1 and all other treatment groups was not replicated. In addition, like the Behrens-Fisher tests, Group 5 (external reward) was not found by the chi-square comparisons to be significantly different from the control group (Group 6).

In summary, like the analysis of variance, the chi-square analyses suggest that self-reward procedures were most efficient when the person exercised maximal influence over the reward procedures. However, like the Behrens-Fisher analyses, no support was found for the usefulness of external reward procedures.

Interpreting the data analyses. The above data analyses found that self-reward procedures which maximize the role of the person (i.e., self-influence), by allowing the person to self-select, self-manage, and self-apply rewards which may or may not be freely available, are of significantly greater efficacy than simple feedback (control) procedures.

The present study did not find support for the efficacy of reward procedures which mix self and external influence (i.e., the
procedures used in Groups 3 and 4 where the reward was externally controlled but was only self-applied or only self-applied and self-chosen).

The data analyses suggested, but did not find conclusive support for, the viability of external reward, as it was used in this study.

The inability to find a significant treatment effect for the external reward procedure used in this study raises a question regarding the motivational value of the reward procedures used in this group (Group 5) and all other groups which received rewards. Recall that subjects whose data are compared here attempted to increase their reading speed in order to gain tickets for a five-dollar lottery. Tirrell, Mount and Scott (1977) found a strikingly significant treatment effect for a group of subjects who received an external reward procedure which was virtually identical to the present one, except the lottery was for a ten-dollar prize. Although group comparisons across studies is dangerous because of the possible presence of differential effects of sampling and extraneous variables, this finding suggests that the present subjects who were externally rewarded (and perhaps all rewarded subjects, herein) may not have performed at higher levels because of the relatively low saliency or reinforcement value of the reward. That is, the five-dollar reward used in this study may have been too small to elicit large differences between groups.

**Experimenter influence.** When compared by a chi-square, no difference was found between the proportions of scores above and below
the median, per experimenter. A one-way ANOVA on the 69 subjects conducted by Experimenter 1 found very similar results to the ANOVA on all 78 subjects. These analyses suggest there was no significant experimenter influence on the distribution of scores.

In a third analysis, a significant difference was found when examining the inclusion to exclusion ratios of the experimenters. It was found that Experimenter 1 yielded an inclusion ratio of 48.2%, while Experimenter 2 yielded an inclusion ratio of only 28.1%. It was suggested that this finding might be partly due to differential large group prescreening ratios. However, the different inclusion ratios may suggest that different populations were sampled by each experimenter. This speculation is supported by the possible time of day influence on the sampling procedures used. Experimenter 1 allowed subjects to sign up for time slots from 8:00 a.m. until 10:00 p.m., while Experimenter 2 allowed subjects to sign up during mid-day hours only, 9:00 a.m. to 5:00 p.m. It is suggested that subjects who were willing to participate in the experiment during early morning or night time slots may have been more motivated to participate, read, or comprehend. Finally, the differential inclusion rates may be due to other reasons which were not evaluated herein, such as differential social desirability, experimenter characteristics, or experimenter procedures (although efforts were made to prevent or detect this by experimenter training, observation, and taped instructions).
Methodological Implications

In part, the purpose of the present study was to demonstrate a self-reward procedure in which the target behavior included deprivation, abstinence, or endurance, was a goal of the subject, and was a low probability behavior; accurate performance feedback was given to the subject; and a tangible reward was self-chosen, self-applied, self-managed, and freely available. A substantial portion of the introduction to this study presented a review of previous laboratory studies wherein the reward procedure was labeled self-reward by their authors, but which did not meet the criteria for self-reward as self-control set forth by this report. Hence, of primary importance in the present study is its potential methodological contribution to the literature.

Large programs of laboratory studies of self-reward have been set forth by Kanfer (1970) and Bandura (e.g., Masters and Mokros, 1974). As indicated in the introduction to this study, the methodological implications of this study relate most directly to their work, because their methods did not use self-rewards which met all of the above criteria.

It is noteworthy that the methods of Kanfer and Bandura did not meet the present definition of self-reinforcement, because their methods were designed to answer different questions than the present research. Kanfer (1970) suggested that his research was designed to examine self-reward as a natural process, or naturally occurring event, and we often self-reward during daily events in the presence of ambiguous environmental feedback using intangible rewards. Hence, Kanfer
has used ambiguous experimenter feedback and nonredeemable poker chips as rewards. It was also suggested by the present review that new laboratory methods of studying self-reward procedures are needed if self-reward as a therapeutic tool is to be studied in a controlled, systematic way.

Contrary to Kanfer's paradigm, the present study was a laboratory study which attempted to be analogous to the therapeutic use of applied self-reward procedures, where a behavior therapist helps a person change a behavior by seeking accurate performance feedback and, most often, using tangible rewards which are self-chosen, self-managed, and self-applied.

In an earlier report, Tirrell, Mount and Scott (1977) found that a reward procedure which was self-chosen, self-managed, self-applied, and freely available significantly improved reading rates. However, the authors did not compare that (maximal) self-reward procedure with other self-reward procedures in which the reward was not self-chosen, or self-managed, or freely available. In their report, Tirrell et al. (1977) suggested that although each criterion for self-reward as self-control appears to be theoretically relevant, further research should evaluate the practical contribution of each criterion. That is, do reward procedures which are self-chosen, self-managed and self-applied lead to greater performance than those which are only self-applied, or only self-applied and self-chosen?

The present research relates to this issue, and it was found that a self-reward procedure which was simply self-applied did not improve
performance more than a simple performance feedback procedure. Similarly, a self-reward procedure in which the reward was self-applied and self-chosen did not improve scores more than a performance feedback procedure did. It was only when three self-oriented criteria were under the control of the person (the reward was self-applied, self-chosen, and self-managed) that the procedure improved scores more than simple feedback did. Giving the person control over four self-oriented criteria (the addition of free availability) maintained the high level of performance observed with three self-oriented conditions.

These findings suggest that not only are the proposed criteria for self-reward as self-control theoretically important, they also influence the person's performance.

Free Availability of Rewards

An interesting question is whether self-reward with a reinforcer which is owned by, and freely available to, the person will improve behavior. Does self-reward with coffee for studying increase studying, when the coffee is owned by and freely available to the person?

The present study provides an analogous evaluation of this issue. As in the Tirrell et al. (1977) study, it was found that subjects in this laboratory experiment significantly increased their reading speed when the self-reward was already possessed by, and freely available to, the subject. Although the primary ANOVA comparing groups suggested that free-availability of rewards may detract somewhat from
the motivational value of the reward, firm conclusions regarding this issue must be determined by future research.

**Future Directions**

The present study suggests several directions for future research. First, an attempt at replication of the present study is needed, especially in light of the nonhomogeneous variances observed and the relatively weak support found for the efficacy of the external reward condition.

Second, further investigation is indicated to evaluate the influence of free-availability of rewards. Does free-availability of rewards necessarily require that a reward be possessed by the person? Would simple, unrestricted access to rewards be ample to constitute free-availability? Do the criteria of possession of rewards and unrestricted access to rewards differentially influence performance?

Third, methodological refinements are suggested. Are there more efficient ways to make a reward self-chosen, self-managed, and freely available in the laboratory? Would self-control be more successfully demonstrated with subjects who do not receive course credit for participation?

Finally, while attempting to place the present study in its proper perspective, one must recall that no attempt was made to measure self-control during the experiment. The attempt was to vary it by six different treatments. Thus, while the preceding discussion has suggested that large portions of external control remained present during the study (e.g., subjects received course credit), it is also
likely that subjects used large portions of unmeasured self-control. All subjects, even those in the no-reward condition, probably used self-praise and self-criticism as their scores varied. This suggests that self-control may be largely influenced by cognitive processes, as Meichenbaum (1975) has proposed. Laboratory methods for studying cognitive mediation are needed for a more complete understanding of self-control processes.

These and other issues in behavioral self-control await future research.
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The Psychological Record, 1975, 25, 3-16.

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APPENDIX: MATERIALS
Reading Goal Questionnaire

Please rate the following statements on a five point scale as follows:

-2 Disagree strongly
-1 Disagree somewhat
0 Can't decide
+1 Agree somewhat
+2 Agree strongly

1. I am interested in increasing my reading speed.
2. I don't think a speed reading course should be offered at this university.
3. After I have learned some speed reading exercises, I intend to continue using them.
4. I want to remember most of what I read.
5. I am interested in increasing my reading comprehension.
6. I have intended to improve my reading for a long time.
7. At this time, I am satisfied with my reading ability.
8. I sometimes can't remember what I've just read, and that bothers me.
9. I hope my participation in this study improves my reading ability.
Reading Goal Questionnaire - Form II

Please rate the following statements on a five point scale as follows:

-2 Disagree strongly
-1 Disagree somewhat
0 Can't decide
+1 Agree somewhat
+2 Agree strongly

1. I am interested in increasing my reading speed.
2. I don't think a speed reading course should be offered at this University.
3. If I would learn some speed reading exercises, I would continue using them.
4. I want to remember most of what I read.
5. I am interested in increasing my comprehension.
6. I have intended to improve my reading for a long time.
7. At this time, I am satisfied with my reading ability.
8. I sometimes can't remember what I've just read, and that bothers me.
9. I would like to participate in a study to increase my reading ability.
Self-Complimentary Statements Used as Rewards

1. I'm doing a good job.
2. My reading speed is increasing.
3. I'm becoming a better reader.
4. I'm gaining a valuable skill.
5. I'm becoming a good reader.
6. This is a good skill to learn.
7. My reading ability is improving.
8. This skill will help me study.
9. I'm doing well.
10. This is a helpful ability to acquire.
11. I'm doing a very good job.
12. I'm becoming a better student.
13. I'm improving my reading ability.
14. Good score.
15. I'm learning something worth-while.
16. I'm working hard.
17. My speed is improving greatly.
18. I'm reading rapidly.
19. I'm showing great effort.
20. Congratulations.
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<th>Check if point was earned</th>
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TABLES
PLEASE NOTE:

Dissertation contains small and indistinct print. Filmed as received.

UNIVERSITY MICROFILMS.
## Table 1. Laboratory Analogue Studies of Self-control

<table>
<thead>
<tr>
<th>Authors</th>
<th>Reward or Punishment</th>
<th>Tangible or Freely Available Consequences</th>
<th>Target Behavior</th>
<th>Low Probability Behavior</th>
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<td>points</td>
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<td>M &amp; M's</td>
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<td>yes</td>
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<td>tokens</td>
<td>yes</td>
<td>yes</td>
<td>wheel turning apparatus</td>
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<tr>
<td>Bellack &amp; Tillman, 1974</td>
<td>orange light</td>
<td>no</td>
<td>no</td>
<td>hungry recognition of letter combinations</td>
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<tr>
<td>Dorsey, Kanfer, &amp; Duerfeldt, 1971</td>
<td>green light</td>
<td>no</td>
<td>no</td>
<td>guess correct geometric figure, projected behind milk glass</td>
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<tr>
<td>Finn, 1973</td>
<td>red light</td>
<td>no</td>
<td>no</td>
<td>written numbers vs. simulated client statements</td>
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<tr>
<td>Kanfer, 1966</td>
<td>candy</td>
<td>no</td>
<td>no</td>
<td>guess numbers from 0-100</td>
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<td>Kanfer &amp; Duerfeldt, 1967</td>
<td>noxious noise</td>
<td>yes</td>
<td>no</td>
<td>detect when a row of blinking lights goes out</td>
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<td>Kanfer, Duerfeldt, &amp; LaPiere, 1969</td>
<td>green light</td>
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<td>match time duration to sample and word association task</td>
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<td>Kanfer &amp; Marston, 1963a</td>
<td>chips</td>
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<td>guess correct nonsense syllable</td>
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<td>Farsley &amp; Kanfer, 1974</td>
<td>movable markers</td>
<td>no</td>
<td>no</td>
<td>compare three unfoctored yes nonsense syllables presented in equal succession</td>
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<td>Hazle, 1974a</td>
<td>self-observation</td>
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<td>--</td>
<td>sentence completion test</td>
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<td>--</td>
<td>--</td>
<td>face recognition</td>
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<td>?</td>
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<td>M &amp; M's</td>
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<td>no</td>
<td>drop hand rubber ball into apparatus</td>
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Table 2
The Design of the Present Study

<table>
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<tr>
<th>Target Behavior</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
<th>Group 5</th>
<th>Group 6</th>
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</thead>
<tbody>
<tr>
<td>Includes Deprivation, Abstinence or Endurance</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>X</td>
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<td>Goal of Subject</td>
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<td>Low Probability Behavior</td>
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<td>X</td>
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<td>Accurate Feedback Given</td>
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<td>X</td>
<td>X</td>
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<td>Tangible Reward Used</td>
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<td>Reward is Self-Applied</td>
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<td>Reward is Self-Chosen</td>
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<td>Reward is Freely Available</td>
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Table 3

Numbers of Persons Excluded for Each Exclusion Criterion, by Experimenter

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<tr>
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<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
<td>Percent</td>
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<td>Total Subjects Excluded</td>
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<td>100.00</td>
<td>23</td>
<td>100.00</td>
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<td>Comprehension</td>
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<td>52.70</td>
<td>14</td>
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<td>37.83</td>
<td>13</td>
<td>54.16</td>
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<td>Not Primarily English Speaking</td>
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<td>Ledger Sheet</td>
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<td>Self-Compliments</td>
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<td>Other</td>
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<td>2.70</td>
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Table 4

Observed Reading Rate Means and Variances by Group for the Averaged Change Scores on Trials 15, 16, and 17

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<tr>
<th>Group</th>
<th>Mean Words per Minute</th>
<th>Variance</th>
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<td>Group 1</td>
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<td>Group 2</td>
<td>405.56</td>
<td>63,824.44</td>
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<td>Group 3</td>
<td>182.46</td>
<td>10,912.93</td>
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<td>Group 4</td>
<td>228.23</td>
<td>19,348.81</td>
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<td>Group 5</td>
<td>244.05</td>
<td>24,502.58</td>
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<td>Group 6</td>
<td>161.82</td>
<td>4,010.18</td>
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Table 5
Tukey's HSD for Comparison of Means of Change Scores,
Averaged Over Trials 15, 16, and 17

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<th>3</th>
<th>4</th>
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<td>161.82</td>
<td>6</td>
<td>0.00</td>
<td>20.64</td>
<td>66.41</td>
<td>82.23*</td>
<td>155.94**</td>
<td>243.74**</td>
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<td>182.46</td>
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<td>0.00</td>
<td>45.77</td>
<td>66.41</td>
<td>135.31**</td>
<td>223.10**</td>
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<tr>
<td>228.23</td>
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<td>0.00</td>
<td>15.82</td>
<td>89.54**</td>
<td>177.33**</td>
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<tr>
<td>244.05</td>
<td>5</td>
<td>0.00</td>
<td>73.72*</td>
<td>161.51**</td>
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<td>317.77</td>
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<td>87.79**</td>
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</tr>
<tr>
<td>405.56</td>
<td>2</td>
<td>0.00</td>
<td></td>
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</tbody>
</table>

* p < .05  
** p < .01
Table 6
The Location of Trial 17 Raw Scores for Subjects of Experimenter 2

<table>
<thead>
<tr>
<th></th>
<th>Score</th>
<th>Sample Mean</th>
<th>Adjusted Mean&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Standard Deviation</th>
<th>Sample Low&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Sample High&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>995</td>
<td>593.38</td>
<td>568.22</td>
<td>205.24</td>
<td>343</td>
<td>996*</td>
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<tr>
<td>Group 2</td>
<td>No observations</td>
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<td></td>
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<tr>
<td>Group 3</td>
<td>230</td>
<td>496.07</td>
<td>525.28</td>
<td>172.22</td>
<td>230*</td>
<td>771</td>
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<tr>
<td></td>
<td>324</td>
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</tr>
<tr>
<td>Group 4</td>
<td>721</td>
<td>535.38</td>
<td>534.43</td>
<td>174.00</td>
<td>364*</td>
<td>1013</td>
</tr>
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<td>364</td>
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<td></td>
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<tr>
<td>Group 5</td>
<td>351</td>
<td>575.54</td>
<td>589.57</td>
<td>210.01</td>
<td>288</td>
<td>930</td>
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<td>Group 6</td>
<td>584</td>
<td>507.38</td>
<td>511.11</td>
<td>74.89</td>
<td>309</td>
<td>626</td>
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<tr>
<td></td>
<td>488</td>
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<td>398</td>
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</tbody>
</table>

* This high or low score was performed by a subject of Experimenter 2.

<sup>a</sup>Adjusted mean is the mean of all observations except those of Experimenter 2.

<sup>b</sup>Sample Low is the lowest score found in that group in the overall sample, including the results of both experimenters.

<sup>c</sup>Sample High is the highest score found in that group in the overall sample, including the results of both experimenters.
Table 7
Behrens-Fisher Revision of Tukey’s Analysis with Welch’s Degrees of Freedom for Comparison of Means of Change Scores,
Averaged Over Trials 15, 16, and 17

<table>
<thead>
<tr>
<th>Group</th>
<th>6</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>1</th>
<th>2</th>
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<tbody>
<tr>
<td>6</td>
<td>0.00</td>
<td>0.61</td>
<td>1.56</td>
<td>1.75</td>
<td>3.79**</td>
<td>3.37**</td>
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<td>0.00</td>
<td>0.84</td>
<td>1.27</td>
<td>2.87**</td>
<td>2.94**</td>
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<tr>
<td>4</td>
<td>0.00</td>
<td>0.26</td>
<td>1.67</td>
<td>2.22*</td>
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<tr>
<td>5</td>
<td>0.00</td>
<td>1.27</td>
<td>1.95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.00</td>
<td>1.11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* $p < .05$

** $p < .01$
Figure 1. Mean reading rates, per group, in words per minute at points A and B. Point A shows the mean reading rate for each group on trials one, two, and three. Point B shows the mean reading rate per group on trials 15, 16, and 17.