Motivational Properties of Frustrative Nonreward, Conflict Involving Nonreward, and Conflict Unconfounded with Nonreward

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Similarities of the motivational properties of frustrative-nonreward and conflict unconfounded with nonreward were evaluated in two different experiments. The purpose was to determine if conflict, unconfounded with primary aversive elements inherent in nonreward, was capable of eliciting "frustration-like" effects; thus allowing adoption of Brown and Farber's (1951) parsimonious explanation of frustration effects, in terms of conflict operations. The main hypothesis tested was that approach-approach conflict and nonreward following experience with reward (Amsel's frustrative-nonreward) would produce similar increments in the general level of motivation (as measured by an increase in Alley 2 running speed).

The general experimental procedures used in Experiments I and II extended traditional frustration methodology to a simultaneous discrimination task, employing as apparatus, a straight double runway maze in which the first goal box is divided into two parallel chambers. Light and dark chambers served as discriminative stimuli occasioning reward, nonreward, or partial reward. Acquisition of discrimination approximated differential conditioning with a guidance procedure of closing the entrance to one side of GB 1 with a Plexiglas door, thus forcing a response to the other side while maintaining simultaneous presentation of the discriminanda of both sides. The methodology provided experimental conditions which subjected different groups of adult male, Long-Evans strain rats to experiences of Conflict with Frustrative-nonreward (FC), Conflict without Frustrative-nonreward (C), and the equivalent of Frustrative-nonreward (F) and Continuous Reward (O) within a simultaneous discrimination task. The designs of

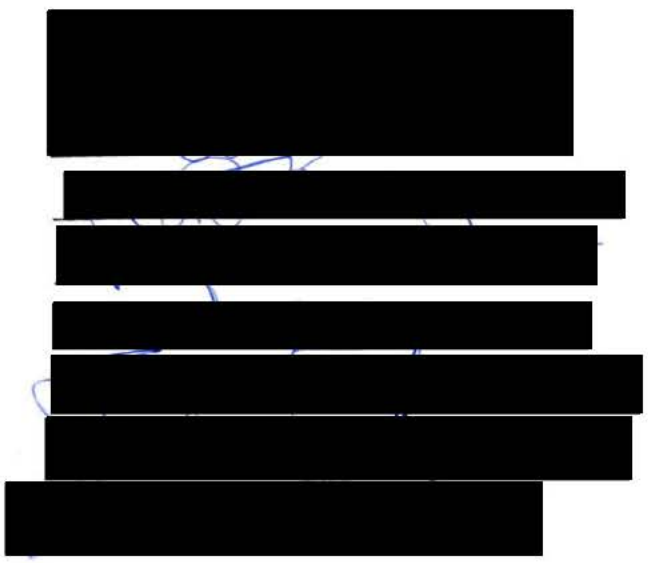
Experiments I and II differed in the procedures used to establish stimulus control, equated practice to both GB 1 sides, and sequential placement of experimental trials in relation to training trials. Both experiments equated groups in terms of acquisition trials, amount of reward, and other motivational and associated variables known to affect running speed. In both experiments, the Conflict-only (C) Ss were trained to an S+ discriminandum, and then made to choose between two S+ GB 1 boxes, being rewarded regardless of which one was chosen. Steps were taken to reduce spatial-positional preferences and odor cues.

Results of overall mixed-design analyses of Experiment I Alley 2 data did not confirm the main hypothesis. However, differential effects supporting the main hypothesis were found within-Ss for the C, FC, and F groups when rewarded training trials and criterion trials were compared. In addition, within-S frustration effects were found when rewarded and nonrewarded training trials were compared. It was concluded that procedures were not effective in producing differential effects at a magnitude sufficient for between-S comparisons. Moreover, effects of stimulus gneralization may have created more complex operations than conceptualized, such that inherent approach-avoidance conflict may have been created in each group through the experience of nonreward associated with undiscriminated S-. Experiment II tested this assumption and eliminated experience with nonreward by consistently guiding Ss' training trial responses to the correct, S+, discriminandum.

Results of overall mixed-design analyses of Experiment II supported the main hypothesis. However, the increment in Alley 2 speed developed with practice, rather than occurring immediately upon the institution of nonreward or conflict. The within-S analyses comparing experimental

and control (acquisition) trials added further support for the confirmation of the main hypothesis.

Results from post hoc discrimination tests immediately following the two experiments, and an examination of the choice behavior of Ss during the course of experimentation, led to two conclusions: (1) the procedure of consistently guiding an S's response to one stimulus where two stimuli were simultaneously presented was successful in establishing stimulus control; (2) subjects tend to adopt positional habits as a conflict-reducing solution to a situation involving a choice between two relatively equal alternatives, but not all of the effects of conflict were thereby removed. Experiment I provided data suggesting that positional preferences may be learned in such choice situations.



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DEDICATION

To Jason and Karl who didn't understand why I didn't have time to play; and to Kay who did.

Chapter I

General Introduction

Reed Lawson (1965) has presented a fascinating essay in which he traced the development of "frustration" as a scientific concept. His contention was that the primary problem with respect to the concept of frustration has been that of clarifying this term in a scientifically useful manner. In so doing he suggested a three-stage theoretical process through which the vernacular term "frustration" would pass in its metamorphoses into a technical term.

> 1. Frustration is accepted at face value as a unique independent topic for study. At this stage there is an attempt to construct a "theory of frustration" that is relatively self-sufficient. The term may be, and usually is discussed against a background of what we know about behavior in general. The integration of the term into this total context is of secondary importance.
>
> 2. Next, there is an attempt to discuss the phenomena presumably covered by the term in the language of some broader behavior theory. This procedure preserves the integrity of the term itself in that it still accepts the term as identifying a usefully distinct subject matter.
>
> 3. Finally, there may be the essential absorption of the term into some other, presumably more "basic" formulation. The term is no longer, for scientific purposes, considered to be a necessary topical entity. It is not always easy to say when a term has reached this stage, because the theorists involved may themselves never use the term. (p. 4).

This present paper suggests that at least two contemporary theories have advanced the concept of frustration to Lawson's

third stage -- those of Amsel, and Brown and Farber.

1. Brown and Farber's Frustration Theory

In 1951 Brown and Farber presented a most stimulating discussion of how emotions, in general, should be treated within a behavioristic framework (specifically, the framework primarily developed by Hull, 1943). As a special case in point, the problem of frustration was analyzed.

Hullian and Neo-Hullian theory has used hypothetical constructs quite extensively and many of them (for example, "drive") have become a part of many psychologists' language. Accordingly, Brown and Farber explored the possibility that frustration itself could be defined in terms of such constructs.[1]

They argued that the introduction of frustration within a behavioral framework involved three major tasks:

1) the denotation of the antecedent conditions that are assumed to lead to frustration;

2) the specification of the functional relations holding between frustration and these conditions;

3) the denotation of ways in which the postulated frustration state might significantly affect behavior.

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[1]There is some disagreement as to the way in which Brown and Farber conceptualized frustration -- either as an intervening variable (Yates, 1962) or as a higher-order hypothetical construct (Lawson, 1965). Brown and Farber did not consider it necessary to differentiate between the two and for the present purpose, there seems to be no need to pursue the argument. Rather, it seems sufficient to recognize Brown and Farber's desire for good science by acknowledging their quest to place frustration on an intervening variable level and to accept its hypothetical construct reality as a statement of the human condition and level of data inherent in the science of psychology.

Accordingly, Brown and Farber's definition of the antecedent conditions of frustration is a very broad one, encompassing many of the conditions employed by researchers in the area. After enumerating a number of different kinds of manipulative conditions which may be defined as antecedents to frustration, the authors state, "Although these antecedents differ widely with respect to their manifest topographical features, the capacity they possess in common to thwart an ongoing response may be accounted for by assuming that each functions in some way to arouse an incompatible reaction tendency" (p. 481). Hence, Brown and Farber's definition of a frustration state in effect equates it with a state of conflict. "The basic assumption is made, therefore, that frustration is the consequence of either (1) the simultaneous activation of two competing excitatory tendencies, or (2) the presence of a single excitatory tendency and an opposing inhibitory tendency" (p. 481). This conflict between opposing tendencies leads to whatever could be said to be the unique behavioral consequences of frustration.

It is possible, then, to conceive of frustation as the consequence of conflict between two opposing response tendencies — one being the one originally evoked by the situation, the other being some alternative response aroused by the frustrating interfering conditions themselves (as does Amsel's frustrative nonreward theory), but on the other hand, it is still possible to conceive of frustration as a consequence of the simultaneous activation of <u>any</u> excitatory tendencies, provided they were conflictual. It is fairly said that Brown and Farber, in

their 1951 paper, viewed the constructs of frustration and conflict as one and the same. In footnote six they state, "We do not believe, however, that a useful division can be made at present between conflict and frustration." And later, "But so far as we are aware, no one has formulated a distinction between the two constructs of frustration and conflict that rests in a convincing way upon demonstrable differences in their functional relations to other constructs or to behavior" (p. 481).

Brown and Farber (1951) suggest two major ways in which frustration may affect overt behavior. One effect, given predominant emphasis, is an increase in the general level of motivation, by functioning as an irrelevant drive and summating with relevant drives in a particular situation. Hence, frustration, adding to the total motivation of the organism, may strengthen whatever responses are already strong in the situation. Thus, if the goal-directed response is far stronger than any other behavior in the situation, frustrating it may lead to its occurrence with even greater vigor. Compared with other drives, however, frustration is unique in that it depends upon the arousal of competitive tendencies rather than upon conditions of deprivation. The second effect of frustration is to produce unique internal stimuli or cues. These stimuli may in turn become associated to other responses not previously present in the situation. As a cue, frustration might serve as a source of new response patterns which may be carried over into other situations in which the subject is frustrated. In such situations, frustration might serve as an unconditioned,

conditioned, or discriminative stimulus eliciting new response patterns. "Responses to frustration originally restricted to a single environmental context might thus be elicited by frustration-produced cues in other contexts despite any ostensible inappropriateness that might characterize such appearance" (Brown and Farber, 1951, p. 490).

Unfortunately, the Brown and Farber view of frustration has not produced specific research of much volume. Lawson (1965) has suggested two possible reasons: first, the view implies that as our knowledge of the basic principle concepts, such as drive and conflict, improves so will our understanding of frustration; and second, the actual quantitative development of a Hullian type of theory is not sufficiently advanced to test some of their more detailed hypotheses. Nonetheless, the treatment of frustration in behavioral terms received its starting impetus from the discussion by Brown and Farber (1951). As we shall see, while the efforts of Brown and Farber did not stimulate much heuristic interest they did have a great influence on Abram Amsel, whose theory has produced much specific research and has integrated the construct of frustration into general behavior theory rather well.

2. Amsel's Frustration Theory

In recent years, one of the most important advances in the study of motivation has been the elaboration of the Hull-Spence tradition to include the analysis of frustration. This line of theorizing was first attempted by Brown and Farber but has received its greatest impetus from the work of Abram Amsel

and his colleagues.

Some time ago, Amsel (1951) advanced the point of view that the major weakness of Hull's inhibition theory was its inability to account for phenomena that depended on goal events. At that time, Amsel proposed a return to Spence's (1936) position, thereby modifying the two-factor inhibition theory (I_R and ${}_SI_R$) so as to recognize frustrative events resulting from nonreward as a third aspect of inhibition.

Amsel conceived of frustrative inhibition as a learned or secondary form of unlearned or unconditioned primary frustration, since he felt it possessed the characteristics of an anticipatory response and served as a mediator between the external stimulus and the instrumental response.

However, the notion of frustrative inhibition required prior demonstration that nonreward following extended periods of reward had certain active properties. Thus occurred (a) a series of experiments, commencing with a study by Amsel and Roussel (1952), investigating the effects of nonreward on the vigor of immediately subsequent responses in an apparatus that was essentially two runways in series, and (b) a study of the mechanism of anticipatory frustration, which led eventually to the proposal of a theory of frustrative nonreward (Amsel, 1958).

A. The Basic Features of Amsel's Theory

The conceptual basis of Amsel's tenets is derived from the Hull-Spence variety of neobehavioristic theory. This form, termed conditioning-model theory by Lachman (1960), combines

elements of Pavlovian and Thorndikian conditioning. As such, the approach emphasizes the role of classically conditioned responses in instrumental learning, and attributes to such hypothetical classically conditioned responses the capacity to provide feedback stimulation and incentive motivation, and to serve as major mediational mechanisms.

Amsel and Ward (1965) provide an excellent introduction to this variety of theory. Figure 1 (from Amsel and Ward, 1965, p. 2) presents a schematic representation of the relationship between classical and instrumental conditioning in conditioning-model theory. The upper portion of the figure shows the basics of classical and instrumental conditioning. The lower portion shows how classical conditioning is conceived to be involved in instrumental learning. Two stages are represented. In the first, the classical-conditioned response to goal (r_G) is formed as part of the instrumental sequence. In the second, the classical-conditioned response is shown to move forward in the behavioral sequence and, through its feedback stimulation (s_G), becomes part of the mechanism for eliciting the instrumental response.

Relationships presented in Figure 1 are based upon a general conception of goal events (R_G). Amsel (1958) proposed that goal events were of three kinds: rewards (R_R), punishments (R_P), and frustrations (R_F). Later, Mowrer (1960) added relief as a fourth kind of goal event. This serves to place relief and punishment into the same functional relationship as reward and frustration. Martin (1963) has shown that this

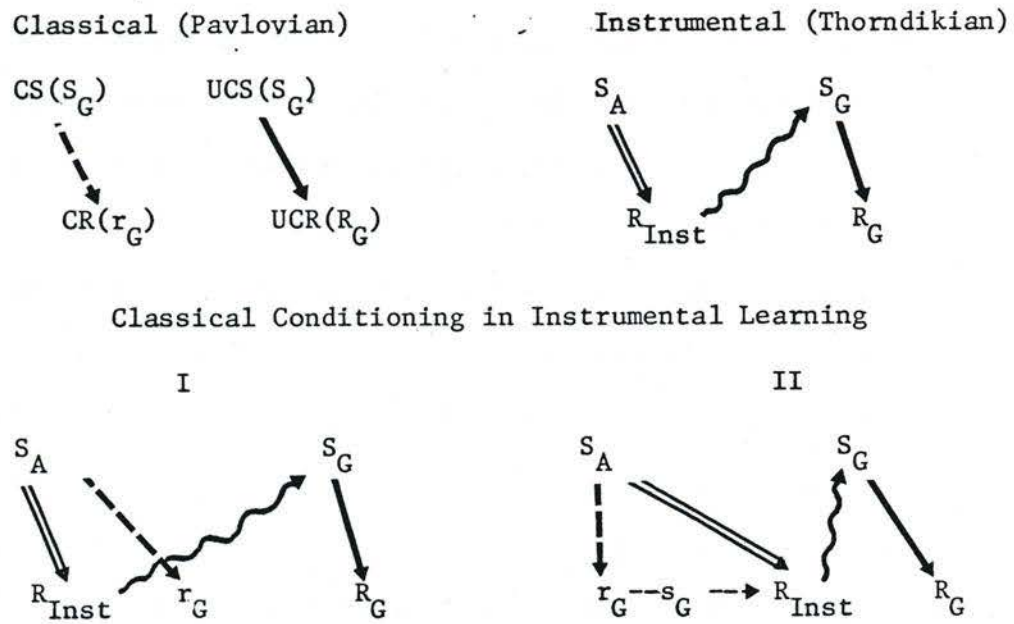

Figure 1. Schema of Pavlovian and Thorndikian learning showing how conditioning processes are assumed to be involved in instrumental learning (after Spence, 1956 , p. 60). In this figure and in Figure 2, dashed lines represent classically conditioned, learned connections; double lines represent strengthened instrumental connections; solid lines represent unlearned connections; and wiggly lines represent a contingency relationship between the instrumental response and the appearance of the goal stimulus in instrumental learning. (From Amsel & Ward, 1965, p. 2)

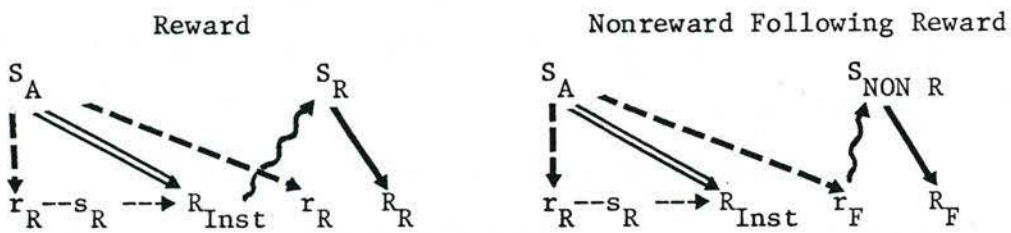

Figure 2. Schematic representation of the conditioning of anticipatory reward (r_R) and the involvement of r_R and nonreward (S_{non-R}) in the conditioning of anticipatory frustration (r_F). (From Amsel & Ward, 1965 p. 2)

conceptual treatment of reward and frustration can also be applied in an analysis of relief and punishment. However, the goal events with which we will be concerned in the present thesis are those of reward and frustration.

Figure 2 presents a schematic of Amsel's assumptions of how reward and frustrative nonreward are involved in simple instrumental learning. Rewarded trials occasion the development of anticipatory reward (r_R). Anticipatory reward moves forward in the temporal sequence to become part of the mechanism affecting the instrumental response. Incentive motivation is said to be operating when r_R and its feedback stimulation, s_R, affects the instrumental response. As can be seen in the right-hand side of Figure 2, primary frustration (R_F) results when nonreward (S_{non-R}) is the goal event rather than the reward which was anticipated. Hence, frustration is defined as nonreward in the presence of anticipated reward (r_R). Amsel and Ward (1965, p. 2) state, "Anticipatory reward and nonreward are both necessary, but not sufficient, conditions for frustration. Since R_F operates as an unconditioned response to S_{non-R}, nonrewards will occasion the conditioning of r_F to the cues of S_A. This conditioned response of anticipatory frustration move forward in time or backward along the instrumental sequence to affect the instrumental response, presumably in a manner antagonistic to that in which r_R affects the instrumental response.

B. Functional Properties of Frustration

Experiments, beginning in the early 1950's, have demonstrated that frustrative nonreward (nonreward in the presence of anticipation of reward) may influence behavior in at least three ways. First, frustrative nonreward appears to have an invigorating or potentiating effect on any behavior which immediately follows it, the so-called frustration effect (FE). Generally, this frustration effect is thought of as an attribute of primary, unlearned frustration.

A clearer understanding of the frustration effect, as well as the other functional properties of frustrative nonreward, may be gained when viewed within the context of the experimental apparatus generally employed. The apparatus, shown schematically in Figure 3, has been called a double or tandem runway. In an apparatus such as this a rat or other animal is trained to run down two alleys with two goal boxes in serial arrangement. In the simplest version of a frustration experiment, the rat traverses runway 1 from the start box and finds food or some other reward in goal box 1, then S is released into runway 2 and finds food again in goal box 2. After a number of such preliminary trials in which the animal is rewarded successively in both goal boxes 1 and 2, there follows a series of test trials in which the food is sometimes omitted from goal box 1 but is always found in goal box 2. In this way, the drive or arousing properties of frustrative nonreward are reflected by an increase in the speed of running in runway 2 following nonreward in the first goal box beyond baseline obtained in

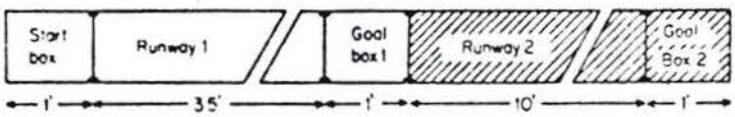

Figure 3. The double-runway appratus for the study of primary frustration effects. (From Amsel & Roussel, 1952)

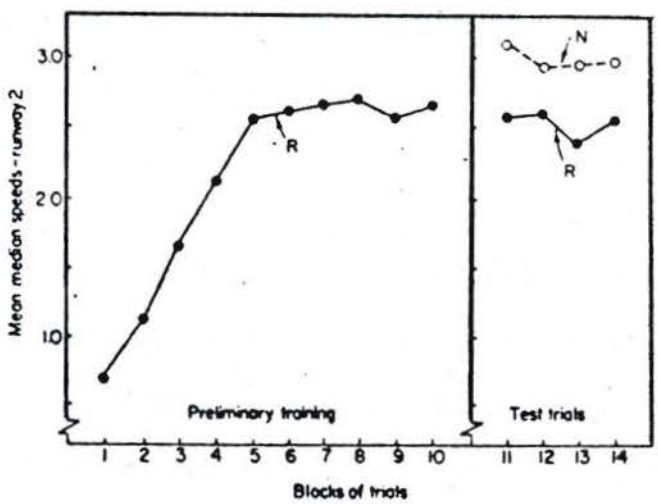

Figure 4. An example of frustration effect data taken from an experiment by Wagner (1959). R = Reward, N = Nonreward.

the preliminary period (see Figure 4).

Through the use of a double runway apparatus it has been possible to separate and measure two responses, each reflecting a property of frustration. Thus far, only one of these properties has been mentioned, the frustration effect (FE) which is the measure of increased vigor of responding in Alley 2 following nonreward in Goal 1. The FE may be taken as the frustration-motivated response indicative of the magnitude of primary frustration (R_F) that develops in Goal 1.

The frustrated response and speed changes indicating anticipatory (secondary) frustration (r_F) are measured in Alley 1. The remaining two properties of frustrative nonreward are reflected in this measure, namely, (1) anticipatory frustration, serving as a drive stimulus whose reduction may be reinforcing and to which other responses may be conditioned; and (2) its inhibition of overt behavior. It seems clear that frustration also has specific directive effects on behavior and that frustration exercises stimulus control over behavior by providing characteristic internal cues. These internal stimuli have been conceptualized as of two major sorts: those arising directly out of the primary frustration reaction itself, as a sort of feedback (Amsel and Ward, 1954; Amsel and Prouty, 1959); and those arising out of conditioned (anticipated) frustration (Amsel, 1958; Spence, 1960). It is important to draw a distinction between these two sources of internal stimulus control over behavior. Stimuli arising out of primary (unconditioned) frustration provide an animal with cues for making responses that

will take him out of an existing frustrated state; those arising out of conditioned frustration are signals that alert the animal to an upcoming aversive event and provide some basis for avoiding this event.

To summarize, Amsel (1958, 1962) operationally defines "frustrative nonreward" as the absence of reward in the first goalbox of a double-runway apparatus following some minimum number of rewards during which incentive (K) has developed in the first runway. Theoretically, the unconditioned "frustration reaction" resulting from frustrative nonreward increases the general drive level (D) of the organism which in turn results in the heightened running speeds of Ss in the second alley of the double-runway apparatus (the "frustration effect"). The experiments of Amsel and Roussel (1952), Amsel and Hancock (1957) and Wagner (1959, 1963) clearly support this assumption. Further, in addition to primary unconditioned frustration, Amsel (1951, 1958, 1962) postulates a secondary, conditioned variety (r_F-s_F) that comes to be elicited by stimuli that are consistently paired with the frustrating manipulation. This assumption has received support from several experiments (Wagner, 1963; Amsel and Surridge, 1964; Daly, 1968, 1969a, 1969b, 1969c). It should be noted that, although several limitations have been demonstrated (e.g., McHose and Ludvigson, 1965), the postulates that have come to be known as "frustration theory" have added a great deal of explanatory power to the Hull-Spence system.

C. The Role of Frustrative Nonreward in Partial Reinforcement and Discrimination Learning

Amsel (1958; 1962; 1967) and others (Amsel and Ward, 1965; Spence, 1960, Ch. 6) have employed the concepts of anticipatory reward and frustration as outlined in conditioning-model theory to show that partial reward and discrimination learning involve similar processes. This theory divides partial reward acquisition and discrimination learning into four stages involving processes quite different from the others, especially in regard to the operation of the conditioned anticipatory responses.

In summary, the frustration hypothesis assumes that during partial reinforcement acquisition in a runway, anticipatory forms (r_R-s_R) of the primary response (R_R) to reward are classically conditioned in the goal box and generalize to earlier segments of the alley (Stage 1). When r_R-s_R reaches a certain strength, nonreward elicits primary frustration (R_F), which serves as the UCS for the conditioning of r_F-s_F (Stage 2). Anticipatory frustration evokes avoidance responses which compete temporarily with stronger approach responses evoked by anticipatory reward (Stage 3). Since the approach-avoidance conflict in this situation is resolved in favor of approach, r_F-s_F becomes conditioned to approach if acquisition is carried on long enough (Stage 4). It is this conditioning (r_F-s_F $\rightarrow$ approach) which constitutes the persistence mechanism of the partial reinforcement effect (PRE). When r_F-s_F is encountered during extinction, animals which have received partial reinforcement during acquisition respond with conditioned approach;

continuous reinforced animals, in contrast, respond with avoidance.

Anticipatory frustration becomes conditioned to approach during partial reinforcement because the stimulus situation does not provide the opportunity for differential conditioning of r_F-s_F and r_R-s_R. However, during discrimination training r_R-s_R comes to be elicited by the positive stimulus (S+) and r_F-s_F by the negative stimulus (S-). A frustration interpretation of discrimination learning contends that the stimulus complex S- $\rightarrow$ r_F-s_F comes to control responding to the negative discriminative stimulus, and S $\rightarrow$ r_R-s_R to the positive. As can be seen, Stages 1 to 3 are conceptualized as being virtually identical for both partial-reward and discrimination training. Amsel suggests that it is only during the fourth stage that mechanisms are different for partial-reward acquisition and discrimination learning. A schematic diagram taken from Amsel and Ward (1965) presents the similarities and differences (Figure 5).

Amsel and Ward (1965), in a series of experiments, found support for the four stage hypothesis. First, a definite relationship was demonstrated between discrimination learning (measured in the first alley of a double alley maze) and the frustration effect (FE) (measured in the second alley). Nonreward was found to be frustrating before a discrimination was acquired; after discrimination was acquired, when S- elicited r_F-s_F, the FE disappeared. This follows, since nonreward is assumed to be frustrating only in the presence of r_R.

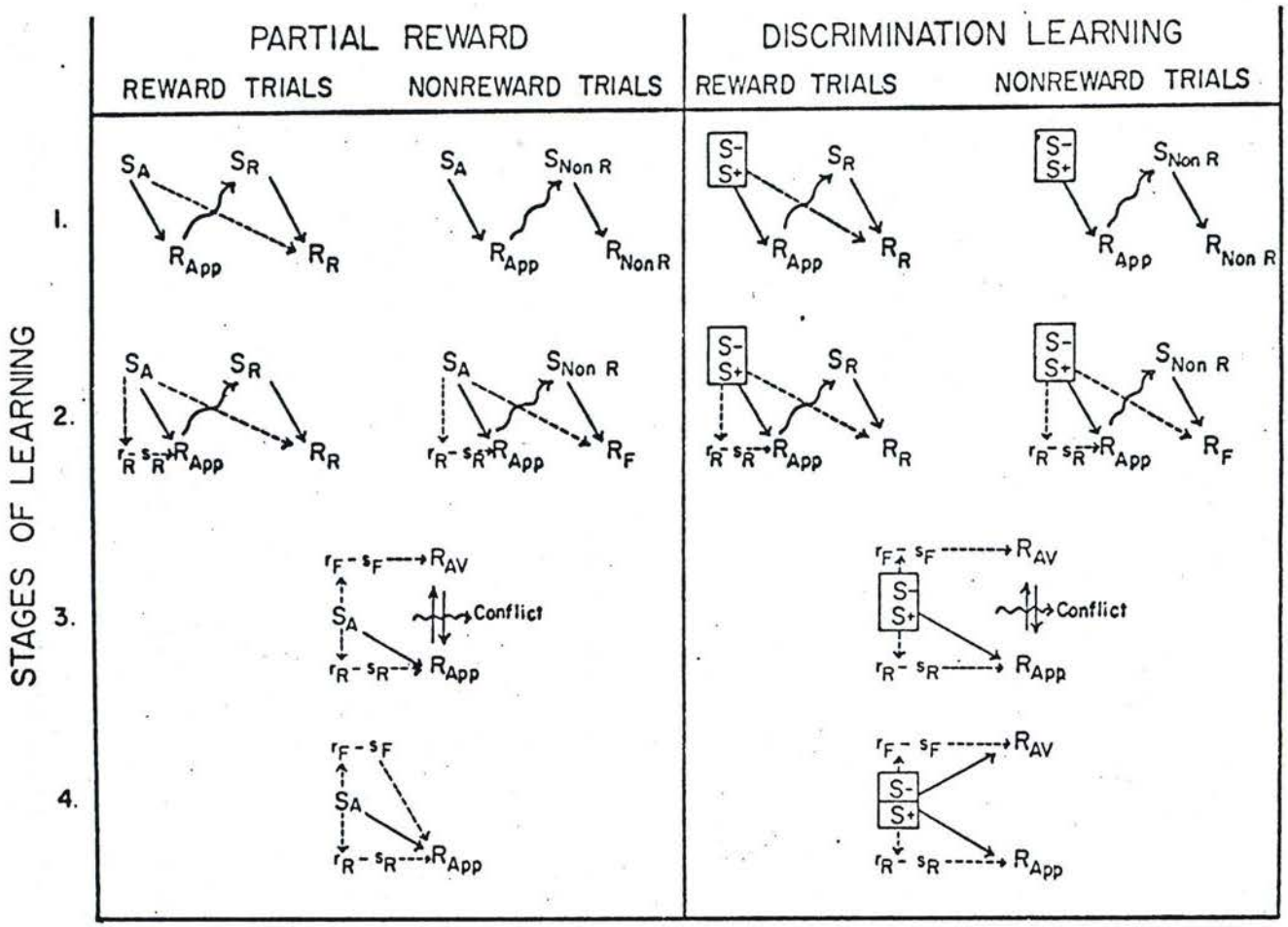

Figure 5. Diagrammed sequence of hypotheses relating frustrative nonreward to stages of partial reward and discrimination learning. From Amsel and Ward (1965).

Second, an increased variability of behavior, expected on the basis of approach (r_R-s_R) vs avoidance (r_F-s_F) conflict, was observed during the period preceding discrimination. Finally, the amount of prediscrimination experience with the discriminanda was found to differentially influence the rate of discrimination learning.

3. A brief comparison of the two theories

Thus far, two motivational theories constructed within a general behavioral framework have been outlined in some detail. Although a detailed comparison of the Amsel and Brown-Farber positions goes beyond the needs of the present research emphasis, a brief comparison is provided in this subsection as one way of focusing attention on the principal empirical interest of the present investigation.

As can be seen from the detailed summaries of the two positions, there are many similarities between the two theories. This is not surprising for both were attempts to construct theories of frustration consonant with Hullian behavioral theory. In addition, Amsel undoubtably was influenced by Brown and Farber's efforts at dealing with the construct of frustration within this behavioral framework. Therefore, the two positions emerge isomorphic in their suggestions that frustration may serve as a nonspecific drive which tends to increase the general level of motivation and also functions as cue to which new responses and other stimuli may become conditioned. In a recent review of the frustration effect, (Scull, 1973) considerable evidence was presented which supports these two motivational

assumptions. However, it is at this point that the two positions diverge.

Where Brown and Farber are most different from Amsel's position is in Amsel's use of conditionable anticipatory reactions (such as r_G-s_G and r_F-s_F) and in the antecedent conditions which are assumed to lead to frustration.

One major facet of Amsel's theory consists in the assumption that frustration, like other responses, can be conditioned, and that an organism may, after a series of nonrewarded trials, come to anticipate frustration. The specific mechanisms underlying this effect is r_F-s_F. The behavior-determining functions of this anticipatory mechanism derives mainly from the capacity of s_F to elicit specific inhibitory (avoidance) responses. The appearance of anticipatory frustration is explained by the Brown-Farber theory without the added assumption that frustration is directly conditionable. From the viewpoint of the Brown-Farber theory, the introduction of nonrewarded trials after an organism has been repeatedly reinforced for approaching a goal would be expected to lead to the development of avoidance tendencies. Through the operation of stimulus generalization, these tendencies could be elicited along with approach tendencies, in the alley leading to the goal box. Since frustration is assumed to arise from the competition between one excitatory tendency and another, it follows that frustration could thus be generated prior to reaching a goal (Brown, 1961). From the foregoing, we see one particularly important distinction between the Brown-Farber and Amsel positions. Amsel gives

frustration the systematic status of a response, which leads to the conclusion that frustration can be conditioned and can be elicited in complete or in fragmentary form by appropriate stimuli. On the other hand, the Brown-Farber position suggests that variations in the frustrated response can be accounted for by the mechanism of stimulus generalization and the learning of new responses to cues attending conflict. This difference between the mechanisms postulated by each theory to account for changes in the frustrated response is intriguing, and well worth empirical consideration. However, the present investigation is primarily interested in the antecedent conditions which are postulated by the two theories to produce frustration. What must come first is the demonstration that conflict alone, without elements of nonreward, can evoke an increase in the general level of motivation in the organism; an effect which has been reliably demonstrated to occur following "frustrative-nonreward."

Amsel operationally defines frustration as the consequence of nonrewarded trials following the experience of rewarded trials. This is a clear and precise operational definition of conditions antecedent to frustration. Hence Amsel has provided one basic operation antecedent to frustration, rather than some of the elaborate lists of variables and conditions that can lead to frustration offered by many other frustration theorists. On the other hand, Brown and Farber suggest that frustration may result from operations which set the occasion for the simultaneous activation of <u>any</u> competitive excitatory

or excitatory-inhibitory tendencies, not just frustrative or punishing ones. Several conclusions emerge: (1) the two sets of operations may be distinct, although given the right circumstances Amsel's operations may be subsumed under those of Brown and Farber; (2) the Brown-Farber position encompasses a larger set of antecedent conditions defining frustrating situations within its operations; and (3) while the Brown-Farber position is more general it need not be any less precise than Amsel's operational definition.

In summary, both theories regard frustration as having two primary effects: (1) it results in an increment to the general level of motivation, and (2) it provides distinctive internal stimuli. At this point they diverge. Amsel postulates the anticipatory frustration mechanism to account for behavior-determining functions of frustration, whereas Brown and Farber rely on stimulus generalization and competing (but not necessarily frustrative) S_G's produced in the conflict situation to account for "frustration" reactions. However, the difference between the two theories in the operations hypothesized to result in a frustration effect is of primary importance to the empirical emphasis of the present paper.

4. Proposed research

Amsel's frustrative-nonreward theory (1958; 1962) has been one of the most recent, and by far the most heuristic, attempts at integrating the construct of frustration into a behavioral framework. His ultimate aim was to enable a modified form of Hullian theory to deal with some classic unsolved learning problems

in an adequate, even elegant, way. However, Scull (1973) in a recent review of the Amsel frustration effect has concluded that the success of his theory in dealing with findings relevant to the FE has been rather limited. But, on the other hand, several alternative theories have not fared any better. Scull's feeling was that the double runway is a much more complex situation than is commonly thought.

It is proposed that several limitations of Amsel's theory are related to its rather limited defining operations. For example, McHose and Ludvigson (1965) have presented data suggesting that r_G and R_F do not covary. Recently, Brooks (1969), Capaldi and Waters (1970), and McCain (1966) have found a frustration effect after a small number of trials and following a trials sequence in which nonreward was not preceded by reward. And most recently Scull (1973) has reviewed some findings in the research areas of magnitude of reward, prior training, variations in the frustrated response, and incomplete incentive reduction that are inconsistent with predictions from Amsel's position.

Several of these inconsistencies and ambiguities might be resolved by investigating whether a frustration-like effect results from simultaneous activation of two competitive excitatory tendencies, but without nonreward or frustration as such. Such a possibility returns to the position of Brown and Farber (1951).

Unfortunately, the position of Brown and Farber has not received much specific investigation. It is unclear empirically

whether conflict, as such, has effects which might usually be attributed to frustrative nonreward, the inception of which is confounded with conflict. King (1972) examined the extent to which an approach-avoidance conflict situation involves frustrative-nonreward. He found the conflict-nonreward group to have a greater inhibition of approach than the frustrative nonreward group. Wong, Scull, and Amsel (1970) investigating whether approach training in the face of quinine aversion would lead to greater resistance to extinction as predicted by Amsel's counterconditioning theory, found that while this treatment resulted in inferior acquisition performance, it had no effect on resistance to extinction. However, previous studies of this type conducted in their laboratory have produced both negative and positive results. A major problem with all of these forementioned studies is that they have manipulated goal events in such a way that aversive or punishing events, which may have primary drive-inducing properties in and of themselves, are confounded with the approach-avoidance conflict.

Wright (1969) proposed the paradigm of approach-approach conflict as one method by which relatively pure competing tendencies, unconfounded with primary aversive properties, may be induced as an experimental condition. Using a spatially balanced 70:30 probability-learning task within a Y maze apparatus, 16 free choice experimental and 16 yoked control Ss were run. Running speeds within the first and correction alleys were found to be significantly faster for the experimental group. A correction procedure which involved a retrace to the

start box rather than the traverse alley also produced faster running speed. Since nonreward effects were considered to be minimal, experimental effects were attributed to conflict-induced drive. Yet, even in this study, presence of nonreward (as delayed reward) could still be argued, and might have produced an aversive influence which possibly confounded results.

The present investigation will extend the use of approach-approach conflict as an operation for the investigation of "frustration-like" effects. The demonstration of "frustration effects" as a reliable phenomenon and as a consequence of nonreward has been well documented (Scull, 1973). However, that such effects may be the consequence of conflict operations unconfounded with the experience of nonreward, as suggested by the Brown-Farber position, has never been experimentally demonstrated. In fact, only a few early studies have even manipulated approach-approach conflict (Godbeer, 1940; Hovland and Sears, 1938; Klebanoff, 1939), much less apply it as an experimental condition in the study of frustration effects. Therefore, the purpose of the present study was to attempt such a demonstration, for only after such a demonstration may other more specific details of the Brown-Farber theory be analyzed and empirically based theoretical comparisons be made.

The general experimental strategy was as follows: traditional frustration methodology is extended to a simultaneous discrimination task, employing as apparatus, a straight double runway maze in which the first goal box is divided into two parallel chambers.

This apparatus is essentially the same as that used in the Amsel studies (beginning with Amsel and Roussel, 1952). It provides a first, plus a second alley component such that increments in the general level of motivation (as measured by an increase in the second alley running speed) could be measured following experimental operations. The first alley running speed provides a measure of the affect of experimental operations on operant behavior occurring during approach to the first goal box (GB 1). Light and dark chambers at GB 1 serve as discriminative stimuli occasioning reward, nonreward, or partial reward. Acquisition of discrimination approximates differential conditioning with a guidance procedure of closing off the entrance to one side of GB 1 with a Plexiglas door, thus forcing a response to the other side while maintaining simultaneous presentation of the discriminanda of both sides. This methodology provides experimental conditions which subject different groups of adult male, Long-Evans strain rats to experiences of conflict without frustrative-nonreward, conflict with frustrative-nonreward, and two traditional procedures, the equivalent of frustrative-nonreward and continuous reward within a simultaneous discrimination task. The conflict without frustrative-nonreward Ss are trained to an S+ discriminandum and then made to choose between two S+ GB 1 chambers, being rewarded regardless of which one is chosen. Conflict with frustrative-nonreward Ss are trained to an S^{+}_{-} discriminandum occasioning partial reward and made to choose between two S^{+}_{-} chambers, receiving nonreward regardless of which one is chosen. Subjects

in the frustrative-nonreward condition are trained to an S^{+}_{-} discriminandum occasioning partial reward and Ss in the continuous reward condition are trained to an S+ discriminandum occasioning continuous reward. During experimental trials, Ss in both groups are not given a choice between chambers. Rather, frustrative-nonreward Ss are forced to the S^{+}_{-} chamber and continuous reward Ss are forced to the S+ chamber, and there receive nonreward and continuous reward, respectively. Inclusion of the traditional frustrative-nonreward and continuous reward conditions provide two baselines, one for behavior as a consequence of the conflict and frustration inherent in the operation of frustrative-nonreward, and another baseline for behavior as a consequence of continuous reward, without elements of conflict or frustration.

Two experiments are proposed. In the first experiment, experimental operations are interspersed during discrimination training which involves forced trials to S- occasioning nonreward. In the second, experimental operations follow the acquisition of discriminated approach achieved through a training procedure of consistently guiding approach responses to the S+ chamber and eliminating any guided trials to S-. Thus, these experiments differ in the procedures used to establish stimulus control, equated practice to both sides of GB 1, and sequential placement of experimental trials in relation to training trials. Both experiments equate groups in terms of acquisition trials, amount of reward, and other motivational and association variables known to affect running speed. In addition, steps are taken in both experiments to reduce spatial-positional

preferences and odor cues. Detailed descriptions of the two experiments are presented in the following chapters.

Chapter II

Experiment I

In its most general form, the experiment may be conceptualized as a two-between by one-within mixed design. The two between factors are Discriminative Stimuli and Experimental Groups, having two and four levels respectively. The former is of minor interest; it merely controls possible light no-light preferences by having one group with L+D-, the other with D+L-. The latter, Experimental Groups, embodies the major independent variable. Criterion Trial Blocks constitute a 15 level within factor. Five dependent measures of locomotor performances are available. Because of the within-S factor, analyses of the data necessarily had to be performed as separate univariate analyses of variance. Hypotheses concerning each of these factors are now considered.

Hypotheses and expected findings

No differential effect is expected as a function of the discriminative stimuli; nor is it expected to contribute to any interaction. Therefore, if the factor of Stimuli is found to be nonsignificant in the general design, then Groups can be collapsed over this factor.

A differential effect of the experimental conditions operationally defining the experimental groups is expected. Interactions of which Groups are a component are also expected

to be significant, since the hypothesized group differences will emerge only with learning trials. The primary comparison is of performance levels between Conflict Only (C), Frustration plus Conflict (FC), Frustration with inherent Conflict (F), and Non-Conflict Non-Frustration (O) groups. Since conflict operations involve two parallel Goalboxes (GB 1) and the Amsel paradigms of Frustration only one, then two Frustration plus Conflict groups are required: one having Frustration in the context of two parallel GB 1's, the other with only one GB 1. These are groups FC and F, respectively. If the effects of frustration plus conflict are additive, then the conflict-only (C) performance should fall somewhere between the F/FC and O groups. This difference is expected to occur after discrimination is learned in the initial phase of discrimination training, most likely after the first five blocks of trials. If conflict proves not to be an independent variable, or exerts little differential effect, then the intensity of behavior seen under conflict-only condition should be indistinguishable from that under continuous reinforcement, while the responses of Ss experiencing frustrative nonreward should converge with responses of Ss under the conflict plus frustrative nonreward condition.

The Experimental Groups X Criterion Trial Blocks interaction should supply the most valuable information regarding the manipulation under investigation. The interaction should be significant for all five dependent variables. Unfortunately, the exact shapes of the acquisition curves of the individual

groups can not be predicted accurately, since previous studies employing procedures analogous to the present study do not exist. It seems reasonable, however, to expect negatively accelerating curves for each of the experimental groups, in line with the usual shapes of learning curves with speeds plotted against practice. Maximum rise for each of these curves should occur within the first five trial blocks and thereafter begin to diverge to different asymptotes.

The Criterion Trial Blocks factor should be significant, if trivial, as a function merely of learning. The shape of the average acquisition curve should normally be negatively accelerated, with maximum rise occurring within the first five blocks of the 15 Blocks of trials. The components of trend most descriptive of the curve should be linear and quadratic. However, a significant higher-order component of trend may be found, because the large number of degrees of freedom for Blocks allow an increased chance of significant inflection.

A summary of the expected findings within the context of the general experimental design is shown in Table I.

Multiple comparisons of Group means are planned for all five dependent measures. The differences between groups over acquisition will be examined in three averaged blocks of Criterion Trials -- initial, middle, and final five-block segments. Expected rank orders of the groups over acquisition segments for the five dependent measures are presented in Table II.

Table I

General Design

A Summary of Expected Findings

Source	df	Dependent Variables: Start 1	Run 1	Goal 1	Start 2	Run 2
Between	23					
Discrim. Stimuli	1	NS	NS	NS	NA	NA
Exper. Groups	3	SIG	SIG	SIG	SIG	SIG
D.S. X Groups	3	NS	NS	NS	NA	NA
Ss/ D.S. X Groups	16					
Within	336					
Criterion Blocks	14	SIG	SIG	SIG	SIG	SIG
Blocks X D.S.	14	NS	NS	NS	NA	NA
Blocks X Groups	42	SIG	SIG	SIG	SIG	SIG
Blks. X Grps. X DS	42	NS	NS	NS	NA	NA
Ss/ Blocks X Grps. X D.S.	224					
Total	359					

N.B. SIG = Significant. NS = Nonsignificant. NA = Not Applicable.

Table II

Rank Orderings of Experimental Groups

Over Three Sets of Criterion

Trials Segments

Dependent Variable	Segments of Criterion Trials		
	Initial	Middle	Finals
Start 1	O=C=F=FC	O>C>F>FC	O>C>F>FC
Run 1	O=C=F=FC	O>C>F>FC	O>C>F>FC
Goal 1	O=C=F=FC	O>C>F>FC	O>C>F>FC
Start 2	FC=F=C=O	FC>F>C>O	FC>F>C>O
Run 2	FC=F=C=O	FC>F>C>O	FC>F>C>O

N.B. Rank orders are in respect to running speed. Mneumonics in the body of the table refer to experimental groups. See Table I for operational distinctions between groups.

Subsections of the overall design allow for two within-S comparisons. In the first of these, rewarded and nonrewarded training trials over trial blocks for each of the four experimental groups will be compared. This analysis tests the hypothesis that within-S frustration effects, of the kind proposed by Amsel, would emerge as Blocks progressed. The analysis supplies a test of the effect of differential reward and the ability of the modified apparatus to elicit frustration effects. The second within-S analysis is a comparison of Rewarded Training trials to Criterion trials and is more important to the thesis. It is planned as a support to the overall analysis. Consequently, it is hypothesized that differential effects due to experimental conditions within-Ss will be found for Groups C, FC, and F. No effects are expected for Group O.

A post hoc test of the success of discrimination training immediately will follow the experiment. The test involves the simultaneous presentation of darkened and lighted parallel halves of GB 1. Subjects have free access to either side and must choose one or the other side. The test should find that Groups C and O consistently choose the S+ side rather than the S- side. Group FC should not show a consistent choice of either stimulus, since both occasion partial reward in ratios usually not discriminable. Group F Ss should choose the stimulus to which they have been consistently guided since they will not have had any experience with the alternative stimulus.

This S+/S- discrimination will be presented for five post-experiment trials, the discrimination criterion being: five out of five choices of S+ (Groups C and O) or S_{60} (Groups FC and F) indicating perfect discrimination, four out of five indicating an error, and two or more errors indicating a position habit.

METHOD

Subjects. Twenty-four experimentally naive Long-Evans hooded, male rats from the closed colony in the Department of Psychology served as Ss. Their ages ranged from 80 to 90 days at the start of training. Assignment to experimental conditions was random. After assignment they were housed individually.

Apparatus. The apparatus was a straight double runway with Goal Box 1 divided to form two parallel chambers. The various components of the apparatus, arranged successively, were a start box, a first runway, a first goal box split into two parallel halves, a second runway, and a second goal box. The start box (SB) measured 30.48 cm long by 7.62 cm wide. Entry to SB was gained via a hinged door on the end of SB or from the top of SB by a hinged clear plexiglas lid. Exit from SB was controlled by an opaque sliding metal door. Runway 1 measured 88.90 cm in length. Its width increased from 7.62 cm at the SB end to 21.59 cm at the GB 1 end. Goal Box (GB 1) was divided down the middle to form two separate chambers measuring 35.56 cm in length by 10.16 cm wide. Each side of GB 1 had its own food cup, a clear plexiglas

sliding door at the entrance and a metal sliding door which permitted exit into Runway 2. Mounted through the outside wall of each side of GB 1 was a 7.5 watt clear night light bulb which generally illuminated its entire box. Each light could be used as a discriminative stimulus independently of the other. Runway 2 length was 274.96 cm overall, and 21.59 cm wide at GB 1 exit, narrowing to 10.16 cm after a distance of 63.50 cm. The remainder of Run 2 was 10.16 cm wide. A sliding opaque metal door led to Goal Box 2 (GB 2) which was 35.56 cm long by 10.16 cm wide. The food cup for GB 2 was recessed in the floor. The inside surfaces of SB 1, Runway 1, and GB 1 were painted semigloss white, and the remainder of the maze a high gloss gray. Sides of the entire apparatus were 14.61 cm high. The apparatus covered with clear plexiglas throughout, hinged to allow access to all components.

Five running-speed measures were available: Start 1, Run 1, Goal 1, Start 2, and Run 2. Run timing was accomplished by a sequence of photocells connected through Hunter Photo-Control Relays (Type 120) to Hunter klockounters. Timing of the Start 1 segment began with the opening of the sliding door at the SB exit and lasted until S activated the photocell located 15.24 cm from the SB. Tripping this photocell activated the timer for the Run 1 segment. The next photocell was located 60.96 cm from the end photocell of the Start 1 segment. Tripping this photocell stopped the Run 1 timer and started the Goal 1 segment timer. The photocell which

ended the goal segment was located 20.32 cm into GB 1. The total length of the Goal entry segment was 34.29 cm. Opening the GB 1 exit doors tripped microswitches which began the Start 2 measure. A photocell located 33.02 cm from the GB 1 exit stopped the Start 2 measure and started the Run 2 measure. The Run 2 segment was 60.96 cm long. The experimental room was dimly illuminated. Potentially distracting extramaze cues were screened from all intramaze locations. Figure 6 presents a schematic of the apparatus.

Procedures.

Drive/Incentive Operations. In all phases, Ss were fed 12 grams lab chow a day, 60 minutes after completion of their running. They were placed on a 12 gram 22 hour food deprivation 14 days prior to the start of running and were maintained on this deprivation throughout the experiment. On each of four days immediately prior to start of running, 45 mg and 100 mg Noyes pellets (with 20% sucrose added) and identical with the pellets used throughout the experiment, were given to the Ss before receiving their daily ration. Water was always available in the home cage.

On each of four days prior to the first day of training, Ss were placed in the apparatus individually and allowed five minutes of exploration. On the fifteenth day of deprivation, the experiment began.

Overview of Experimental Procedure. The actual experiment was run for 15 consecutive days. On each day, one block of five trials was run. Each block consisted of two types of trials:

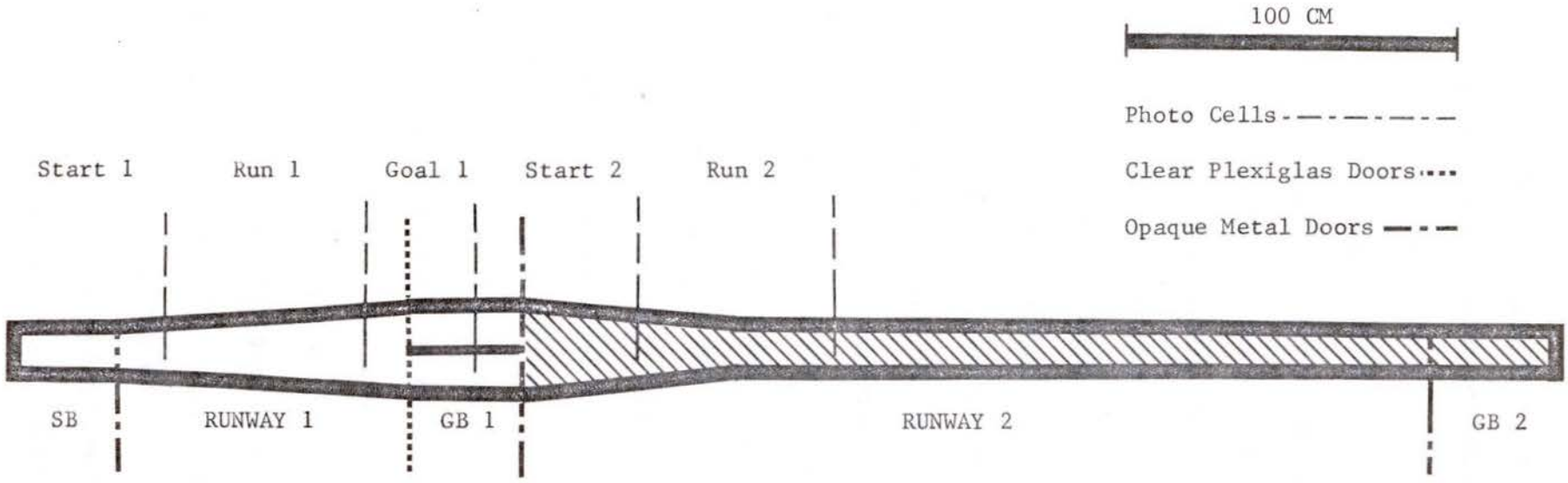

Figure 6. Scale schematic sketch of double runway maze. Apparatus to scale of 20 to 1.

the first four were Training trials and employed procedures for developing (a) discrimination between S+ and S-, and (b) equalizing preference for GB 1 side. The fifth trial was a criterion trial during which the experimental operations which distinguished experimental groups were performed. Because of the complex nature of the procedures employed on Training and Criterion trials, they will be discussed in more detail in separate sections.

Throughout Training and Criterion trials, lighted and unlighted pilot lights which illuminated or darkened the parallel chambers of GB 1, served as discriminative stimuli denoting reward, nonreward, or amount of partial reward. Since previous literature reported a differential effect due to light and dark discriminative stimuli, stimulus condition was made an independent variable and counterbalanced within pairs of experimental Ss. Therefore, for every S within an experimental group for which light was positive and dark was negative (L+D-) there was another S for which dark was positive and light was negative (D+L-).

The Ss were run in platoons of eight Ss each - one S and its stimulus-counterbalanced mate from each of the four experimental groups. There were three such platoons. Each platoon was run in the following subject sequence: Conflict only (L+), Conflict only (D+), Nonconflict Continuous Reward (L+), Frustration plus Conflict (D+), Frustration only (L+), and Frustration only (D+). The general running procedure on all trials was to take an S from its holding cage and place it in the start box. After three seconds the

metal exit door was opened and the animal allowed to run to GB 1. At GB 1 the S encountered either Training or Criterion operations. Once S entered GB 1 the plexiglas entrance door was closed. If the animal was to receive reward on that trial a 45 mg Noyes pellet (20% sucrose added) was present in the food cup and S allowed to eat it. Regardless of the presence of reward or nonreward, the S was confined for 10 seconds on all trials. After 10 seconds the metal exit door of GB 1 was opened and S was allowed to run down the second Alley and into the dark GB 2. GB 2 was always rewarded with a 100 mg Noyes pellet (20% sucrose added). After confinement of 10 seconds in GB 2 the animal was taken out and placed in its holding cage. The maze was wiped with soap and water between each run. When each S had been run once, the cycle of Ss was repeated in the same order until each S was run for five trials.

The same run-order procedure was repeated for Ss in the second and third platoons.

The order in which platoons were run was randomized from day to day.

Training Trials. Training trials involved a slightly modified simultaneous discrimination task approximating differential conditioning. On each trial the lighted and unlighted sides of GB 1 (light and dark being the discriminative stimuli) were simultaneously presented. What differentiated the procedure of these Training trials from the usual simultaneous discrimination procedure was that an S's response was guided

to one or the other sides of GB 1 by closure of the opposite plexiglas entrance door. On Training trials the S was not given a choice between sides. Unlike the usual discriminative conditioning, the procedure used on Training trials subjected S to both S+ and S- on every run, but response to stimuli were fixed by E to one or the other. The guiding procedure controlled S's experience with each of the discriminative stimuli; the percentage of reward associated with each stimulus was determined by the Experimenter. As an example, one block of Training trials for a S might be the following: first the left side of GB 1 might be dark and the right side lighted; the position of the light and dark stimuli randomly altered between runs. Now a Training trial is run, with S guided to the dark, left, side of GB 1 and rewarded; on the second trial, S might be guided to the lighted, right side of GB 1 and not receive reward. At this point the stimuli positions might be reversed; on the third trial, S might be guided to the lighted, now left, side again and not receive reward; and on the fourth trial, S might be guided to the dark, now right, side and receive reward. Thus a series of differential conditioning trials was presented within the context of a guided simultaneous discrimination task.

The specific details of procedures used during Training trials for each experimental group are as follows:

Conflict without Nonreward (C). The light-dark discriminative stimuli were simultaneously presented in the two-parallel chambered GB 1 on each Training trial. Discriminative stimuli

were counterbalanced within the group so that half the Ss were in a L100 and D0 condition and the other half were in a D100 and L0 condition. Training trials were guided by closure of the opposite GB 1 plexiglas entrance door. Two trials in each block were guided to S+ and two to S-. S+ was always rewarded (S_{100}) and S- was never rewarded (S_0). A Gellerman sequence determined reward or nonreward occurrence on any given trial. Because reward/nonreward was related to stimuli in this group the side to which a S was guided was determined by the position of the Stimuli in relation to the sides of GB 1 and by the reward/nonreward sequence. Subjects in Group C were always run first in a platoon. Within Group C, an S in the L100/D0 stimulus condition was run before an S from the D100/L0 condition.

Nonconflict without Nonreward (0). The Training trial procedure used for Group 0 was exactly the same as that used for Group C. The groups differed only in that pairs of Ss in Group 0 formed yoke-mates to pairs of Ss in Group C. Yoking means, for example, that the response of an S in Group 0, stimulus condition L100/D0 was guided so as to duplicate entirely the stimulus, reward, and GB side conditions experienced by its yoke-mate in Group C, stimulus condition L100/D0. Group 0 subjects were run following Ss in Group C. L100/D0 Ss were run before D100/L0 Ss.

Conflict with Frustration (FC). Light and dark discriminative stimuli were simultaneously present in GB 1 on each training trial. Discriminative stimuli were counterbalanced within the

group so that half the Ss were in the L60/D40 condition and half were in the D60/L40 condition. Trials were guided by using the plexiglas entrance doors to GB 1. Two trials in each block were guided to S+ and two S-. S+ was partially rewarded 60% of the time and S- was rewarded 40% of the time, determined over the entire experiment. A Gellerman sequence independent of that used for Group C, determined reward or nonreward on a given trial. The side to which S were guided followed the sequence formed for Groups C and O. Group FC Ss were run following group O and an S from Stimulus condition L60/D40 was run before one in condition D60/L40.

Frustration only (F). Stimuli were counterbalanced within the group so that half of the Ss were in L60 and half were in D60 stimulus conditions. A double GB 1 was used in which light and dark discriminative stimuli were simultaneously presented. However, Ss in Group F were consistently guided to only one stimulus condition or the other. The relevant stimulus was partially rewarded 60% for the five trial block. The sequence of reward within any given block duplicated that of Group FC. Since position of stimuli was randomly altered over trials and Group F Ss were consistently guided to one or the other of the stimuli, the side to which a S was guided varied randomly with the sequence determined for the position of stimuli. As for the other groups, L60 Ss were run before D60 Ss.

Several principles inherent in Training trials should be noted:

1. The discriminative Stimuli (GB light or GB dark) were counterbalanced within groups. Therefore, for half of the Ss in each group light was positive and for the other half dark was positive.

2. The alternating spatial positions of the discriminative light-dark stimuli on successive training trials throughout the experiment were determined by the same Gellerman sequence for all Ss.

3. Independent sequences of reward-nonreward were determined for Group C and Group FC. Group O followed the same reward sequence as Group C; Group F followed the sequence determined for Group FC.

4. Because reward/nonreward was related to stimuli in Groups C and O, the sequence of reward-nonreward also determined the side to which Ss in these groups would be guided. In order to equate experience with spatial positions of GB sides, the Ss in Group FC were guided to the same side as Groups C and O. Because Group F Ss in the two stimulus-counterbalanced conditions were consistently guided to only one appropriate stimulus, the position of that stimulus on any given trial determined the side to which Ss would be guided. The randomization of spatial position of stimuli in relation to GB 1 sides insured equal experience with GB sides for Ss in Group F.

5. By using GB 1 entrance doors to guide Ss' responses on Training trials, a 50/50 ratio of spatial position experience was achieved in all experimental groups.

Criterion trials. The last trial of the five trial block was used as the Criterion trial. Experimental conditions on criterion trials represent the main independent variable. The experimental operations which distinguished experimental groups were as follows:

Conflict without Nonreward (C). S+ was simultaneously presented at both sides of GB 1; both entrance doors were open and an S had a choice of either side. Which ever choice the S made, the response of entering the GB was rewarded 100% of the time. Therefore, this condition was designated as approach-approach conflict and is operationally defined as a free-choice run to the simultaneous presentation of S+ in parallel chambers of GB 1. "Without nonreward" is operationally defined as 100% reward associated with S+.

Nonconflict without Nonreward (O). The stimulus and reward conditions on Criterion trials for Group O were the same as for Group C. The operations distinguishing Group O differed from those of Group C in that rather than an S in Group O having a choice of sides, its response was guided by the plexiglas doors to the side that its yoke-mate in Group C had chosen. Therefore, if the D100 S in Group C had entered the left side of GB 1, then the D100 yoke-mate in Group O would be guided to the left side of GB 1. Responses of Group O Ss on Criterion trials were rewarded 100% of the time. Nonconflict was operationally defined as not having a choice between the two S+ sides of GB 1. The operational definition of Without nonreward was presented in Group C.

Frustration with Conflict (FC). For Group FC, discriminative stimuli had an associated reinforcement ratio of $S\pm_{60}/S\pm_{40}$ over the experiment. During Criterion trials the light-dark discriminative stimuli were presented simultaneously in GB 1. Both plexiglas entrance doors to GB 1 were open and the S had a choice of either side. Which ever choice was made, the response of entering the GB was never rewarded. Therefore, the conflict condition was operationally defined as a free choice run to the simultaneous presentation of stimuli occasioning partial reward. Frustration is operationally defined, in this context, as nonreward following the expectation of reward.

Frustration only (F). The experimental conditions defining Group F were intended to approximate an Amsel Frustrative-nonreward group within the context of a simultaneous discrimination task. During Criterion trials both stimuli were present in GB 1. However, Ss in Group F were always guided to their assigned discriminative stimulus occasioning partial reward (either L60 or D60). As on Training trials, the alternate stimulus was irrelevant, since Ss were never allowed to enter that GB side and experience reward or nonreward. Responses of Group F Ss on Criterion trials were never reinforced. Frustration, within this context, is operationally defined as nonreward following the expectation of reward.

Aside from experimental manipulation in GB 1, the general running procedures of Criterion trials followed those employed on Training trials. The main distinctions of Criterion trials

and Training trials lie in the experimental conditions occurring in GB 1.

A summary of experimental operations defining groups is presented in Table III.

Discrimination Test Procedure. A post hoc test of the success of discrimination training was done on the day immediately following the fifteenth Block of Experiment I. On each trial, light and dark discriminative stimuli were simultaneously presented in the parallel halves of GB 1; Ss were given free access to either side and required to choose one of them. Five such trials were run. Position of the discriminative stimuli were randomized over trials. For each group reward/nonreward ratios associated with each stimulus remained the same as in the actual experiment, but amount of reward obtained was naturally contingent upon S's correct, discriminated response. Subjects were run in platoons and in the same S-within-platoon order as in the actual experiment. As always, the maze was wiped between each S. Data on run times were not recorded since only the choice of discriminative stimulus was of interest.

RESULTS

All original running time scores were transformed to their reciprocals in order to insure homogeneity of variance within the transformed scale. The original and transformed data are recorded in Appendix B.

A spurious Goal 1 score for a S in Group 0, stimulus condition L100/D0, occurred on the Criterion trial of Block 7.

Table III

Summary of the Operations Defining Experimental Groups

Experimental Groups	Description of Conditions	Disc. Stim. & Reinforcement Rate	Training Trials 1 2 3 4	Criterion Trial 5
1. Conflict without Nonreward (C)	Double GB 1. Trials guided by GB 1 doors. Half to S+ half to S-. S+ always rewarded. Stimuli counter-balanced.	L100 D0 D100 L0	Gellerman sequence determined position of stimuli & reward.	S+ S+ Free Choice
2. Nonconflict without Nonreward (O)	Double GB 1. Trials guided by GB 1 doors. Half to S+ half to S-. S+ always rewarded. Guided to S+ on Criterion trial - Training and Criterion trials yoked to Grp. C Ss.	L100 D0 D100 L0	Sequence yoked to Group C.	S+ S+ Yoked to Grp. C
3. Conflict with Frustration (FC)	Double GB 1. Trials guided by GB 1 doors. 60/40 reinforcement rate - random in 5 trial blk. Gellerman sequence determines position and reward. Criterion trial nonrewarded.	L60 D40 D60 L40	Gellerman sequence determined position of stimuli & reward.	S_{60} S_{40} Free Choice
4. Frustration only (F) (Amsel control)	Double GB 1. S60 is only stimulus to which Ss are guided. Other stimulus is irrelevant. Reward is 60% for a blk. and yoked to Grp. FC. Criterion trial nonrewarded.	L60 Irrel D60 Irrel	Sequence of reward yoked to Group FC.	S_{60} Irrel. Guided to S_{60}

N.B. Discriminative stimuli used were lighted (L) and unlighted (D) pilot lights. GB 1 stands for Goal Box 1. Numbers under reinforcement rate indicate percent reinforcement of each stimulus. Symbols under Criterion Trial indicate what discriminative stimuli were presented in GB 1 on that trial.

This was corrected by giving the S a score equal to the mean of the scores achieved by the other Ss in this cell. Substituting the mean of the sample is considered to be the most acceptable of the various methods of substitution, although technically one degree of freedom is lost. Overall analyses performed with and without correction found that correction made little difference to the probability of results. The analyses on Goal 1 reported in this section included this corrected score.

Between Groups Analyses

Analyses utilizing the complete design

Exact tests of the repeated measure data within the mixed design were performed for each of the five dependent measures by means of multivariate analyses of Variance (Morrison, 1967; Wilson and Lange, 1972). The computer program MANOVA (Clyde Computing Service) was used on the IBM 370 computer at the University of Victoria. Raw running time scores were transferred to punch cards and verified by hand. These raw scores were then transformed to reciprocals of the raw scores by a transformation program of the author's own writing. All means and variances were verified by parallel runs between MANOVA and a traditional mixed design analysis of variance program (ANOVA88) on file in the computer centre.

Only data from Criterion trials were analyzed and are reported in this subsection. The traditional critical level of $\alpha = .05$ was used to determine statistical significance.

Start 1. No statistically significant effects were found in an analysis of the dependent variable Start 1.

Results of this analysis are summarized in Table IV and presented graphically in Figure 7.

Run 1. The higher order interaction of Blocks X Groups X Stimuli was significant ($p < .024$), indicating differences between the profile shapes formed over the Trial Blocks of the four groups under the different Stimulus conditions. Inspection of the Groups X Stimuli interaction (Figure 10) and the Stimuli X Blocks interaction (Figure 9) reveals that differential reactions between Groups C and O developed with practice, relative to whether the discriminanda were L+D- or L-D+. This effect between Groups C and O accounts for the bulk of the triple interaction. Interestingly, however, no trend components were significant for this interaction. While fourth and ninth order components had the lowest probabilities ($p < .089$ and $p < .055$), quadratic and twelth order components possessed the largest discriminant weights. No ascertainable single component accurately describes the differences in group profiles found in the overall test of the interaction.

The Blocks X Groups interaction was also significant at $p < .014$. An inspection of Figure 7 revealed that all groups showed numerous block to block variations in performance early in the experiment. Later, as the effect of practice became apparent, Group O ran the fastest and Group FC ran the slowest in this section of Alley 1. During this phase of the experiment running speeds of Groups C and F converged midway between those of Groups O and FC. Linear ($p < .060$) and fourth order components of trend were most descriptive

of the difference in the group profile developed during the experiment.

The Blocks X Stimuli interaction was not significant ($p < .052$) at the traditional critical level. A tenth order component of trend was significant, and indicates that there was a considerable variation in the differential effect of stimuli over the experiment.

The Blocks factor was significant at $p < .003$, indicating that Ss ran faster in this section of the first alley as the experiment progressed. The trend was linear ($p < .001$), meaning that running speed developed at a constant rate with practice.

No between-S effects were found to be significant. See Table IV for a summary of findings related to the Run 1 measure.

Goal 1. Only the Blocks factor was found to be significant ($p < .032$) in an analysis of the Goal 1 measure. The trend of Blocks was composed of significant linear ($p < .001$) and quadratic ($p < .001$) components. The Ss apparently entered the GB 1 faster with practice as the experiment progressed. Table IV summarizes these findings. Figure 7 presents the data graphically.

Start 2. No effects were found to be significant on this dependent variable. Apparently Start 2 running speed was not affected significantly by any of the independent variables, or their interactions. See Table V and Figure 8 for results.

Run 2. No effects for Run 2 were significant. The lack of differential effects of the independent variables found on Start 2 were also reflected in this section of the second alley. Table V and Figure 8 summarize these findings.

In general, the hypotheses of the overall design were not supported. The only results which were correctly predicted were the increases in running speeds, developed with practice, found in the Run 1 and Goal 1 sections of the first alley.

The differential effects of experimental conditions developed during the progress of the experiment revealed in the Run 1 section of the first alley were also predicted. It was not surprising, since avoidance tendencies should have the least effect on approach in Group O and the most effect in Group FC.

The Blocks X Groups X Stimuli interaction of Run 1 was not predicted. It means that Groups C and O reacted differently from block to block, relative to whether or not discriminanda were L+D- or D+L-.

Originally it was planned that groups could be collapsed over stimuli, since it was expected that stimuli would exhibit no differential effects or at least no interactions. However, because the numbers in each group are small it is necessary to pool Ss within groups and ignore the factor of Stimuli. Because the effect of stimuli varied from block to block and did not show a consistent divergence to either faster or slower running speed, collapsing over the Stimulus factor may be tolerated. However, subsequent interpretations

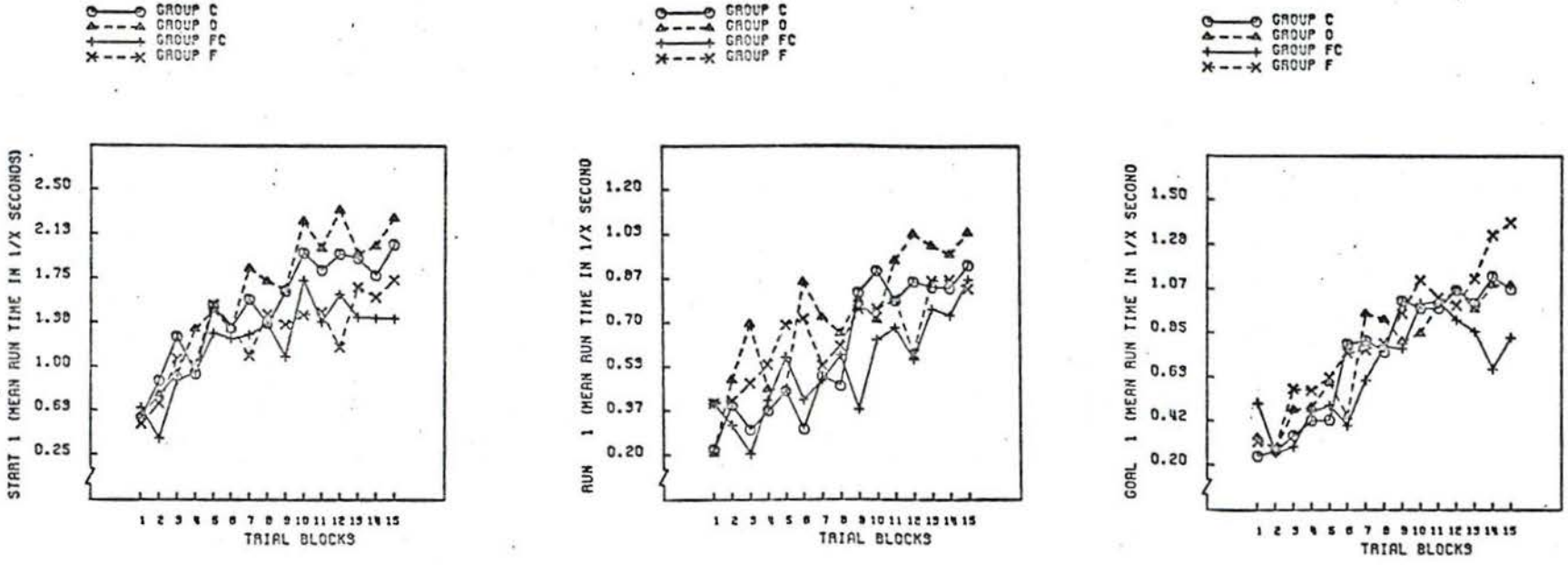

Figure 7. Experiment I. Performance of experimental groups over trial blocks. Mean 1/run times on the three dependent variables obtained from the first alley. The stimuli condition has been collapsed over experimental groups.

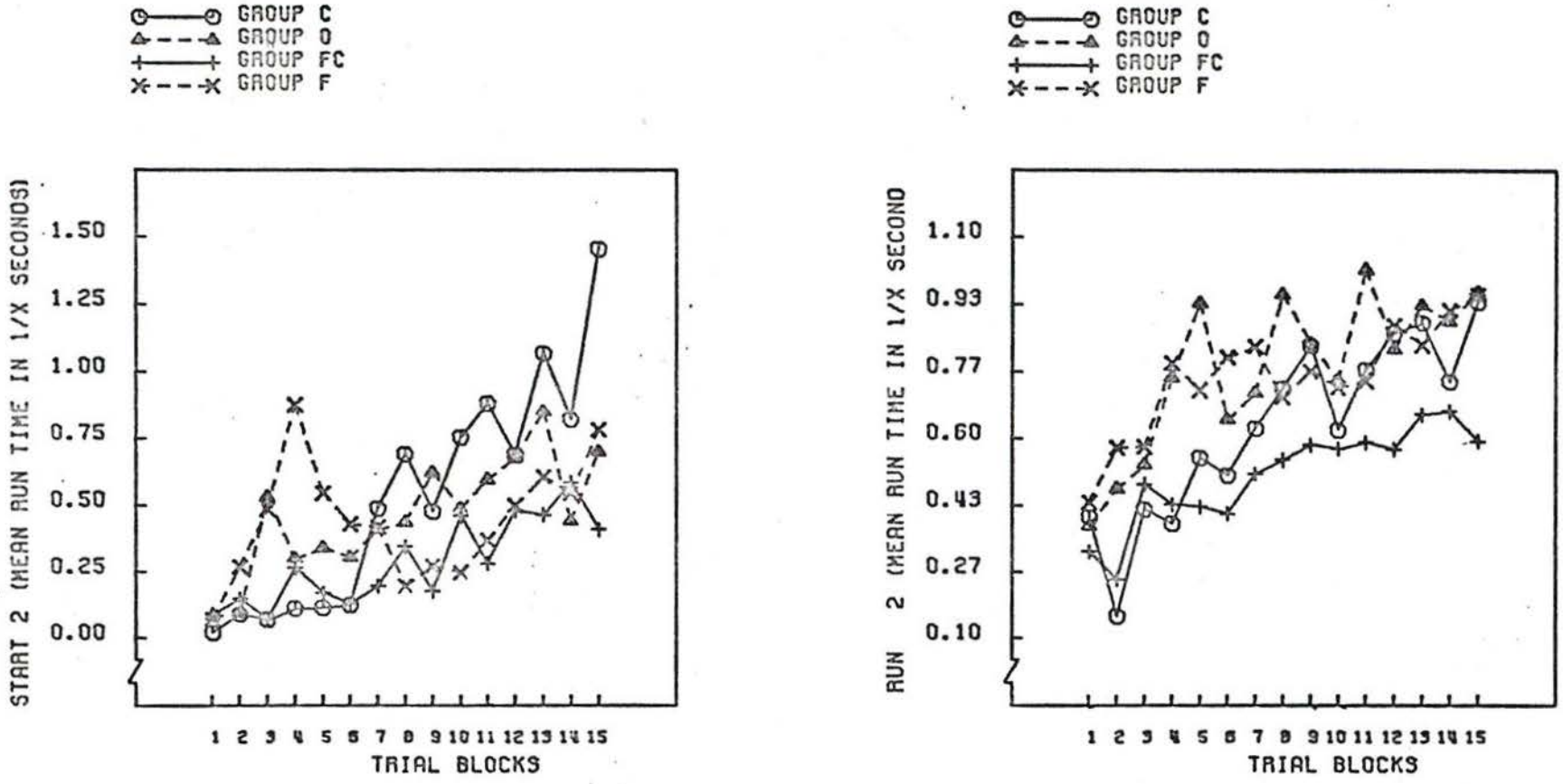

Figure 8. Experiment I. Performance of experimental groups over trial blocks. Mean 1/run times on the two dependent variables obtained from the second alley. The stimuli condition has been collapsed over experimental groups.

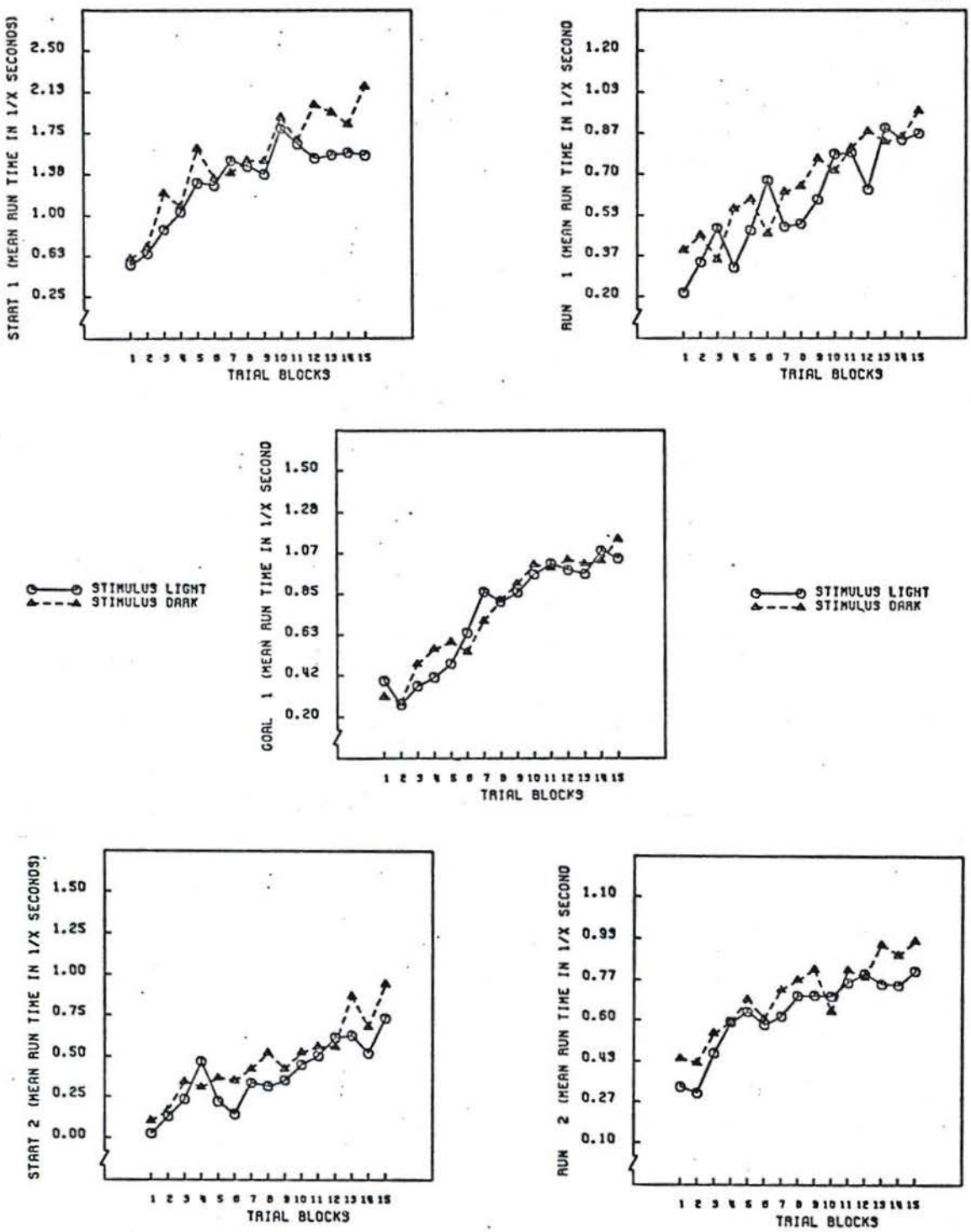

Figure 9. Experiment I. The effect of stimuli over trial blocks. Mean 1/run times on the five dependent variables. Experimental groups have been collapsed over the stimuli condition.

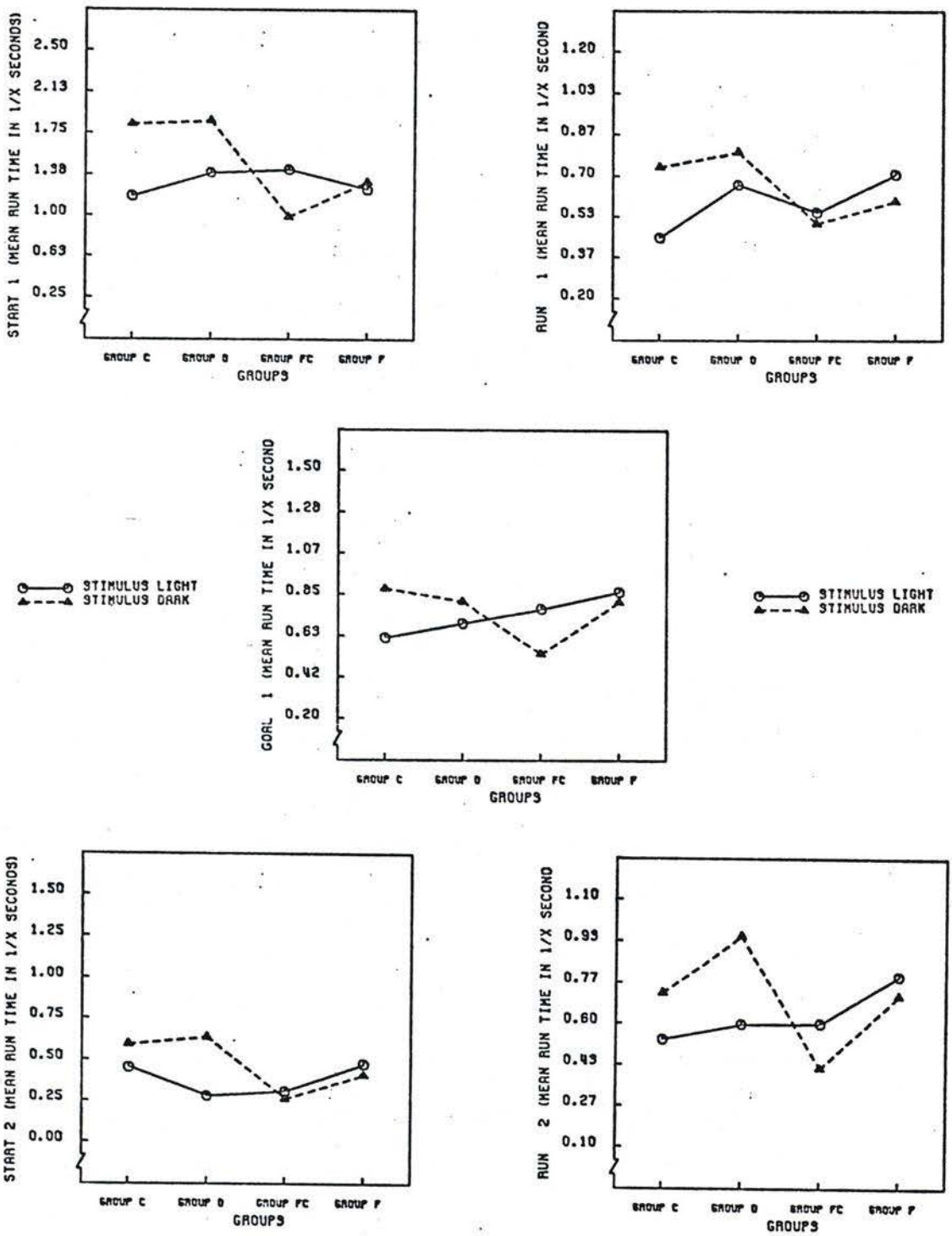

Figure 10. Experiment I. The effect of stimuli over experimental groups. Mean 1/run times on the five dependent variables. Trial blocks have been collapsed.

of findings relating to the Run 1 measure took the confounding of Stimulus effects with error into account.

Multiple Comparisons of Group Means

Overall analyses only determine if there is at least one group different from the others; it does not answer the question of which groups are different from the other groups. To answer such a question multiple comparisons between the various group means were performed. Accordingly, data from Criterion trials for each S was averaged over three sets of five Criterion trial Blocks. Therefore, the first five blocks of the 15 Block experiment formed the initial set; the second five formed the middle set; and the last five formed the final set. The means of these three sets formed the data for the multiple comparisons calculated by the Newman-Keuls technique (Winer, 1962). Results of these analyses are presented in Tables VI through X.

Interestingly, the analyses found no statistically significant differences between groups, not even at the final phase of the experiment. The rank ordering of Group means was generally as predicted (compare Table II with Tables VI to X) for first alley speed, although differences are non-significant. However, ranking of Group means of second alley speeds gave nearly opposite results to those predicted. These lend support to the overall finding that experimental manipulation produced little differences between the performance of groups.

Within-S Comparisons of Rewarded vs Nonrewarded Training Trials

Means of rewarded and nonrewarded Training trials within each of the 15 Blocks were computed for each of the Ss in all experimental groups. These means were then compared in order to investigate possible within-S "frustration" effects. Each analysis took the form of a two-within-S analysis of variance, where Reward vs Nonreward Trial Conditions represented one factor and Trial Blocks represented the other. The Stimuli (L+D-/D+L-) factor included in the larger mixed design was not considered in within-S analyses since this was not a within-S variable, and is of little theoretical interest to the main thesis. Separate analyses were performed for each of the experimental groups and each of the five dependent variables. Analyses were computed on the University's IBM 370 using a within-S analysis of variance program, ANOVA88. Verification of means and variances were performed by comparing them with those obtained from the program MANOVA and a means summary program of the author's own writing.

Group C. Summaries of the individual analyses performed on the Conflict group (C) data are presented in Tables XI through XV. The same data are graphically presented in Figures 11 through 15.

The Trial Blocks effect was found to be statistically significant for all five dependent variables. Such findings merely indicate an expected increase in running speed with practice, in all portions of the maze.

A statistically significant Blocks X Trial Conditions interaction emerged on dependent variable Goal 1 ($p < .002$). The pattern of this interaction is characterized by a series of fluctuations in entry speed occurring between the fifth and twelth Blocks. Speed of entry into GB 1 for Group C was slightly faster on nonrewarded trials from Blocks five to eight, but then speed of entry became faster on rewarded trials from Blocks nine to twelve. This finding indicates that the S- stimulus associated with nonreward began to elicit avoidance tendencies later in the experiment. Most interestingly, the pattern of trend underlying this interaction shows a remarkable concordance to the within-S PRE acquisition findings reported by Amsel (1967).

On the basis of the nonsignificant findings of analyses of Start 2 and Run 2 variables, it must be concluded that Group C did not manifest a measurable within-S frustration effect (FE). The implication therefore is that discrimination had occurred successfully but nonreward produced only a small increase in the level of motivation of Group C Ss.

Group O. Summaries of the individual analyses performed on the Nonconflict control group (O) data may be found in Tables XI through XV. Graphic presentation of these same data may be found in Figures 11 through 15.

The Blocks effect was found to be statistically significant for all dependent measures ($p < .0009$). As expected, the Ss learned to run faster with practice.

Significant Blocks X Trial Conditions interactions emerged in all but the Start 1 measure.

The pattern of trend underlying the Blocks X Trial Conditions interaction found for Run 1 is most generally characterized by numerous fluctuations in running speed that began at Block 5 and continued until the end of the experiment. This implies that at no time during the experiment did stimuli occasioning reward or nonreward elicit consistent control of running in this section of the alley.

The pattern of trend underlying the Blocks X Trial Conditions interaction of Goal 1 is similar to that found for Group C. It is characterized by faster entry of Group O Ss into GB 1 during nonrewarded Training trials beginning at Block 5, then faster entry on rewarded Training trials during Blocks 9 through 12. As for Group C, this indicates that the stimulus occasioning nonreward began to elicit avoidance tendencies during the latter phase of the experiment.

A pattern of numerous fluctuations in running speed in the second alley was shown by Group O Ss (dependent measures Start 2 and Run 2). These fluctuations began at Block 5, and continued until Block 12. At that point, running became faster following nonreward in GB 1 than when reward occurred in GB 1; this was more apparent in the Start 2 section of Alley 2 than in the Run 2 section. This elevation of running following nonreward in GB 1 produced the significant interactions found on Start 2 and Run 2 measures and indicates a within-S frustration effect.

Group FC. Summaries of the individual analyses performed on the Frustration with Conflict (FC) data are presented in Tables XI through XV. Figure 11 through Figure 15 present these data in graphic form.

The Blocks effect was found to be significant for all but the Run, 2 measure; it was marginally significant for Start 2 ($p < .045$). Again this indicates that Ss learned to run faster as the experiment progressed.

A significant Blocks X Conditions interaction was found in the analysis of the Start 2 measure ($p < .002$). The pattern of this interaction shows numerous block to block fluctuations from the start of acquisition; however, the significant interaction probably depends primarily upon the extreme difference between nonreward and reward showing only in Block 15.

A significant Trial Conditions main effect was found for the Run 2 measure ($p < .019$). Beginning at Block 2, running in this section of the second alley became faster following nonreward in GB 1 than following reward, and remained faster except for a crossover at Block 8 and convergence at Block 14. This finding indicates that nonreward in GB 1 produced a within-S frustration effect in Group FC. However, the frustration effect was primarily evident in the Run 2 section of Alley 2 and no avoidance effects were elicited by the stimuli occasioning nonreward in GB 1.

Group F. Tables XI through XV present the findings of individual analyses performed on the Frustration only (F) data. The graphic presentation may be found in Figures 11 - 15.

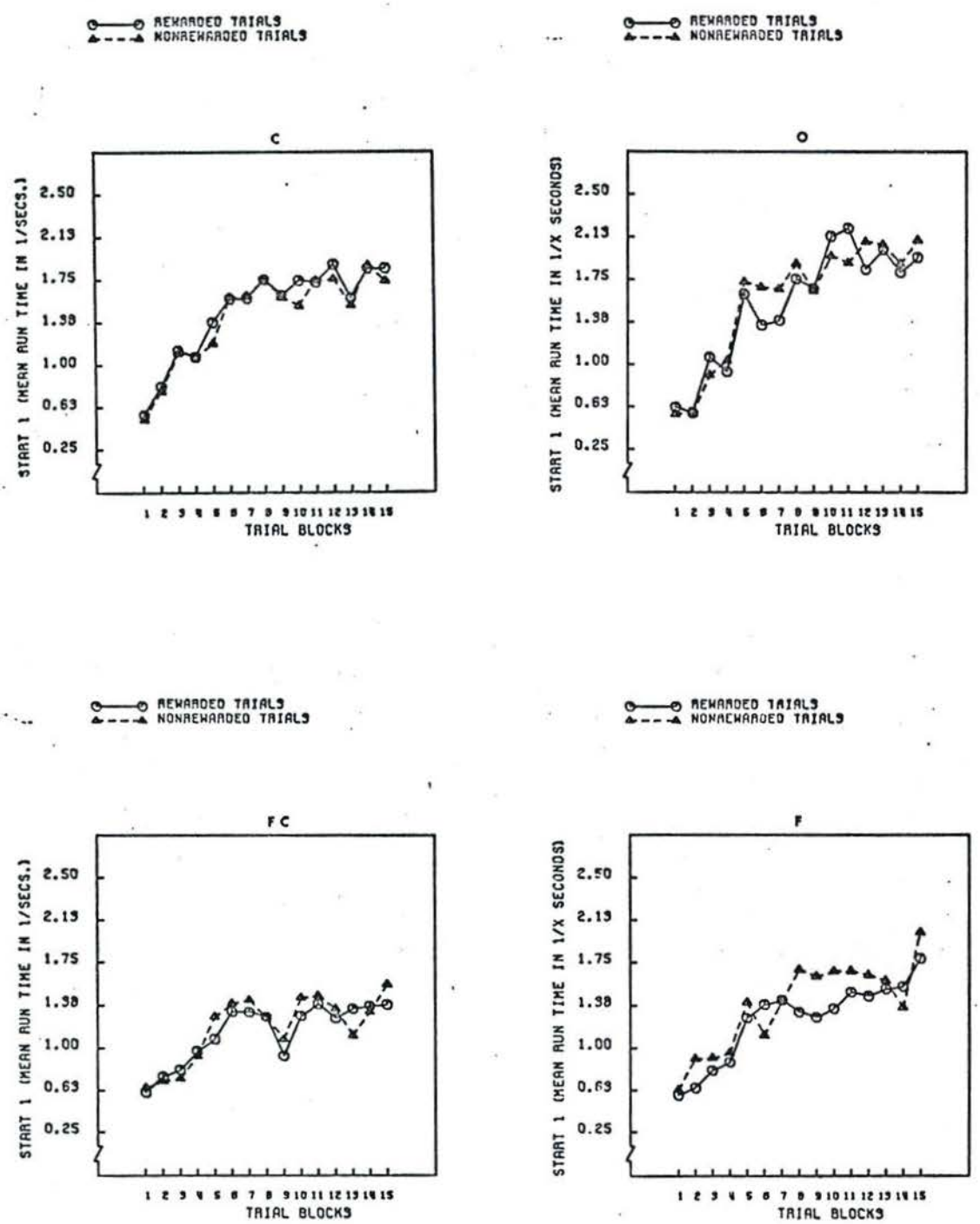

Figure 11. Experiment I. Within-S comparison of rewarded and nonrewarded training trials for Conflict (C), Nonconflict (O), Frustration with Conflict (FC), and Frustration groups. Mean 1/run times of Start 1.

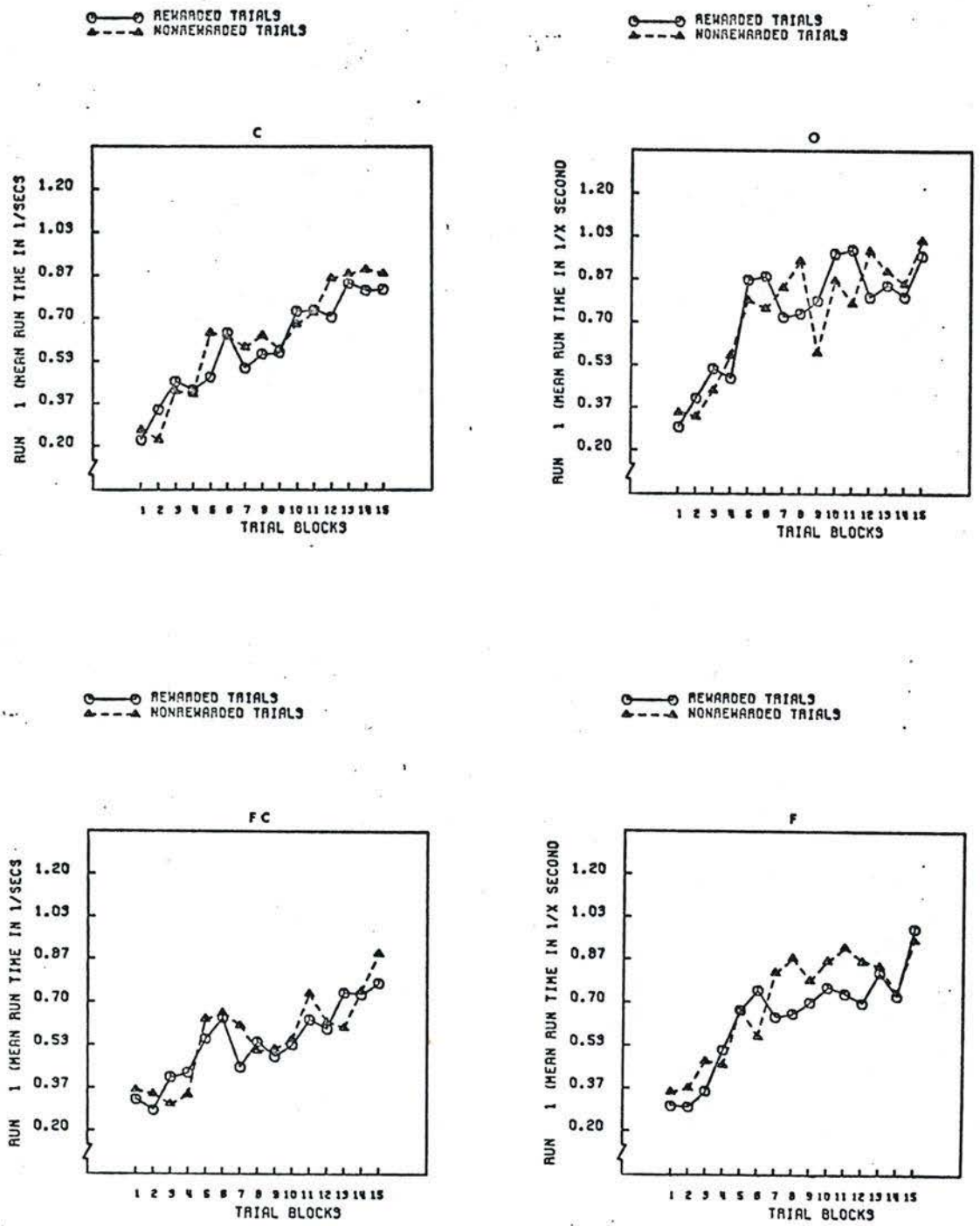

Figure 12. Experiment I. Within-S comparison of rewarded and nonrewarded training trials for Conflict (C), Nonconflict (O), Frustration with Conflict (FC), and Frustration groups. Mean 1/run times of Run 1.

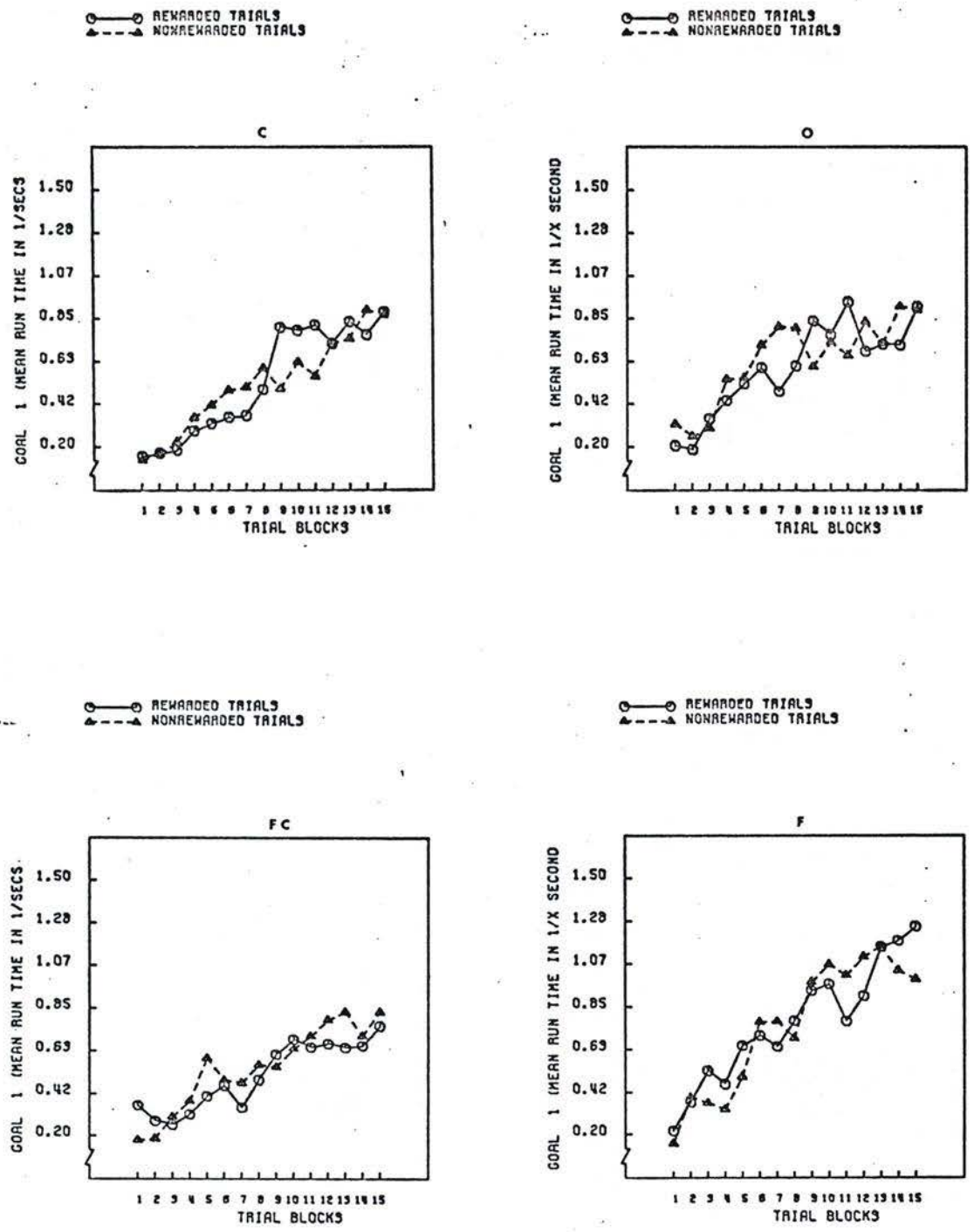

Figure 13. Experiment I. Within-S comparison of rewarded and nonrewarded training trials for Conflict (C), Nonconflict (O), Frustration with Conflict (FC), and Frustration groups. Mean 1/run times of Goal 1.

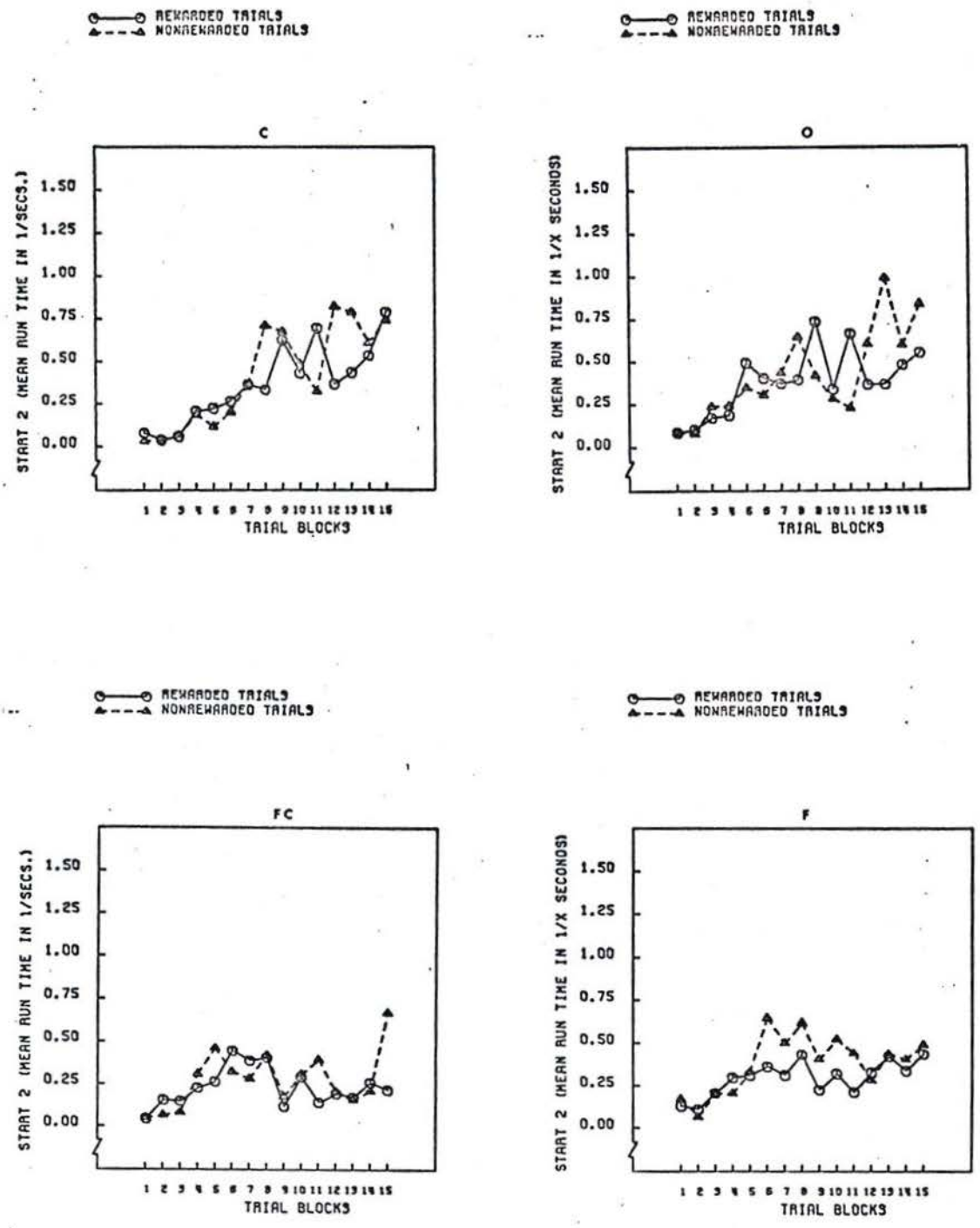

Figure 14. Experiment I. Within-S comparison of rewarded and nonrewarded training trials for Conflict (C), Nonconflict (O), Frustration with Conflict (FC), and Frustration groups. Mean 1/run times of Start 2.

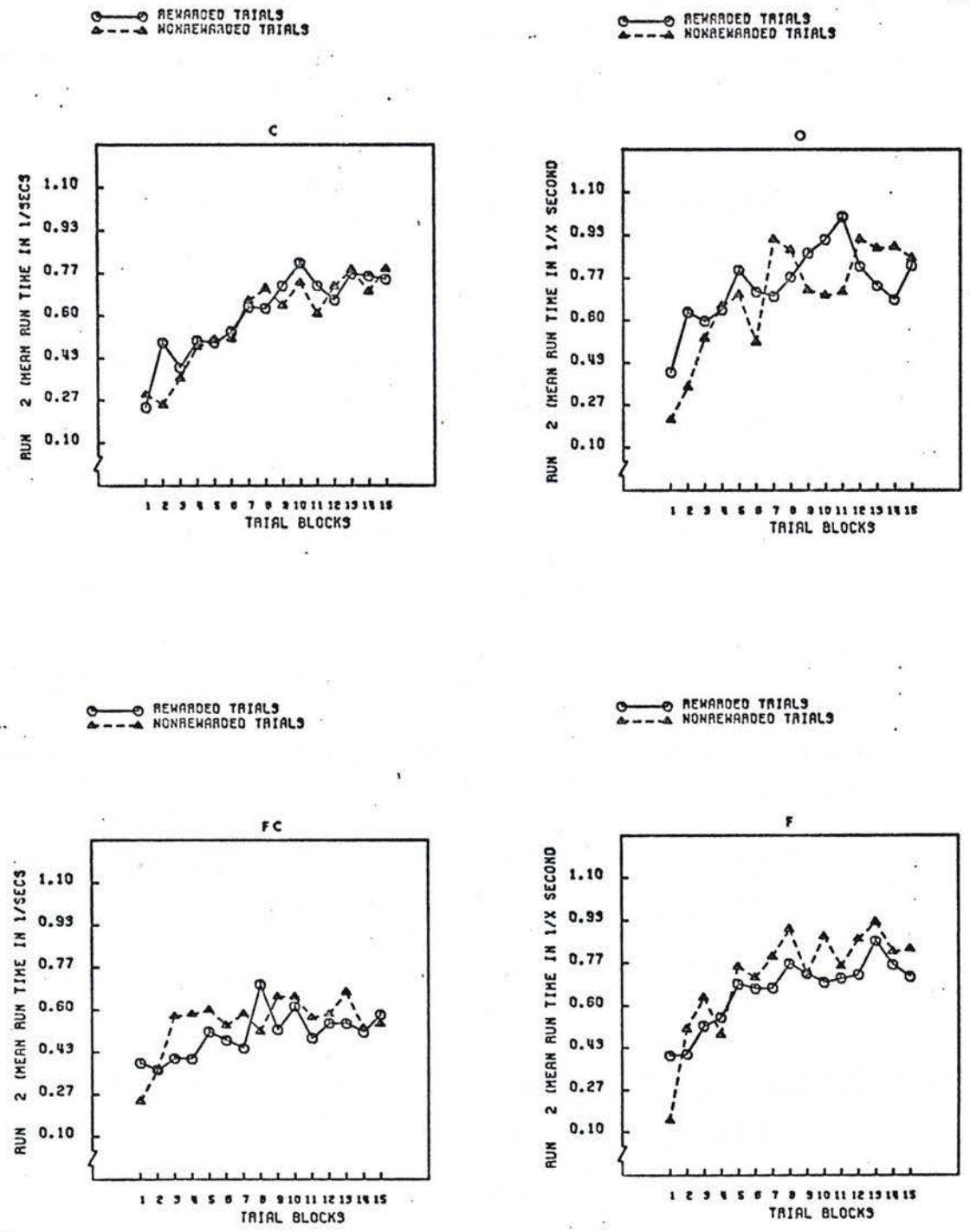

Figure 15. Experiment I. Within-S comparison of rewarded and nonrewarded training trials for Conflict (C), Nonconflict (O), Frustration with Conflict (FC), and Frustration groups. Mean 1/run times of Run 2.

All Blocks effects, except for Start 2, ($p < .064$), were significant at $p < .0009$.

The Trial Conditions main effect was significant ($p < .007$) for the Start 1 measure. On nonreinforced Training trials the mean Group F speed of starting into Alley 1 became clearly faster than on reinforced trials at Block 8, and remained faster until Block 12. This period of faster starting was sufficient to produce a main effect rather than an interaction.

A significant Blocks X Trial Conditions interaction was found in the Run 2 analysis ($p < .045$). Running speed after nonreward in GB 1 became faster than on rewarded trials at Block 5 and remained faster until the end of experimentation. This same pattern was also evident in the Start 2 measure, except that the two types of trials converged again at Block 12. Probably for this reason the Trial Conditions effect did not reach significance ($p < .063$). These findings of elevated running speed in the second alley following nonreward in GB 1 suggest the expected presence of a within-S frustration effect in Group F.

Within-S Analyses of Rewarded Training Trials vs the Criterion Trial

In the following analyses, the mean running time on rewarded Training trials was compared to the running time on the fifth, or Criterion trial of each Block. The reader is reminded that Ss were always guided to one or the other of the sides of GB 1 during Training trials. In this analysis only rewarded trials are compared to Criterion trials. The

experimental conditions during Criterion trials varied between groups: Group C had a choice between two S+ stimuli and was always rewarded; Group O was presented two S+ stimuli but was guided to the side chosen by their yoke-mate in Group C and was always rewarded; Group FC had a choice between two S± (S_{60} and S_{40}) stimuli but was never rewarded; and Group F was presented both the S± (S_{60}) and the alternate irrelevant stimuli, but was always guided to S_{60} and never rewarded. As in the previous within-S analyses, the Stimulus factor was ignored. Separate analyses were performed for each of the five dependent variables and for each of the four experimental groups. All analyses were computed by ANOVA88 on the university's IBM 370. Means and variances were verified by comparing them to output from MANOVA and a summary program written by the author.

Group C. Results of the individual analyses of Group C data are summarized in Tables XVI through XXII. Figures 16 through 20 present the data in graphic form.

The Trial Blocks effect was statistically significant ($p < .0009$) for all five dependent measures. As expected, the performance of Group C Ss improved with practice.

The main comparison between Rewarded Training vs Criterion trials (hereafter referred to as the Trial Conditions effect) was found to be significant for Goal 1 ($p < .001$) and Start 2 ($p < .047$) measures.

Group C Ss showed a clearly faster entry into GB 1 on Criterion trials than on Rewarded Training trials. This finding

was definitely opposite to the original prediction and strongly implies that the operation of approach-approach conflict increased the vigor of responding in the goal section of Alley 1 when compared to performance on Rewarded Training trials, when no choice was available.

Running speed in the Start 2 section of the second alley became clearly faster at Block 10 following conflict operations during Criterion trials than running speed following reward during Training trials. This finding lends support to the main thesis that conflict alone, without elements of nonreward, can produce "frustration-like" effects. This increase in running speed in the second alley following conflict indicates an elevation in the general level of motivation of a S; it is more accurate to refer to the phenomenon as a Conflict Effect.

A Blocks X Trial Conditions interaction was found to be significant on the Run 2 ($p < .019$) measure. This significant interaction appears to have been produced by numerous fluctuations in running speed occurring early in the experiment and faster running following conflict operations during Criterion trials occurring in the last five Blocks of the experiment. As a check on this interpretation of the interaction, an analysis was performed which included only the last five Blocks. This analysis found a significant Trial Condition main effect ($p < .037$) which supports the conclusion that a conflict effect did emerge following acquisition of approach to S+ (Table XXII).

A Blocks X Trial Conditions interaction ($p < .022$) was also found on the Run 1 measure. The pattern characterizing this interaction indicates that in the first half of the experiment, running speed of Ss was slower in this section of Alley 1 during Criterion trials than during rewarded Training trials, but that running became faster during Criterion trials in the last half of the experiment. It appeared that the energizing effect of conflict operations moved backward along the behavioral sequence as the experiment progressed.

Group O. Results of the individual analyses of Group O data are presented in Tables XVI through XXII. Figures 16 through 20 present graphic summaries.

The Blocks effect was significant ($p < .0009$) for all but the Start 2 measure, which was significant at $p < .002$, all as expected.

The only other effect found to be significant was the Trial Conditions main effect on Goal 1 ($p < .001$). The effect was produced by faster entries into GB 1 on Criterion trials than on Rewarded Training trials beginning at Block 7, slowing quickly until Block 12, then increasing again until the end of the experiment. Actually, the main effect result does not seem to be due so much to an increase in the vigor of goal entry during Criterion trials as it does to a decrease in the speed of entry of Group O Ss during rewarded Training trials.

It is important to note that the lack of significantly faster running following Criterion trial operations than

following Rewarded Training trial operations in GB 1, as measured in the second alley of the apparatus, provides an important conceptual comparison to the significant results found on these measures for Group C. The lack of differential effects due to GB 1 conditions experienced by Group O Ss provides some support for the conclusion that Conflict operations produced the effects found for Group C. It is true that a significant Trial Conditions main effect ($p < .030$) was also found for Group O on the Run 2 measure when only the last five Blocks were analyzed; however, the effect was produced by slower running following reward on Training trials rather than faster running following reward on Criterion trials. For Group C this effect was produced by faster running following conflict operations. (See Table XXII and Figure 20).

Group FC. The individual analyses of Group FC data are presented in Tables XVI through XXII. Figures 16 through 20 present the data graphically.

Blocks effects were significant for all but the Run 2 measure. Group FC Ss learned to run faster in all but the Run 2 section of the maze.

A significant Trial Conditions main effect was found on Start 1 ($p < .036$). The data indicate that Ss started faster during Criterion trials, if fluctuations in starting speed over Blocks are ignored. An inspection of Figure 16 does not reveal clearly significant differences in the two types of trials. The lack of apparent differences leaves the impression

that this finding may be an artifact, due to the sensitive nature of within-S analyses.

The Trial Conditions main effect was significant for Goal 1 ($p < .015$). This effect was produced by faster entry into GB 1 during conflict operations of Criterion trials. The increased vigor of approach was most clearly apparent from Blocks 7 to 13. As for Group C, one apparent effect of having a choice of GB 1 sides is an increase in the vigor of approach to goal beyond that seen during rewarded Training trials, during which no choice was given. Another inference here is that the FC Ss did not form a discriminated criterion trial avoidance due to nonreward, or if they did its effect was to increase approach speed.

A Blocks X Trial Conditions interaction was found to be significant for Start 2 ($p < .013$). The pattern that characterized this interaction was one of numerous fluctuations in running speed lasting until Block 10; at that point, running speed following Conflict and Nonreward operations in GB 1 during Criterion trials became faster than running speed following reward during Training trials. This interpretation of the interaction is supported by a significant Trial Conditions main effect ($p < .035$) found when only the last five Blocks were analyzed (see Table XXI).

Group F. Results of the individual analyses of Group F data are summarized in Tables XVI through XXII. Figures 16 through 20 present this data in graphic form.

All Blocks effects except for the Start 2 measure, were significant at $p < .0009$. This indicates that Group F, like the other groups, ran faster in most sections of the maze with practice.

A significant Trial Conditions main effect was found on Goal 1 ($p < .035$). However, this finding almost defies interpretation. The only points at which speed of entry into GB 1 during Criterion trials appears to be faster than on Rewarded Training trials are at Blocks 10, 11, 12, 14 and 15. Moreover, the collapsed means that are compared are .769 for Rewarded Training trials and .840 for Criterion trials. It seems unlikely that this difference could produce a significant result, but nonetheless, the magnitude of the contrast was found to be significant, relative to a very small error mean square.

No other within-S effects were significant in Group F. However, the Trial Conditions main effect for Start 2 was nearly significant ($p < .051$). Faster running speed following nonreward on Criterion trials, during the initial five and final five Blocks of the experiment, appeared to produce this effect. In support of this interpretation, an analysis of the final five Blocks of the experiment found a significant Trial Conditions main effect ($p < .012$). (See Table XXI). An analysis of the first five Blocks did not find a significant Trial Conditions effect ($F = 1.95$, $df = 1/5$, $p < .221$), nor a significant Blocks X Conditions interaction ($F = 1.516$, $df = 4/20$, $p < .235$). It was surprising that these effects

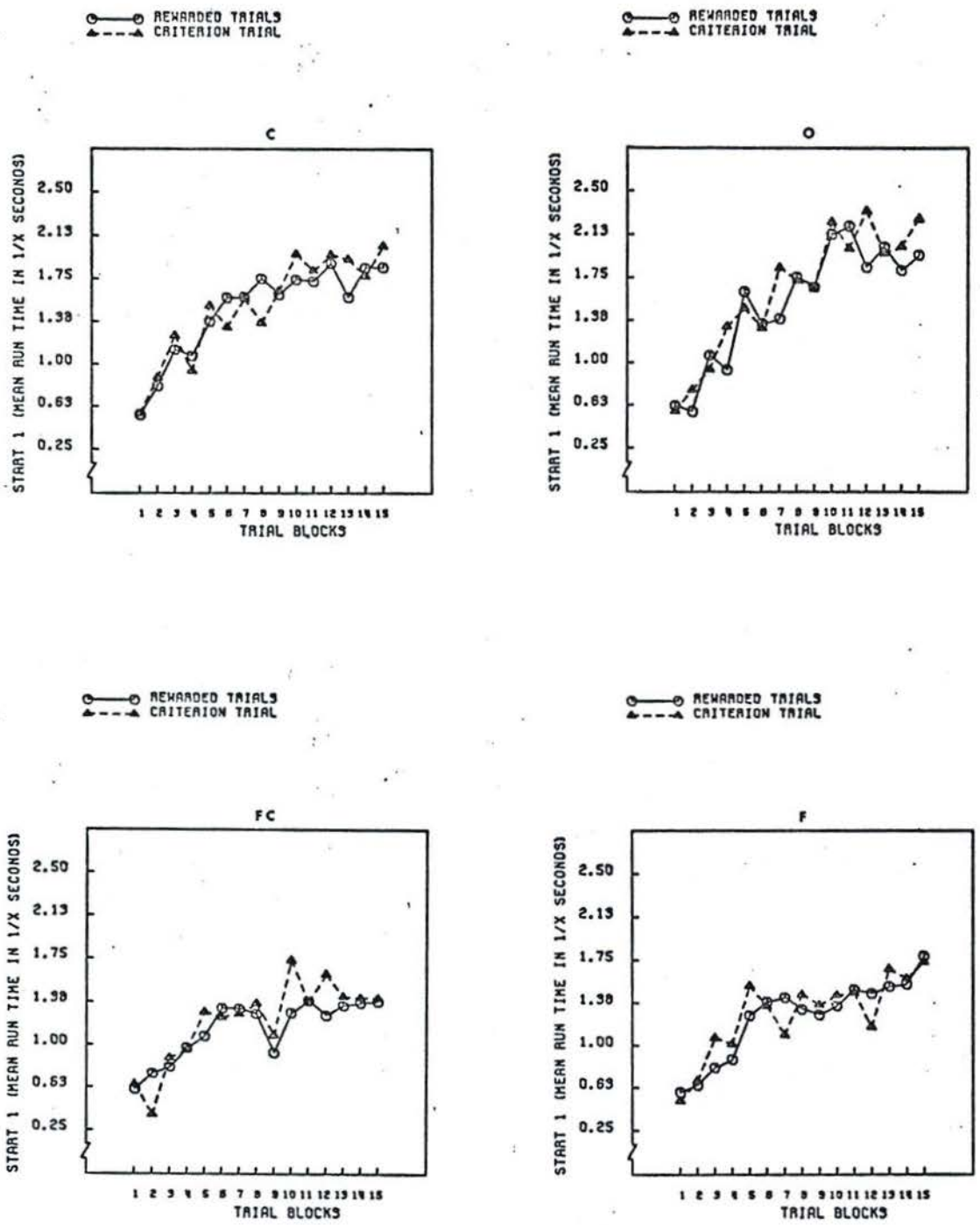

Figure 16. Experiment I. Within-S comparison of rewarded training trials and criterion trials for Conflict (C), Nonconflict (O), Frustration with Conflict (FC), and Frustration groups. Mean 1/run times of Start 1.

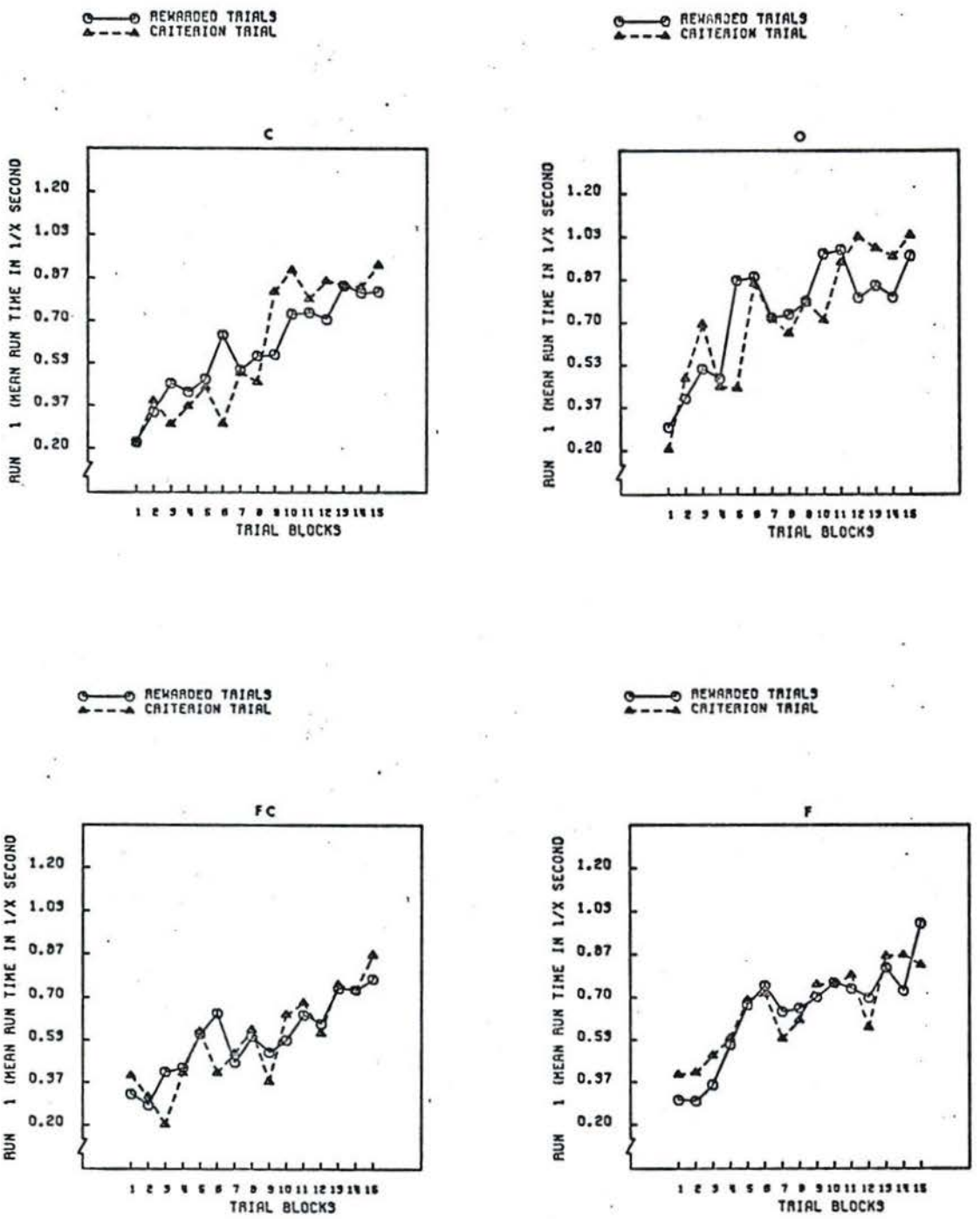

Figure 17. Experiment I. Within-S comparison of rewarded training trials and criterion trials for Conflict (C), Nonconflict (O), Frustration with Conflict (FC), and Frustration groups. Mean 1/run times of Run 1.

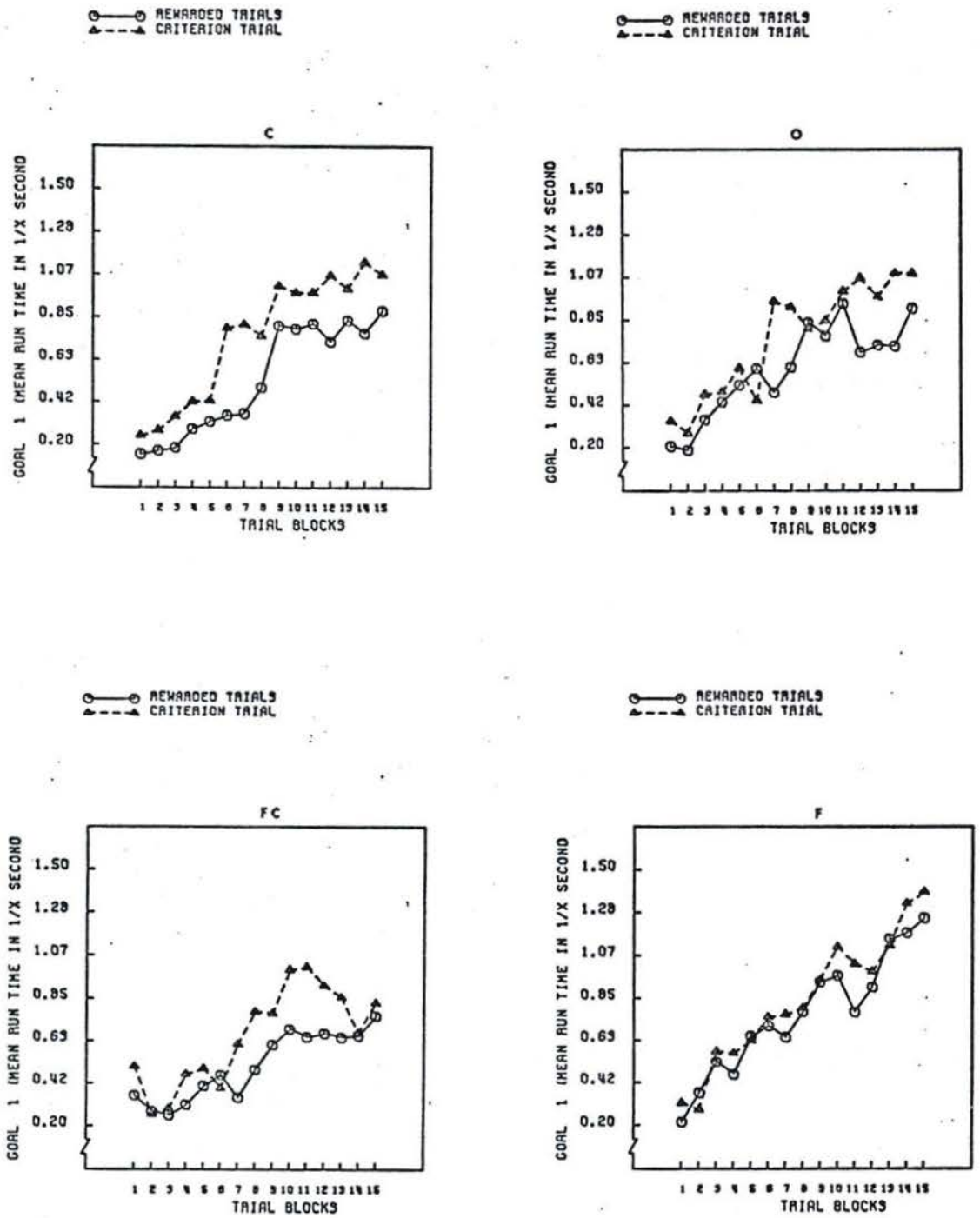

Figure 18. Experiment I. Within-S comparison of rewarded training trials and criterion trials for Conflict (C), Nonconflict (O), Frustration with Conflict (FC), and Frustration groups. Mean 1/run times of Goal 1.

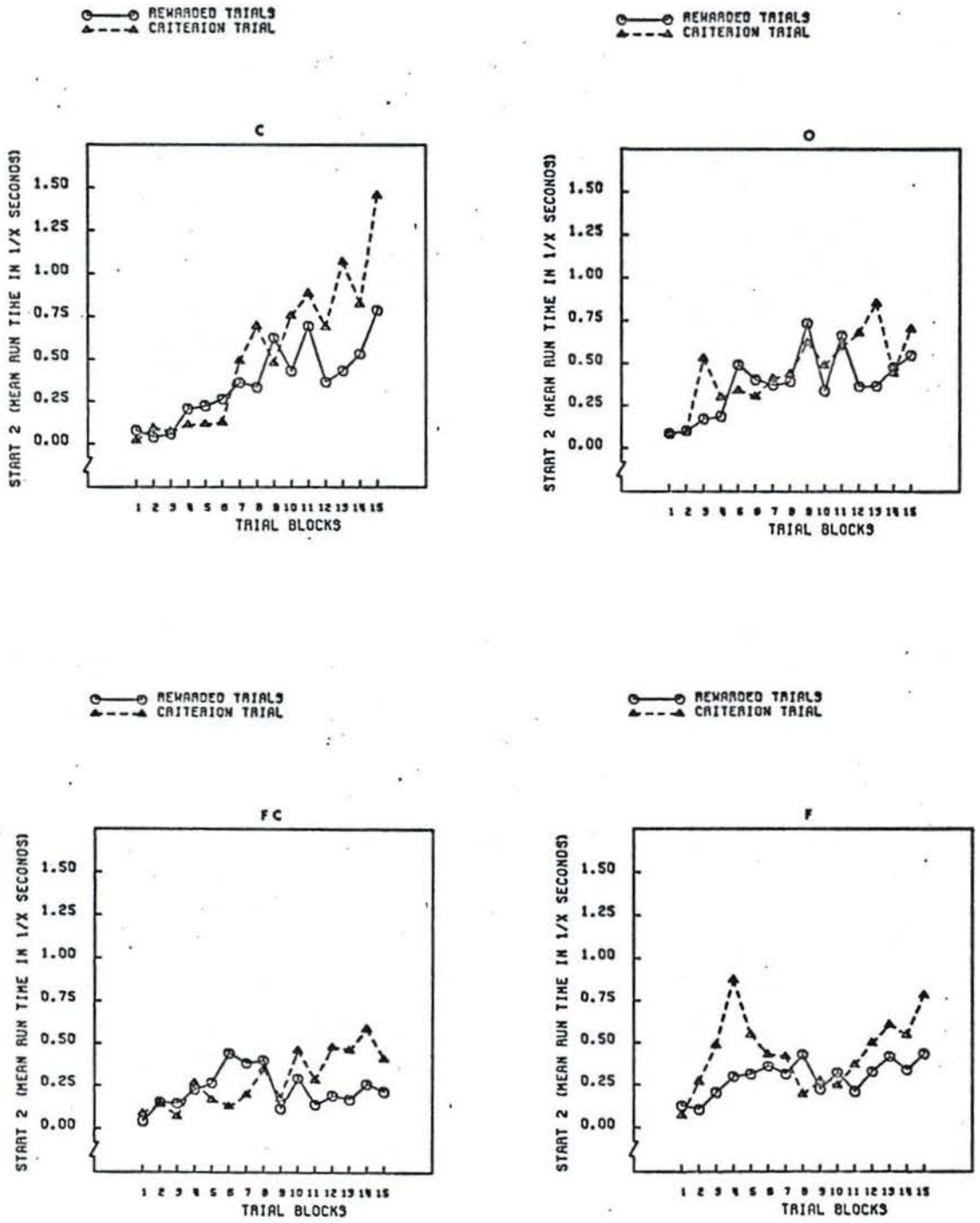

Figure 19. Experiment I. Within-S comparison of rewarded training trials and criterion trials for Conflict (C), Nonconflict (O), Frustration with Conflict (FC), and Frustration groups. Mean 1/run times of Start 2.

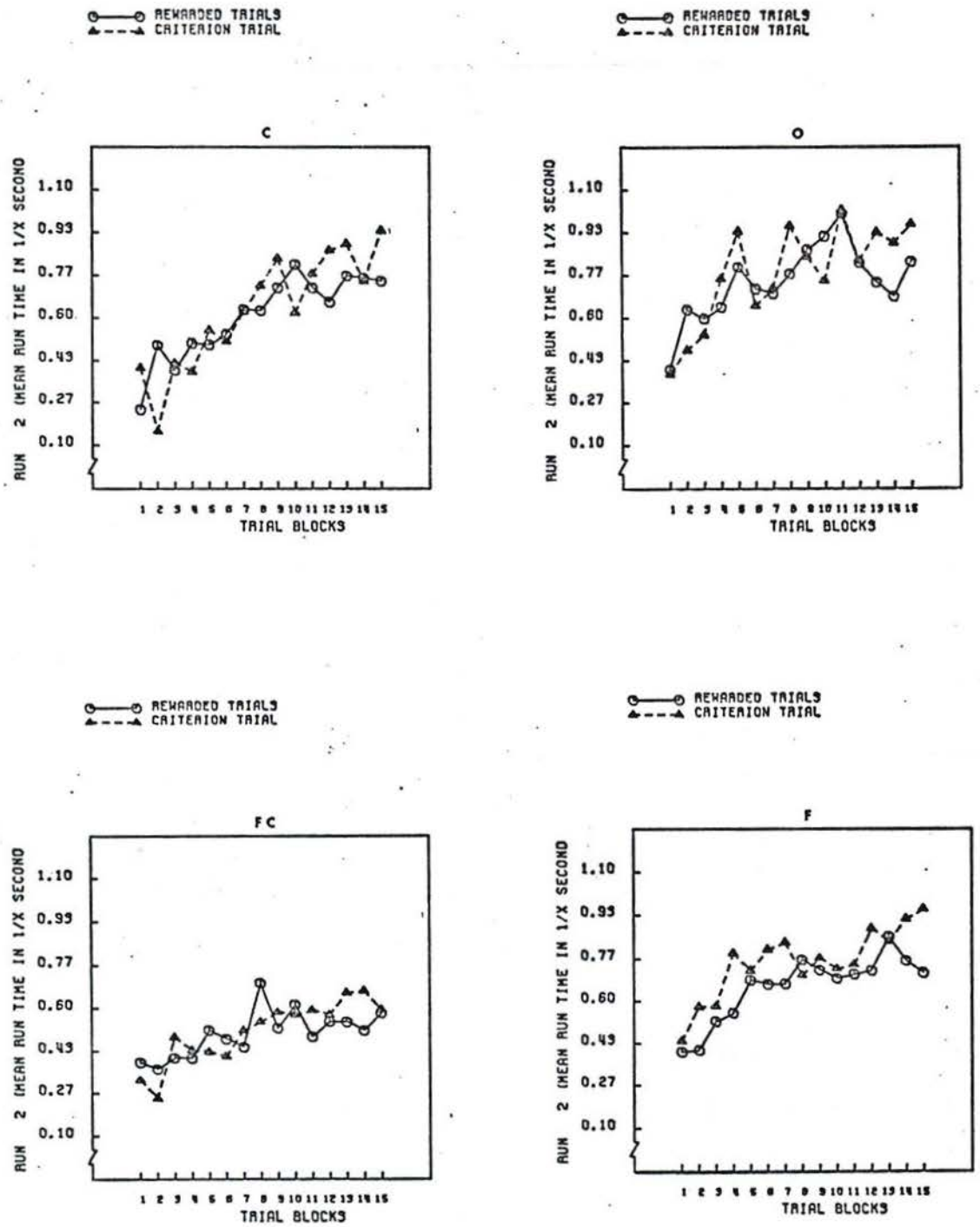

Figure 20. Experiment I. Within-S comparison of rewarded training trials and criterion trials for Conflict (C), Nonconflict (O), Frustration with Conflict (FC), and Frustration groups. Mean 1/run times of Run 2.

did not prove to be significant in an analysis of the first five Blocks of the experiment, for the difference in the running speed obtained on the two types of trials appear to be sufficient to produce significance. On the other hand, the Trial Conditions main effect was found to be significant within the first five Blocks on the Run 2 measure ($F = 6.617$, $df = 4/20$, $p < .049$). This effect, however, only approached significance when all 15 Blocks were included in the analysis ($p < .072$). On the basis of these analyses one can conclude that a within-S frustration effect was shown in this group. However, unlike the conflict effect shown in Group C, or the conflict/frustration effect shown in Group FC, the frustration effect shown in Group F appeared early in the experiment, disappeared during the middle, and reappeared during the final phase of the experiment. Moreover, the effect was not as clearly evident in Group F as were the experimental effects in the other groups.

Post Hoc Test of Discrimination

Results of the test of discrimination were somewhat surprising. As can be seen from an inspection of Table XXIII the only group which showed what could be called discrimination was Group F. The remaining groups showed definite position preference. Although most Ss correctly chose S+ on the initial trial of the test, most Ss also continued to approach the initially chosen side.

An examination of Criterion Trials over the Experiment's 15 Blocks for Groups C and FC revealed that at least 5 out of 6

Ss in each of the groups chose one side at least two-thirds more often than the other. However, neither the left nor right side was preferred more than the other.

Table XXIV provides a Block by Block summary of the GB 1 side chosen by each S in Groups C and FC during Criterion trials. An inspection of this table reveals that, except for one S in each group, runs of five or more blocks showing a consistent choice of one or the other sides of GB 1 were not evident until after the initial five Blocks of the experiment. Moreover, only 2 of the 6 Ss in Group FC did not show alternation during the final five Blocks of the experiment; whereas, only 1 of the 6 Ss in Group C showed any deviation from their side preference. The fact that runs of consistent side preferences emerged only after the initial phase of the experiment suggests that position preferences were learned during the course of the experiment, possibly as a solution to a choice between equal alternatives. The differences between Groups C and FC as to the consistency of position preferences also implies that the continuous reward received by Group C during Criterion trials increased the probability that a positional response would be made.

An additional check was made to determine if Ss' majority position choices on Criterion Trials were carried over to the test of discrimination. To do this, Ss' majority position choices on Criterion trials were compared to their position choices on Discrimination Test Trials. It was found that 5 out of 6 Ss in Group C had the same position preference, while

only 2 out of 6 Ss in Group FC had the same.

On the basis of these data it must be concluded that only Group F exhibited what would be commonly called discrimination. The remaining Ss' behavior in choice situations was dominated by position preference. Nonetheless, it can not be concluded that stimulus control of Ss' behavior in Groups C, O, and FC did not exist in the experiment; data from Training Trials indicate a differential effect of stimuli on behavior occurring in the first alley.

DISCUSSION

Experiment I was designed primarily to investigate the motivational properties of Frustrative-nonreward, conflict involving nonreward, and conflict unconfounded with nonreward. Several hypotheses regarding between and within-S effects were tested by examining subsets of the overall design.

The overall mixed-design was the primary vehicle for investigating the motivational properties of frustration and conflict. This design tested the hypothesis that the operations of nonreward and approach-approach conflict would elicit similar motivational properties, reflected in performance in the first and second alleys of the double runway maze. Specifically, it was predicted that, after an initial phase of discrimination training, the differential effects of experimental conditions would result in the second alley running speed of the Conflict-only (C) group falling somewhere between the second alley speeds of Frustration-only (F) and Frustration with Conflict (FC)

groups; and that the second alley speeds of Groups C, F, and FC would be faster than that of the Continuous Reward Control (O) group. Conversely, the rank order of group running speeds in the first alley, from fastest to slowest, was expected to be Group O, C, F, and FC. This prediction of first alley performance was based on the assumption that aversive properties of nonreward and conflict would elicit avoidance responses as discrimination training progressed.

The expected differences between experimental groups on second alley running speed was not found in the overall mixed-design analyses. Therefore, the hypothesis that experimental operations would elicit a differential increase in the general level of motivation (reflected in the differential increase in second alley running speed) was not confirmed. The lack of differential effects in group performance in the second alley was supported by nonsignificant findings from multiple comparisons of the group means performed over the beginning, middle, and final phases of the experiment. Moreover, rank orders of the group means on measures of the second alley were nearly opposite to those which were predicted (compare Table II with Tables VI to X).

The only results from the overall mixed-design analyses which were correctly predicted were the Blocks effect of Run 1 and Goal 1 segments of the first alley and the Blocks X Groups interaction of Run 1. The Blocks effects indicate that performance on Run 1 and Goal 1 did increase as the experiment progressed. Ordinarily this would be of little interest in such

a study; but in this case, where little evidence for a differential effect was found, the finding of significant Blocks effects does indicate the development of approach responses as the experiment progressed. The significant Blocks X Groups interaction of Run 1 confirmed the prediction that Group O would show faster approach than the other groups as the experiment progressed, while Group FC would show the slowest. This prediction was made on the assumption that aversive properties of nonreward and conflict would elicit avoidance responses in alley 1. Although multiple comparisons of group means were nonsignificant, the rank orders of group means were generally as predicted for measures of the first alley (compare Table II with Tables VI to X).

Differential effects due to stimuli were not expected and neither was the finding of a significant higher-order interaction on Run 1; the presence of a differential effect of stimuli must limit somewhat any interpretation of findings related to Run 1. This interaction was the result of differential reactions of Groups C and O to the discriminative stimuli over the experiment. Possibly the effects of a dark stimulus associated with GB 2 generalized to elicit faster approach in Ss in the Dark-Stimulus Condition of Groups C and O. Why this "dark preference" effect was not found in Groups FC and F may be related to the effects of nonreward associated with the discriminative stimuli. The fact that this effect was not found in the other two components of Alley 1 is somewhat puzzling, however. The small N of the experiment allows for a

possibility that the "stimulus preference" component of the interaction is an artifact.

Within-S comparisons between rewarded and nonrewarded Training trials over trial blocks for the four experimental groups tested the hypothesis that within-S frustration effects might occur as Blocks progressed. Findings from such an investigation are only of minor interest to the main thesis, but may be important in providing both a test of discrimination training and a test as to the success of the apparatus in eliciting frustration effects. The hypothesis of within-S frustration effects was supported for Groups O, FC, and F. Group C did not show a frustration effect. At this point it is unclear why Group C never exhibited an effect. Perhaps the approach-approach conflict operation on Criterion trials influenced the behavior of Ss in Group C so as to reduce the primary effects of nonreward. The frustration effects shown by the remaining groups were quite small, however, when compared to those generally noted in the literature. The present findings may depend upon differences in experimental procedures, especially upon differences in the size of rewards and in the extensive trial blocking used by other researchers.

Originally, within-S comparisons of Rewarded Training trials and Criterion trials were viewed as merely another way to support the findings of the overall mixed-design. However, as it became apparent that differential effects of experimental operations were too small to produce significant between-S effects, the role of within-S analyses became more important.

Perhaps significantly, within-S analyses preclude the complications of between-S error variance, and allow for a more sensitive test of differential effects expected in Groups C, FC, and F, but not Group O. Such an expectation, that experimental operations would elicit an increased level of motivation (reflected in increased running speed in the second alley), was confirmed in Groups C, FC, and F. Performance of Ss in Group O was not significantly different on the two types of trials. The pattern of running manifest in Alley 2 was different for Groups C, FC, and F, however. As predicted, Groups C and FC showed an increase in Alley 2 running speed (reflecting the general level of motivation) around Block 10, during the final phase of the experiment. This finding was not surprising since differential effects were expected only after acquisition of discrimination or approach. On the other hand, an increase in the motivational level of Group F was observed in the initial phase of the experiment, it tended to disappear during the middle phase, and reappeared at a statistically significant level during the final phase.

Differential effects of experimental operations were also seen in first alley behavior. Approach-approach conflict produced faster Group C approach to goal, as measured at the goal segment, throughout the entire 15 Blocks. This finding was opposite to what was expected. On the other hand, Group FC approached the goal equally as fast on both types of trials until the middle phase of the experiment, when greater vigor was shown on Criterion trials, followed by a rapid decrease in

the speed of approach during the final phase. Again, this was a somewhat surprising finding, since conflict, especially conflict with nonreward, is generally assumed to slow approach. Interestingly, however, the pattern shown for Group FC is similar to what one observes in within-S PRE studies. Group F also showed faster approach to goal on Criterion trials. However, the pattern was strikingly different from those shown by Groups C and FC; very small differences between the two types of trials emerged at blocks 10, 11, 12, 14 and 15. Moreover, the small effect was reflected in the Trial Conditions main effect rather than in the interaction. The difference in approach to goal found for Group O was similar to that found for Group F, except during the final phase of the experiment when Group O goal approach slowed on rewarded training trials. Two possible interpretations of the findings for Goal 1 are available:

1. When two or more response tendencies are simultaneously encited, the one having the greatest momentary strength will be revealed in action. In this case, approach is assumed to be the strongest tendency. Wright (1969) has shown that conflict has an invigorating effect on responses occurring at the point of conflict, in the present case approach to Goal 1, and that this increased level of motivation may be maintained to affect responding in the second alley. On the other hand, nonreward without conflict elicits competing tendencies only within the goal, thus, is seen to affect an increase in the vigor of response only in the second alley. It is postulated

that only after the establishment of avoidance tendencies to Goal Box 1 will the inherent approach-avoidance conflict confounded in frustrative-nonreward elicit a more vigorous approach to goal. 2. Possibly free-choice on Criterion trials provided an additional cue, such that the behavior of Groups C and FC may have been elicited by more complex operations than originally conceptualized. For example, if one assumes that stimulus generalization of S- effects occurred, then rewarded Training trials could be thought of as "Partial Reward" trials. The free-choice aspect of Criterion trials may have cued "certain" reward for Group C and "double-partial" reward for Group FC. Under this assumption, the operations compared may well have been "certain" reward vs partial reward for Group C and "double-partial" reward vs partial reward for Group FC. However, this interpretation is only workable if one makes the further assumption that free-choice did not provide Group FC with a cue for "certain" nonreward on Criterion trials. It is easy to see how the hypothesized conditions would have produced faster approach in Group C, but slower approach would be expected in Group FC. Group F performance may well be evident of small magnitude PRE acquisition.

The fact that both Group O and F did not show patterns of approach similar to Group C and FC does not provide clear support for one interpretation over the other, especially since there was no between-group difference. The stimulus conditions in GB 1 were the same on Training and Criterion trials for Group F, so no additional cues were provided there, although

inherent approach-avoidance conflict may have been operative. Group O, however, was presented with two S+s on Criterion trials, so there were extra cues. Only the lack of free-choice on Criterion trials were common to groups O and F. Free-choice, then, as a conflict operation producing an increase in the vigor of an ongoing response appears to provide the most viable interpretation of the results. This is particularly true in view of the many assumptions which must be made in order to make the second interpretation workable.

The results of the post hoc discrimination test do not support the notion that procedures of Experiment I were effective in establishing discrimination. Findings indicate that Group F, the only group which never had experience with an alternate stimulus, was the only group to show successful discrimination between rewarded and nonrewarded discriminanda. The remaining groups showed position habits when faced with a free-choice of discriminanda. At least in Groups C and FC, evidence for a position habit was found on Criterion trials in the actual experiment. However, only the Ss in Group C appeared to carry a side preference over into the discrimination test. There is also some evidence that Ss in these groups developed position habits as a response to free-choice. A plausable explanation for the position preference shown by Group O is that covert odour cues may have been followed. Since position of GB 1 was yoked to Ss in Group C, it is possible that a habit of following odour cues developed in

this Group, even though precautions against odour cues were made. The mechanism by which Group F developed continuous approach to S+ may well have been the straight forward conditioning of avoidance tendencies to approach, counter-conditioning, as Amsel calls it.

In summary. The hypothesis that primary experimental operations involving conflict and frustrative-nonreward would show differential effects on the general level of motivation was not supported in overall analyses of the data. Although there was some evidence for differential effects of experimental operations on behavior in the first alley, specifically in the run and goal segments, differential effects were not observed on behavior occurring in the second alley. It must be concluded that procedures were not effective in producing differential effects at a magnitude sufficient for between-S comparisons.

Within-S frustration effects were found when rewarded and nonrewarded training trials were compared. Although significant, these effects were small.

Differential effects were found between rewarded Training trials and experimental operations occurring on Criterion trials in within-S analyses. Operations of approach-approach conflict, conflict with frustrative-nonreward, and frustrative-nonreward alone were found to increase the general level of motivation within groups. Patterns of this increased vigor of performance in alley 2 were different for the groups. A gradual increase in performance level was shown in the two

groups involving conflict, while Group F performance was affected early, showed a decrease in effect, and increased again, during the final phase of the experiment. The affect of experimental operations on behavior occurring in the first alley was not expected. It was suggested that effects of stimulus generalization may have created more complex operations than conceptualized, such that inherent approach-avoidance conflict may have been created in each group through the experience of nonreward associated with S-. If this assumption is correct then differential effects of experimental operations between-Ss may have been significantly reduced. Experiment II was planned to test this assumption.

Chapter III

Experiment II

Experiment I was only partially successful in demonstrating support for the investigation's main hypotheses. Procedurally Experiment I was intended to develop stimulus control and equalized positional preference by forced discrimination training. However, from the results of the post hoc discrimination test following the experimental phase, it appears that stimulus generalization and position preference responses which may have been learned over choice-trials reduced stimulus control of responding in all but the Frustration group -- the only group which did not receive experience with the S- stimulus.

If it is true that stimulus generalization influenced the behavior of Ss in the other three groups, then for all purposes, these groups were not qualitatively different. Accordingly, the possibility remains that because of the effect of stimulus generalization, the aversive properties of nonreward associated with S- may have influenced behavior normally under the control of S+ in such a way that inherent approach-avoidance conflict was operating in all groups. This possible confounding is similar to that found in Wright's (1969) paradigm.

Experiment II was designed to eliminate the possibility of confounding and to supply a more "pure", less complicated, demonstration of the similarities between the motivational

properties of conflict and frustration by eliminating any possibility of nonreward effects associated with S- generalizing to S+ situations. Results of Experiment I indicated that stimulus control could be achieved by consistently guiding the response of the animal to the relevant stimulus, designated as S+. Using this procedure, one can train Ss to approach S+ consistently, and at the same time, eliminate the possibility of generalization of nonreward experiences, which are normally associated with discrimination training when S- is used. The procedure also allowed for a design-simplicity frequently found in classical frustrative-nonreward experiments. The penalty of this simplified procedure is the abandoning of any attempt to equalize position preference by means of S- (occasioning nonreward) being used at the favored side.

In its most general form, Experiment II was a one-between by one-within mixed design. The three-level between-S factor was Experimental groups, the major independent variable. Blocks constituted a six-level within-S factor. During the experimental phase (Phase III) which immediately followed two phases of approach acquisition, Control trials (identical to acquisition trials) were randomly interspersed within the sequence of Experimental trials (employing experimental operations defining groups). Overall mixed-design analyses were performed separately on the Experimental and the Control trials. However, the provision for Experimental and Control trials during Phase III also allowed for an additional set of two-within-S analyses, where Experimental and Control trials

formed one two-level factor and Blocks formed the other six-level factor. The set of within-S analyses provided additional support for findings of the two Experimental trials and Control trials overall mixed-design analyses. Five dependent measures of locomotor performances were available: Start 1, Run 1, Goal 1, Start 2, and Run 2. Because of the within-S factors, analyses of the multiple dependent measures necessarily had to be performed as separate univariate analyses of variance.

Hypotheses and expected findings

Three comparison groups were formed after the two acquisition Phases: approach-approach conflict, frustrative-nonreward, and a continuous reward control. It is hypothesized that Frustration and Conflict groups will show an immediate increase in running speed (measured in time) in the second alley of the double alley maze following experimental conflict and frustrative-nonreward operations in Goal Box 1 (GB 1). Frustration and Conflict groups are expected to show significantly faster second alley speeds (dependent measures Start 2 and Run 2) than the Continuous Reward Control group. The difference between the running speeds of the Frustration and Conflict groups is not expected to be statistically significant. No difference between the three groups are expected in performance measured over the first alley, since usually more than six trials are needed before experimental conditions will affect Alley 1 performance to a point where differences between groups can be observed.

Differential effects of experimental operations are also hypothesized within-Ss. Within-S analyses are expected to find that Frustration and Conflict groups will run faster in the second alley following frustration and conflict in GB 1 (Experimental trials) than following continuous reward in GB 1 (Control trials). The Control group is not expected to show any difference in Alley 2 running speed between Experimental and Control trials, since GB 1 conditions are identical on both trials. Differential effects in Alley 1 running speed are not expected for Frustration and Control groups since it should take longer than six trials for avoidance tendencies associated with nonreward to develop in the Frustration group, and there are no differences between operations of the two trials for the Control group. Subjects in the Conflict group are expected to approach the goal faster on Experimental trials than on Control trials; this expectation is based on the Experiment I finding that Ss approached the goal faster during conflict than during nonconflict operations.

A post hoc test of the success of approach acquisition (differential discrmination training) will immediately follow Phase III of the experiment. The test involves the simultaneous presentation of darkened and lighted parallel chambers of GB 1. Subjects have free access to either side of GB 1 and must choose one or the other side. The S_L/S_D discrimination task will be presented for four post-experimental trials. The test should find that all three groups will

consistently choose the light (S_L) side rather than the dark (S_D) side of GB 1, since Ss will be consistently guided to S_L throughout acquisition in Experiment II. The discrimination criteria are: four out of four choices of S_L indicating perfect discrimination, three out of four choices of S_L indicating an error, and two errors indicating a position habit.

METHOD

Subjects. Twenty-eight experimentally naive, male rats of the Long-Evans strain, drawn from the closed colony at the Department of Psychology, University of Victoria, served as Ss. The animals were 95 to 97 days old at the start of experimental phases.

Apparatus. The same apparatus described and used for Experiment I was employed in Experiment II. One significant modification was made, however. In Experiment I, microswitches, activated by fully opening the GB 1 exit doors, were used to start the timing of the Start 2 measure. In Experiment II, these microswitches were replaced by silent photocells placed immediately adjacent to the rear of the sliding exit doors, when the doors were in the closed position. What this modification achieved was the measurement of Start 2 beginning just as GB 1 exit doors opened, rather than when the doors were almost fully opened, as was the case with the microswitches.

Procedure. When the Ss were 80-82 days old they were placed on deprivation feeding of 12 gms/day of rat chow, and prefed 200 mgrs of Noyes pellets (20% sucrose added).

The Deprivation phase lasted 14 days, and then habituation began on the fifteenth day of deprivation and lasted for four days. The procedure for habituation was the same as that used in Experiment I. The actual experiment was divided into three phases.

Phase I. Phase I commenced immediately after the four days of habituation. During this phase, trials were blocked so that massed-trials acquisition of maze running could be achieved. The number of trials an S received increased with the number of days so that Ss were run for one trial the first day, two trials the second day, and so on up to five trials on the fifth day. Each S was then run for five trials on days six and seven of Phase I. The total number of trials for Phase I was 25. During the acquisition trials of Phase I, Ss were consistently rewarded in Goal Box 1 (GB 1) with a 45 mg (20% sucrose added) Noyes pellet. For all acquisition trials the rewarded side of GB 1 was lighted, while the non-relevant side of GB 1 was dark. Goal Box 2 was always dark and was always rewarded with a 100 mg (20% sucrose added) Noyes pellet. The spatial (left/right) position of discriminanda was randomized across trials throughout acquisition, with the same random sequence for all Ss. Entrance into GB 1 was guided by closure of the opposite plexiglas door; the same guiding procedure as was used in Experiment I. Therefore, an individual acquisition trial for Ss during Phase I consisted of an S running the double alley maze to consistent reward in GB 1, then release from GB 1 after 7 seconds confinement,

and a run to consistent reward in GB 2. The run-order of Ss was randomized every Block. The maze was wiped with soap and water after each run in order to minimize odour cues.

Phase II. Phase II was identical to Phase I in respect to the procedures which distinguish acquisition trials. The two phases differed only in that an S received only one trial per day during Phase II, rather than massed acquisition, as in Phase I. Phase II lasted for 10 Blocks (i.e., 10 trials) and was designed to accustom the animal to receiving only one trial per day in preparation for Phase III. Data were recorded beginning with the third block.

Phase III. The independent variable of the experiment was first applied in Phase III, beginning with Block 16 of the experiment. Following Phase II, Ss were divided into three matched groups. In order to make this division, all Ss were rank-ordered according to their average running speed (mean 1/raw time scores of the last four Blocks of Phase III) on the Start 2 measure. Once ordered, Ss were divided into nine sets of three Ss each. The first set contained the three fastest running Ss; the second contained the three next fastest Ss; and so on, until the three slowest Ss were placed in the ninth set. Each S in the first set was assigned to one of the three experimental groups at random, then Ss from the subsequent sets were assigned in similar fashion, until all Ss had been assigned to groups. This assignment procedure is called block-random assignment.

Twelve trials were run, one per day for 12 consecutive days, during Phase III. These trials were of two types, Experimental and Control; one Experimental and one Control trial formed one Trial Block. The procedures employed during Control trials were same for all three experimental groups and identical to all previous training trials; lighted (S_L) and unlighted (S_D) sides of GB 1 were simultaneously presented, but responses were always guided to, and rewarded at, S_L by closure of the plexiglas entrance door to the S_D side. The Experimental trial procedures varied for each of the experimental groups: for the Control group, Experimental trials were identical to the Control trial, except by definition; for the Frustration group, the Experimental trials merely did not involve reward in GB 1; and for the Conflict group, the experimental trials provided S_L and reward in both sides of GB 1, with the subject allowed a free-choice of either side. The general running procedures of Experimental and Control trials in Phase III followed those employed during acquisition trials of Phase II. However, unlike Phase II, in which the spatial position of S_L and S_D was randomized in the same sequence over the 10 Blocks for all Ss the spatial position of discriminanda was randomized 50:50 within each Experimental trial across the Control and Frustration group Ss; the Conflict Ss had two S_Ls. On Control trials, the spatial position of discriminanda was reversed for each Control and Frustration group S from what it was on the previous Experimental trial; the S_L stimulus was positioned

opposite of the GB 1 side chosen by Conflict Ss during the previous Experimental trial. This procedure for determining the spatial position of stimuli during Phase III achieved two objectives: (1) it maintained the left/right GB 1 side experience at a 50/50 ratio; and (2) since the sides to which Ss would run were random from S to S over a trial, the possibility that Ss would adopt a habit of following the path run by the previous S was further minimized.

As in the previous phases, the order in which Ss were run was randomized from Block to Block. The maze was wiped with soap and water after every run.

Subjects were initially fed 12 grams of lab chow per day. However, by the end of the fourth week of deprivation the average body weight of Ss had fallen to 77.4% of initial weight. Compared to ad lib fed controls, the actual body weight of Ss was 50 to 60% of normal. At such an extreme weight loss the chance of an animal dying is too great. Therefore, daily rations were increased to 20 grams of lab chow. A disturbance in motivational level was considered to be more acceptable than the loss of an experimental animal. The increased ration commenced on the sixth block of Phase II and continued until the second block of Phase III. At that time the average weight of the animals had increased to 82.4% of initial weight and the daily ration was reduced to 14 grams for the remainder of the experiment.

Discrimination Test Procedure. A post hoc test of the success of discrimination training was done on the day immediately

following the last block of Phase III. On each trial, light and dark discriminative stimuli were simultaneously presented in the parallel halves of GB 1; Ss were given free access to either side and required to choose one of them. Four such trials were run. Position of the discriminative stimuli were randomized (with a 50/50 ratio to each side) across trials. S_L was always rewarded and S_D was never rewarded. The order in which Ss were run was randomized for the four trials. The maze was wiped after each run. Data on run times were not recorded since only the choice of stimulus was of interest.

RESULTS

All original time scores were transformed to their reciprocals in order to insure homogeneity of variance within the transformed scale. The original and transformed data are recorded in Appendix C. Data on the last eight trials of the ten-trial Phase II are presented in Figure 21.

Subjects were divided into three comparison groups for the experimental phase of the investigation -- Phase III. In order to assign Ss to experimental groups, the mean run time in reciprocal form was computed from the last four blocks of phase II for each S. Using these means of the dependent measure, Start 2, a rank order of all Ss was obtained. Once ordered, Ss were arranged in nine blocks containing three Ss each, then randomly assigned to groups from these rank-ordered blocks. Two one-way ANOVAs were performed to check the success of this unbiased assignment technique. The analyses

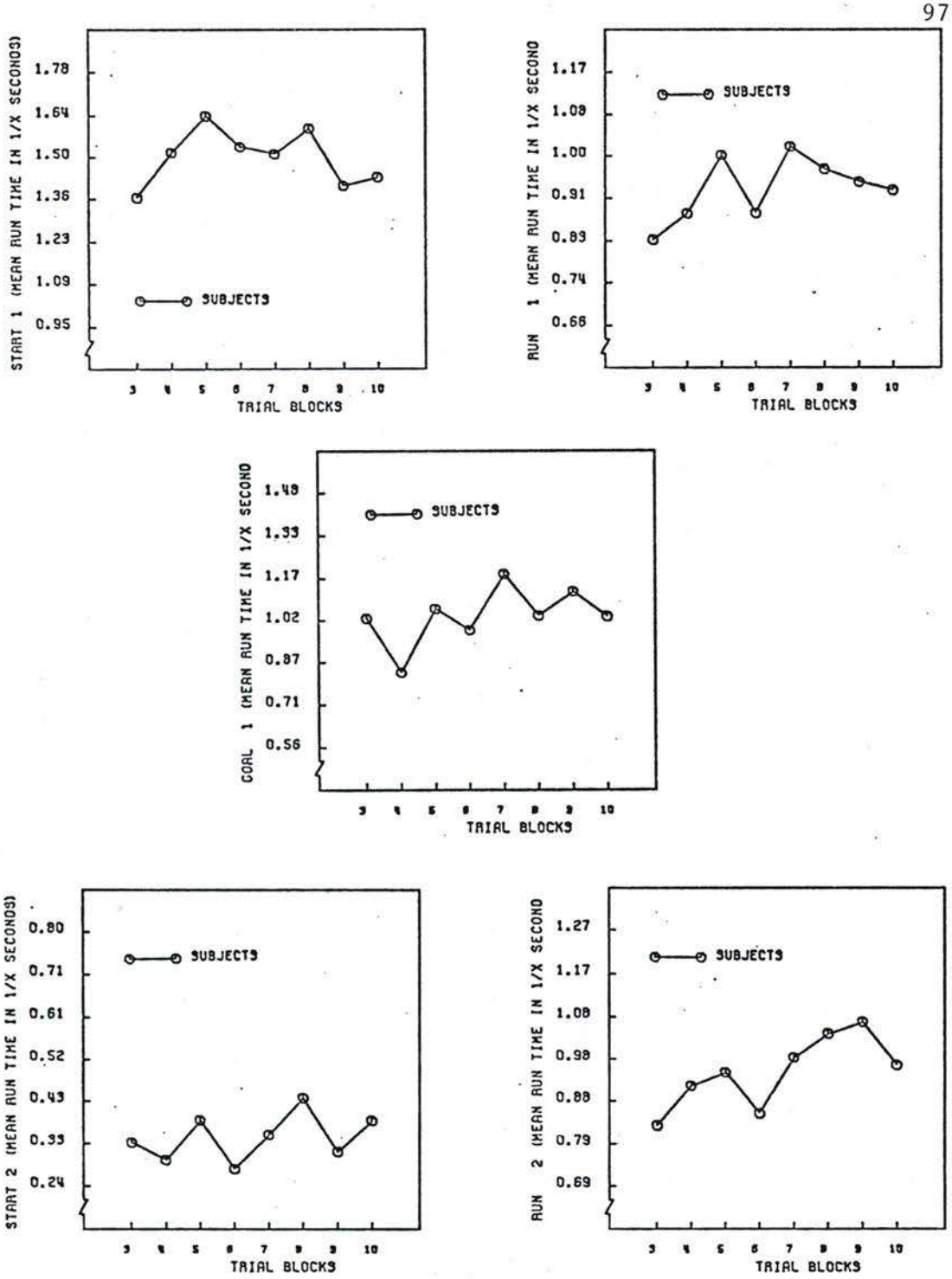

Figure 21. Experiment II. Mean 1/run times on the five dependent variables obtained over the last eight acquisition trials of Phase II.

of the Start 2 and Run 2 measure were not significant ($F < 1.0$) so any differences between groups obtained during Phase III can not be due to differeces existing at the time of assignment of Ss to groups.

Between Groups Analyses

Analyses utilizing the complete design

Exact tests of the repeated measures data within the mixed design were performed for each of the five dependent measures by means of multivariate analyses of Variance (Morrison, 1967; Wilson and Lange, 1972). Data obtained from both Experimental and Control trials of Phase III have been separately analyzed but are presented together for the purposes of comparison.

Start 1. The only effect which was found to be statistically significant on this dependent variable was the Blocks main effect ($p < .013$) for the Experimental Trials. These findings are summarized in Table XXV. Results are graphically presented in Figure 22.

Run 1. The only significant effect to be found on Run 1 was the Blocks main effect. This finding emerged on both Experimental and Control trials with obtained probabilities less than .018 and .050 respectively. These findings are summarized in Table XXVI and graphically presented in Figure 23.

Goal 1. No statistically significant differences were found on this dependent measure. However, the Groups effect on the Control Trials analysis did obtain a probability of

less than .084. Although this was not significant at the conventional critical value of .05 it is worth noting since it was the slow goal approach of the Conflict group compared to the other groups which produced the difference. As we shall see in the section presenting the Block by Block comparisons, slow Goal 1 entry of the Conflict group emerged on the first Block. Therefore, it is possible that the presentation of a nonconflict trial after the experience of a conflict trial might suppress Goal approach of Ss in the Conflict group even below that found during conflict. Findings are summarized in Table XXVII and graphically presented in Figure 24.

Start 2. Most important to the present investigation are the dependent measures Start 2 and Run 2. These measures, taken from the second alley of the double-alley maze, reflect the motivational effects of conflict and frustration on behavior. It was expected that Ss would show qualitative increases in running speed following either nonreward and conflict. The interaction of Groups X Blocks approached significance ($p < .060$). While not statistically significant at the traditional .05 level, the low probability of such an interaction does reflect practice-related divergence between the Frustration and Conflict groups and the Control group. This divergence was as predicted, in that the Frustration and Conflict groups exhibited faster starts in the second alley following experimental manipulation when compared to the Control group. As expected there was no

significant Groups X Blocks interaction for Control trials. The nonsignificant finding on Control trials lends support to the validity of the interaction which emerged on Experimental trials. The main effects of Groups and Blocks were not significant for either the Experimental or Control trials analyses. Results of these analyses are summarized in Table XXVIII. Figure 25 graphically presents the data.

Run 2. The effect of Frustration and Conflict on the behavior of the Ss was most apparent on the Run 2 measure. The Groups X Blocks interaction of the Experimental trials analysis was significant at $p < .042$. Significant divergence of the Conflict group towards faster running occurred on the third block of Experimental trials; faster running of Ss in the Frustration group followed one block later and became faster than Ss in the Conflict group on Blocks five and six. The main effects of Group and Blocks were not significant on the Experimental trials analysis. None of the effects on the Control trials analysis were significant. The findings relevant to Run 2 are summarized in Table XXIX and Figure 26.

Figure 27 presents a graphic summary of the performance of experimental groups averaged over Experimental and Control trials of Phase III.

Analyses using only the last four blocks of the Experimental Trials

The parsimonious initial expectation was that Conflict and Frustration effects would emerge immediately in Phase III. However, since it was necessary to place the animals on an increased daily food ration during part of Phase II and the

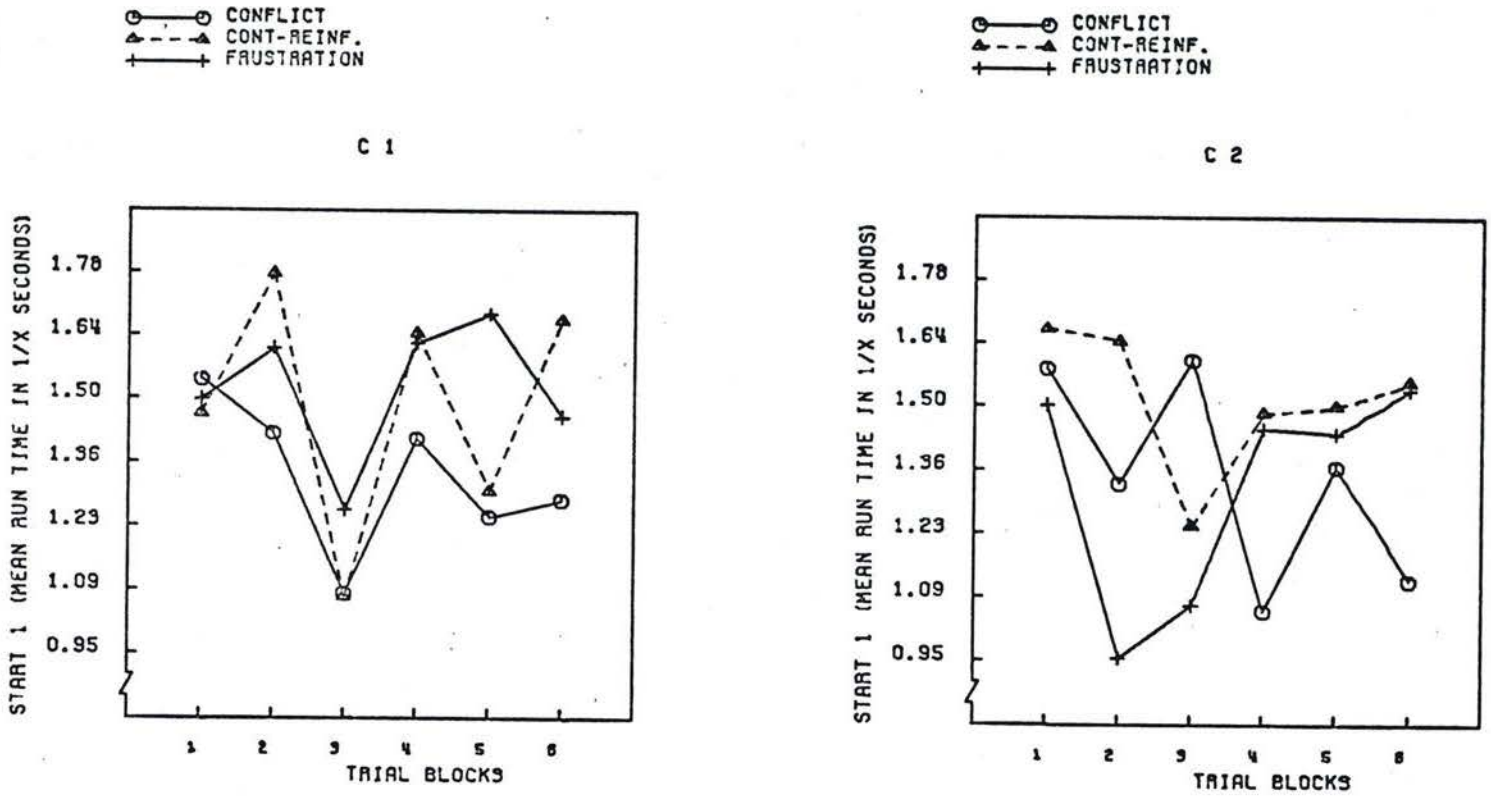

Figure 22. Experiment II. Mean 1/run times of experimental groups over trial blocks of Phase III using Start 1 as the dependent variable. Experimental (C 1) and Control (C 2) trials are presented for comparison.

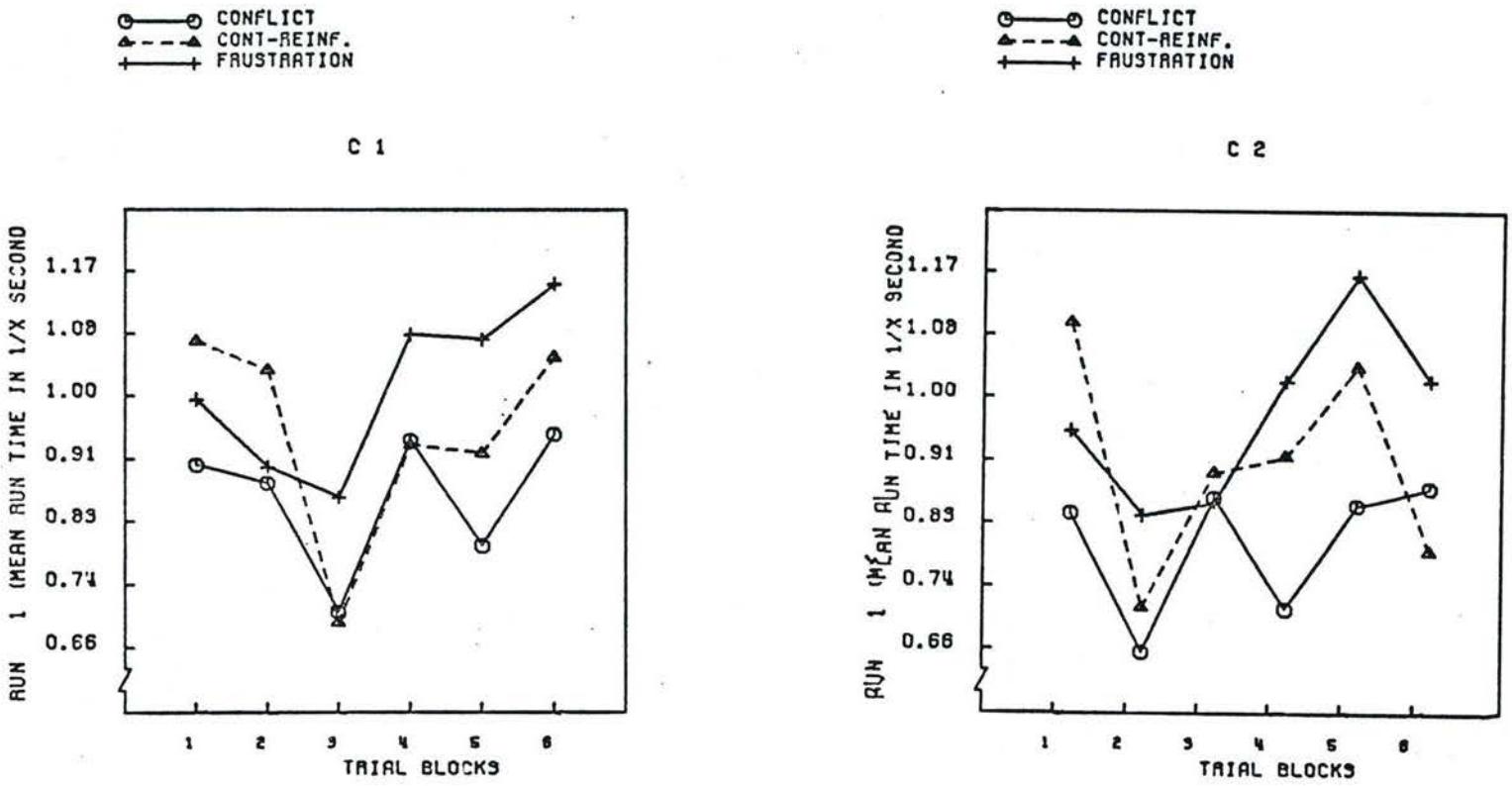

Figure 23. Experiment II. Mean 1/run times of experimental groups over trial blocks of Phase III using Run 1 as the dependent variable. Experimental (C 1) and Control (C 2) trials are presented for comparison.

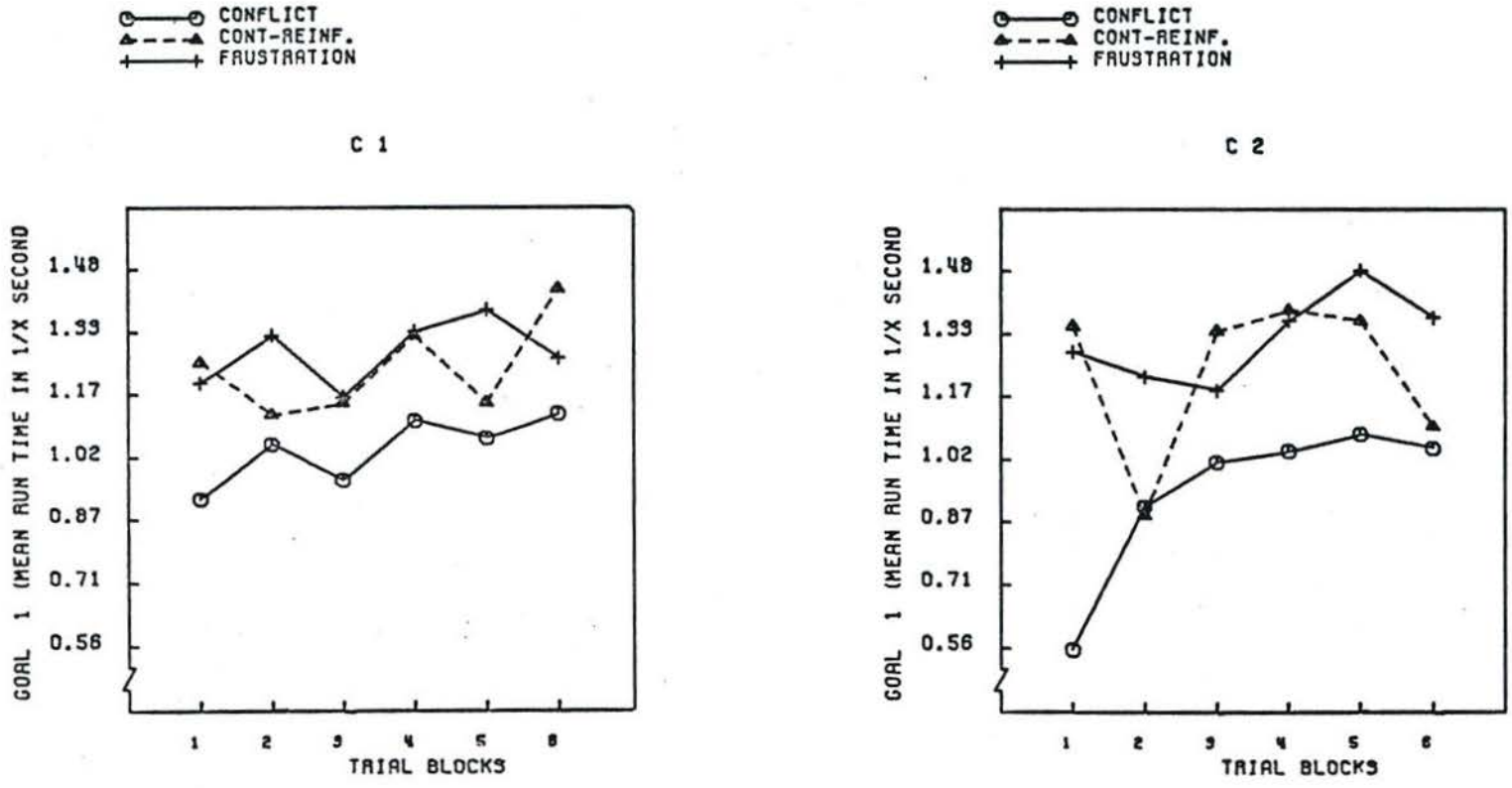

Figure 24. Experiment II. Mean 1/run times of experimental groups over trial blocks of Phase III using Goal 1 as the dependent variable. Experimental (C 1) and Control (C 2) trials are presented for comparison.

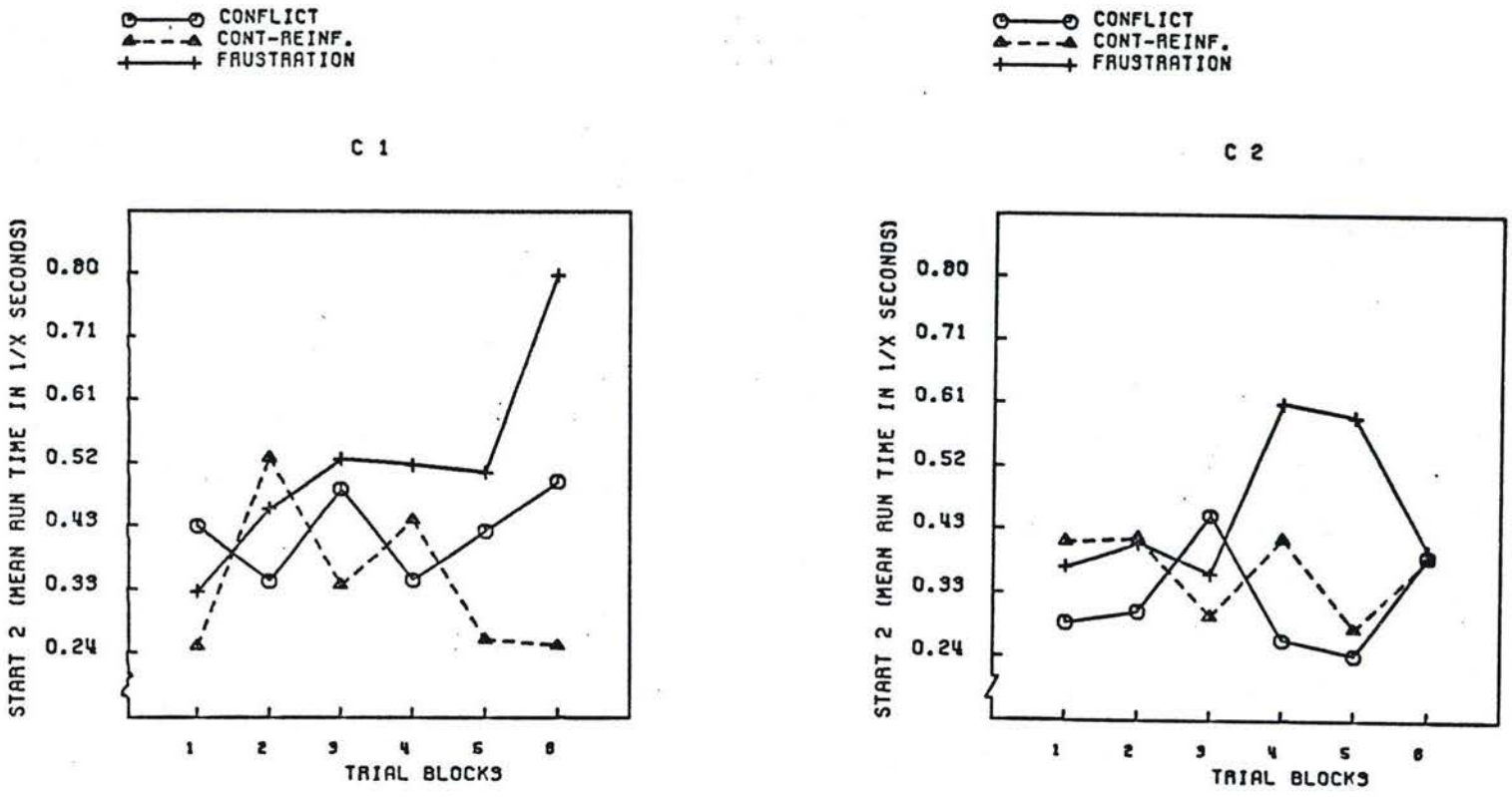

Figure 25. Experiment II. Mean 1/run times of experimental groups over trial blocks of Phase III using Start 2 as the dependent variable. Experimental (C 1) and Control (C 2) trials are presented for comparison.

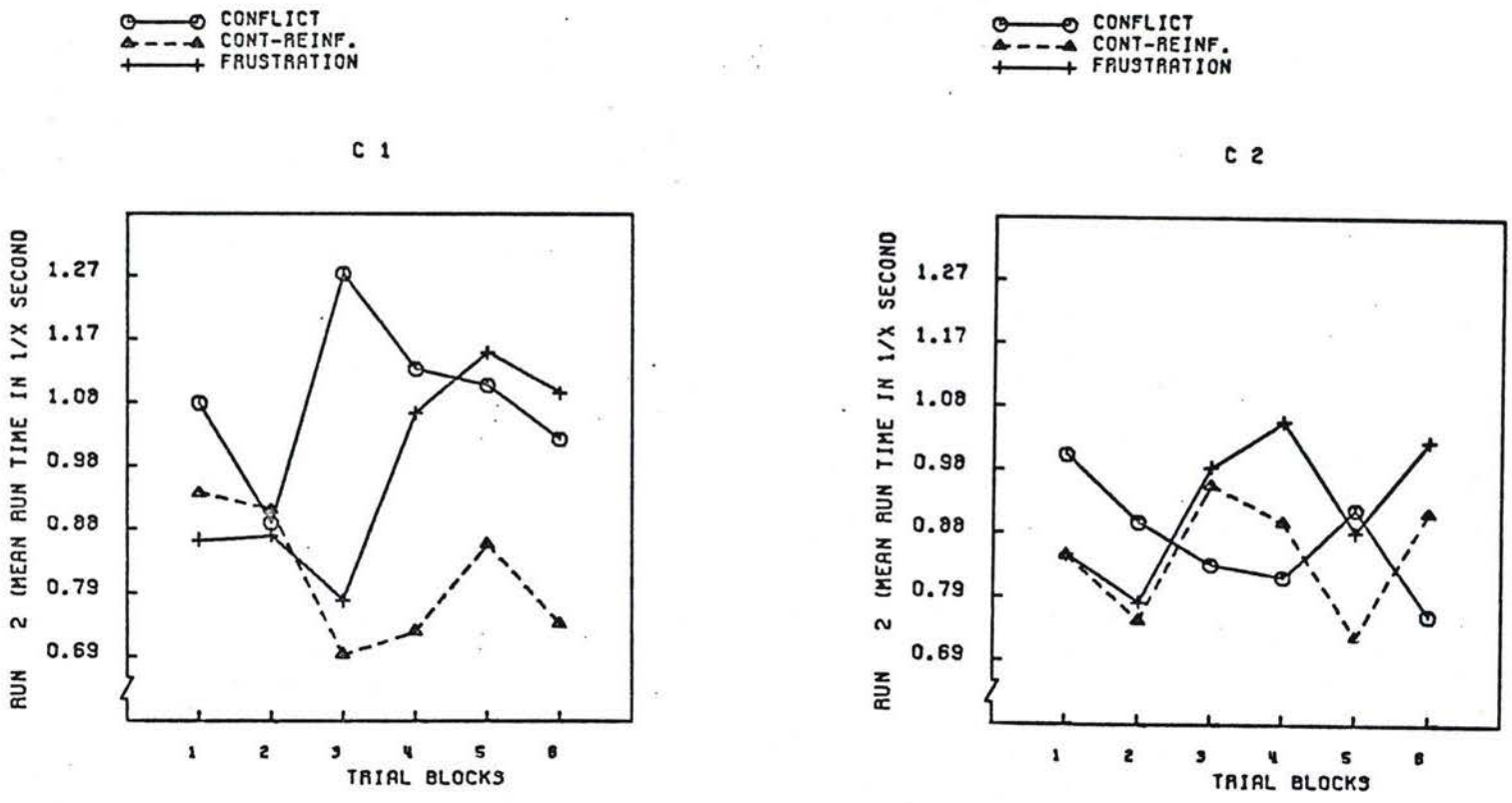

Figure 26. Experiment II. Mean 1/run times of experimental groups over trial blocks of Phase III using Run 2 as the dependent variable. Experimental (C 1) and Control (C 2) trials are presented for comparison.

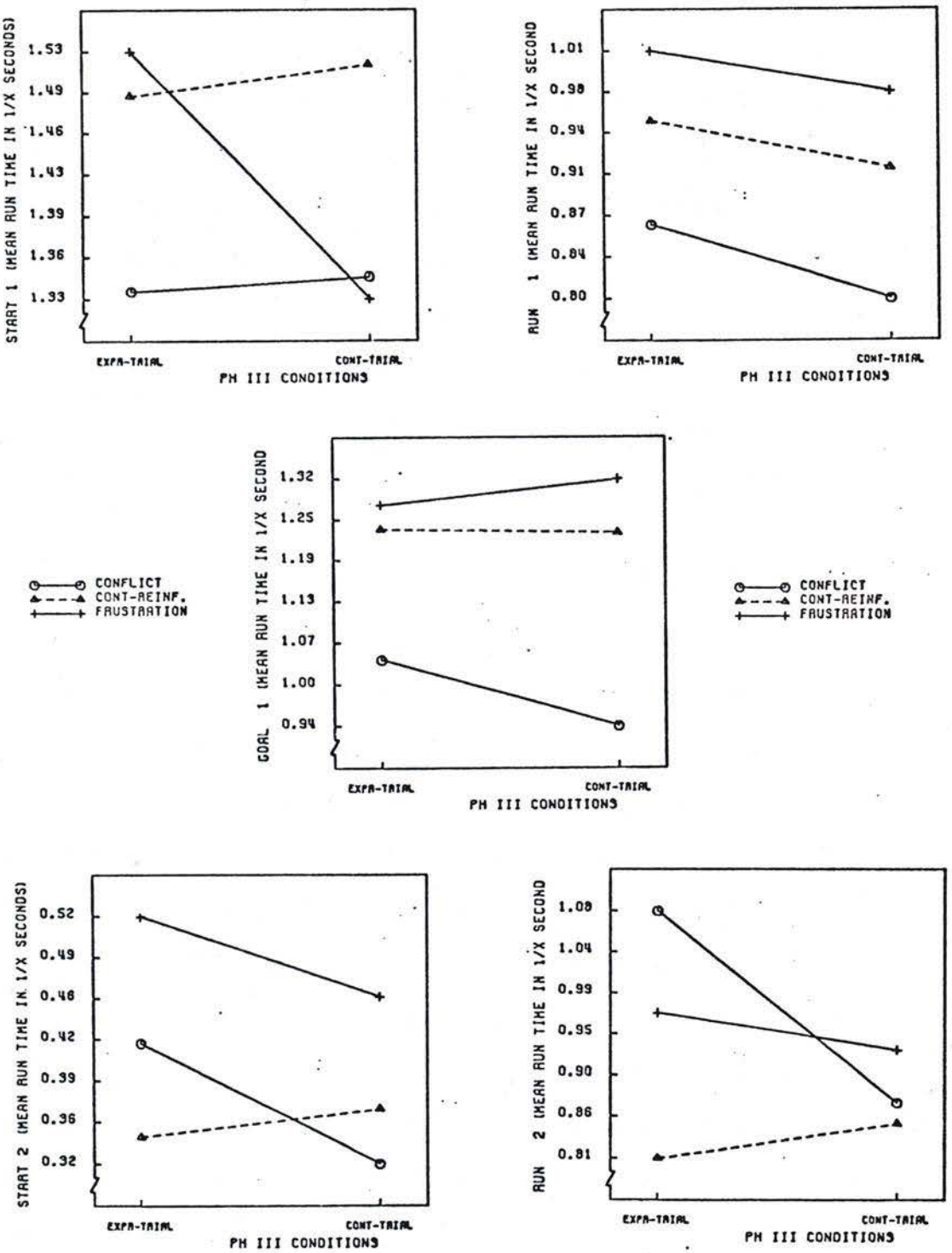

Figure 27. Experiment II. Mean 1/run times on the five dependent variables collapsed over trial blocks. A comparison of the performance of experimental groups over experimental and control trials of Phase III.

first block of Phase III, it is possible that the experimental effects which were expected to emerge at the start of Phase III may have been mitigated. Several analyses were made of only the final four Experimental Trial Blocks of Phase III. The results of these analyses are presented below.

Start 1. The only significant effect was the Blocks main effect ($p < .011$). This finding indicates that Ss were still continuing to start faster even during the last four blocks of Experimental trials. Although no significant components of trend were obtained, quadratic and cubic functions were most descriptive of the trend. See Table XXX and Figure 22.

Run 1. The Blocks effect was significant at $p < .003$ on the analysis of the Run 1 measure. This trend was made up of significant linear ($p < .001$) and cubic ($p < .001$) components. No other components were significant. See Table XXX and Figure 23.

Goal 1. No significant effects were found on the Goal 1 measure. See Table XXX and Figure 24.

Start 2. While the Groups X Blocks interaction on the complete analysis only approached significance ($p < .060$), it was significant ($p < .021$) within only the last four Blocks of Phase III.

No significant components of the trend were found, although linear and quadratic functions were most descriptive. Significance of this interaction indicates that a clear difference between the groups emerged with practice. When the

first two Blocks are included, this difference tends to be obscured. See Table XXXI and Figure 25.

Run 2. While the Groups X Blocks interaction was significant ($p < .042$) on the complete analysis of Run 2, this interaction was not significant ($p < .093$) when only the last four Blocks were included. A significant linear component of trend ($p < .037$) described the interaction. Rather than the differences between the groups being reflected in the interaction, as in the complete analysis, they emerged in a Groups main effect ($p < .05$) when only the last four Blocks were analysed. This finding indicates that a reliable difference emerged by the third Block and remained through the sixth. The effect of including the first two blocks was to obscure this between-groups difference even though it was still reflected in the Groups X Blocks interaction. See Table XXXI and Figure 26.

Multiple Comparisons of Groups Means

Block by Block Analyses

A more complete picture of the data was given by one-way ANOVAs and multiple comparisons of group means, performed Block by Block with the Newman-Keuls technique. The results of these analyses are presented in Tables XXXII and XXXIII and arranged so that Experimental and Control Blocks can easily be compared. An inspection of these Tables reveals that the first statistically significant difference between groups occurred at Goal 1 on the first Control Block. The groups effect was significant at $p < .003$. Comparisons among

groups found that the Conflict group was significantly slower in Goal approach on this Control Block than either the Frustration or Control groups ($p < .05$). One implication is that experience with nonconflict after an experience with conflict may produce a marked slowing in Goal approach.

The second significant effect of major importance emerged at Run 2 on the third Experimental Block. The Groups effect was significant at $p < .015$. Comparisons among groups found that the Conflict group ran significantly faster in this section of Alley 2 on this Experimental Block than either the Frustration or Control groups ($p < .015$). This difference continued on the next Experimental Block, but there it was not significant.

Superior running speed by the Frustration group on Experimental trials in the second Alley did not emerge until the final Block of trials. The Group effect on the Start 2 measure was found to be significant at $p < .034$. Comparisons among group means revealed that the Frustration and Conflict groups were similar, with the significant F being produced by the very much slower Start 2 times of the Control group.

Except for the significant Goal 1 finding during the first Block of Phase III, no significant effects were found in the Control Blocks data. Clearly there is a strong probability that the significant findings which emerged on analyses of the Experimental Blocks were not spurious.

Within-S Analyses

Experiment II was designed so as to provide within-S comparisons, achieved by inclusion of Control Trials with Experimental Trials in Phase III; hence, the data yield within group as well as between group information. The within-S analyses took the form of a two-within-S analysis of variance, where Experimental vs Control Blocks represented the Trials Condition factor, and Blocks the practice factor. Separate analyses for each of the three experimental groups were performed, using each of the five dependent variables. Results of the analyses are summarized in Tables XXXIV through XXXVIII. The data are graphically presented in Figures 28 through 32.

Conflict Group. The only within-S effects which were statistically significant on analyses of Conflict Groups data were associated with Goal 1 and Run 2 dependent measures.

The Trials Conditions and Blocks main effects on Goal 1 were significant with associated probabilities of $p < .017$ and $p < .050$, respectively. On the average Conflict Ss were found to enter the Goal slower on Control Trials than on Experimental Trials. However, it was the large difference in the approach speed between the two types of trials that occurred during the first two blocks of Phase III which seemed to produce this difference. It would seem that nonconflict following the experience of conflict produces a response decrement. The significant Blocks effect indicates that Ss within the Conflict group approached the Goal faster with practice.

The Trials Conditions main effect for the Run 2 analysis was found to be statistically significant ($p < .012$). Generally, running speeds were faster following conflict than following control conditions. This difference was not clearly apparent, however, until the third Trial Block.

Control Group. Two statistically significant Trials Condition X Blocks interactions were found on analyses of Run 1 and Goal 1 measures ($p < .007$ and $p < .048$). In both cases, these interactions appear not to be the result of any consistent divergence between Conditions over Blocks, but rather, as the result of significant crossovers which occurred with time. This was also the case for the nonsignificant Run 2 measure ($p < .060$). The reader should be reminded that critical ratios tend to be inflated in designs involving within-S factors because of the dependencies among levels which exist. Therefore, one should not be too surprised at these spuriously significant interactions.

No other significant effects emerged in the analyses performed on the remaining dependent variables.

Frustration Group. The Blocks main effect was found to be significant in all but the Goal 1 measure. This reflects a gradual increase in running speed as Phase III progressed. Such findings are of little importance to the main research interest, and would not be worth mentioning except that no other groups presented such a consistent trend in the data.

A significant Trial Conditions main effect was found on the Start 1 analysis. When averaged over Blocks, Ss in the

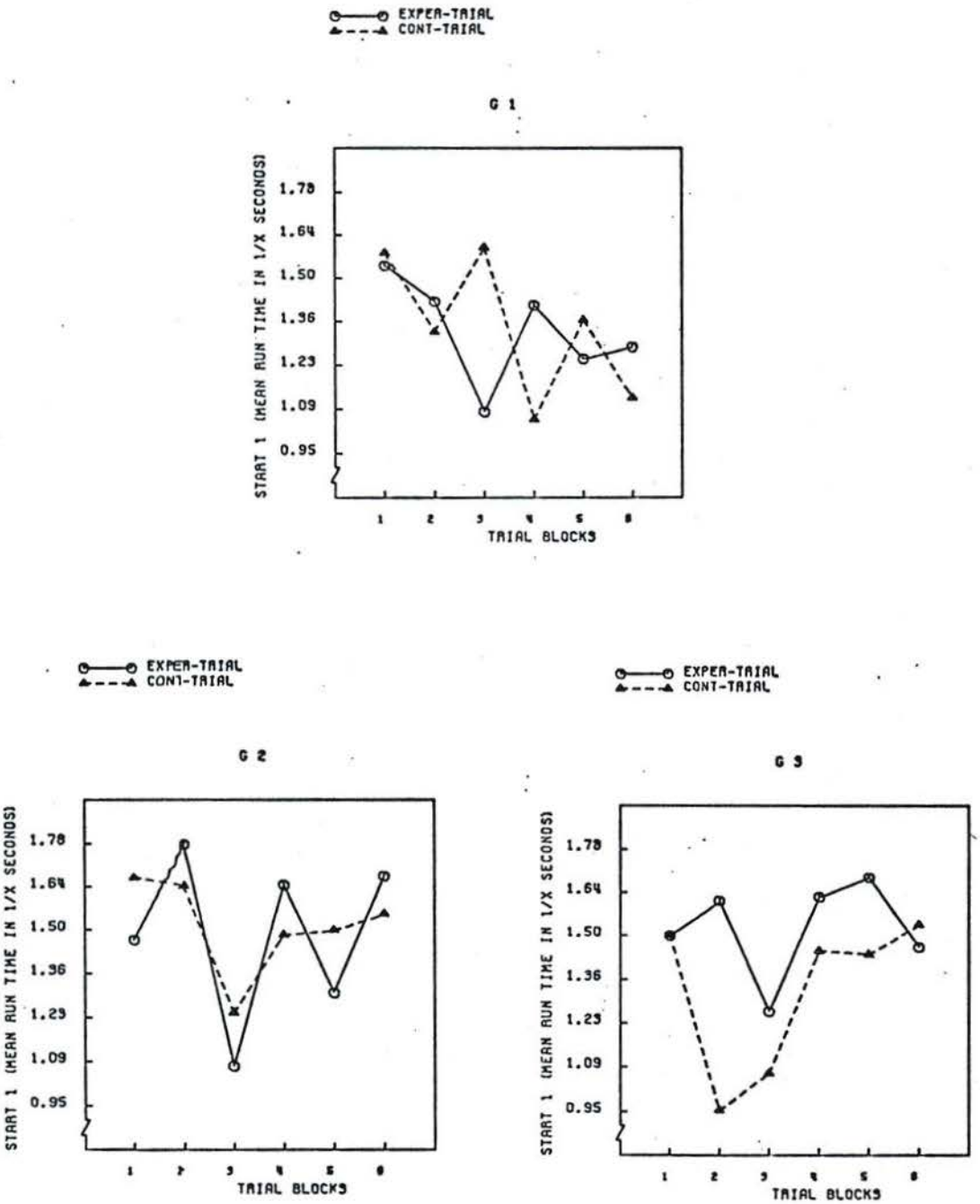

Figure 28. Experiment II. Within-S comparison of Phase III Experimental and Control trials for Conflict (G 1), Control (G 2), and Frustration (G 3) groups. Mean 1/run times of dependent variable Start 1.

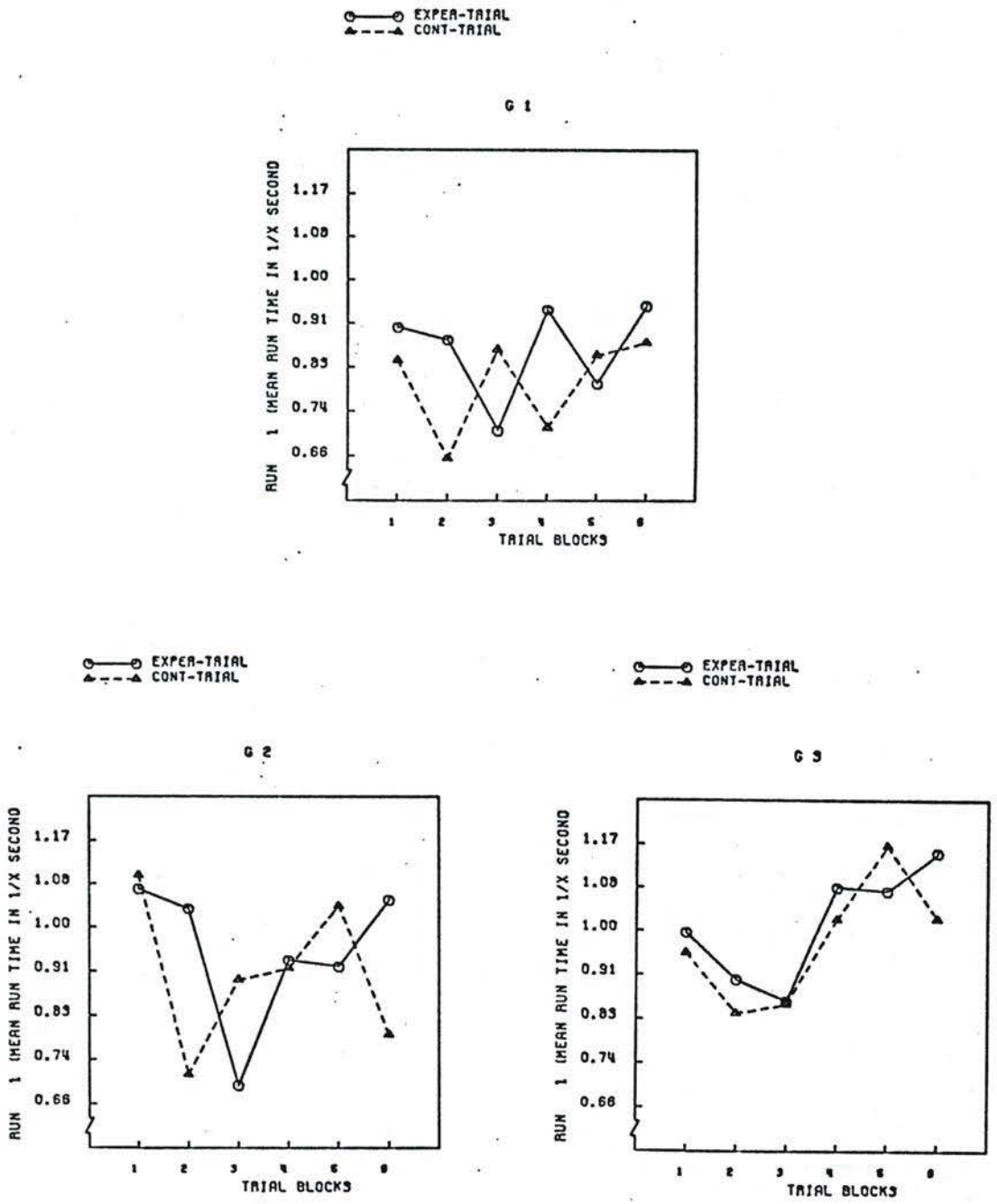

Figure 29. Experiment II. Within-S comparison of Phase III Experimental and Control trials for Conflict (G 1), Control (G 2), and Frustration (G 3) groups. Mean 1/run times of dependent variable Run 1.

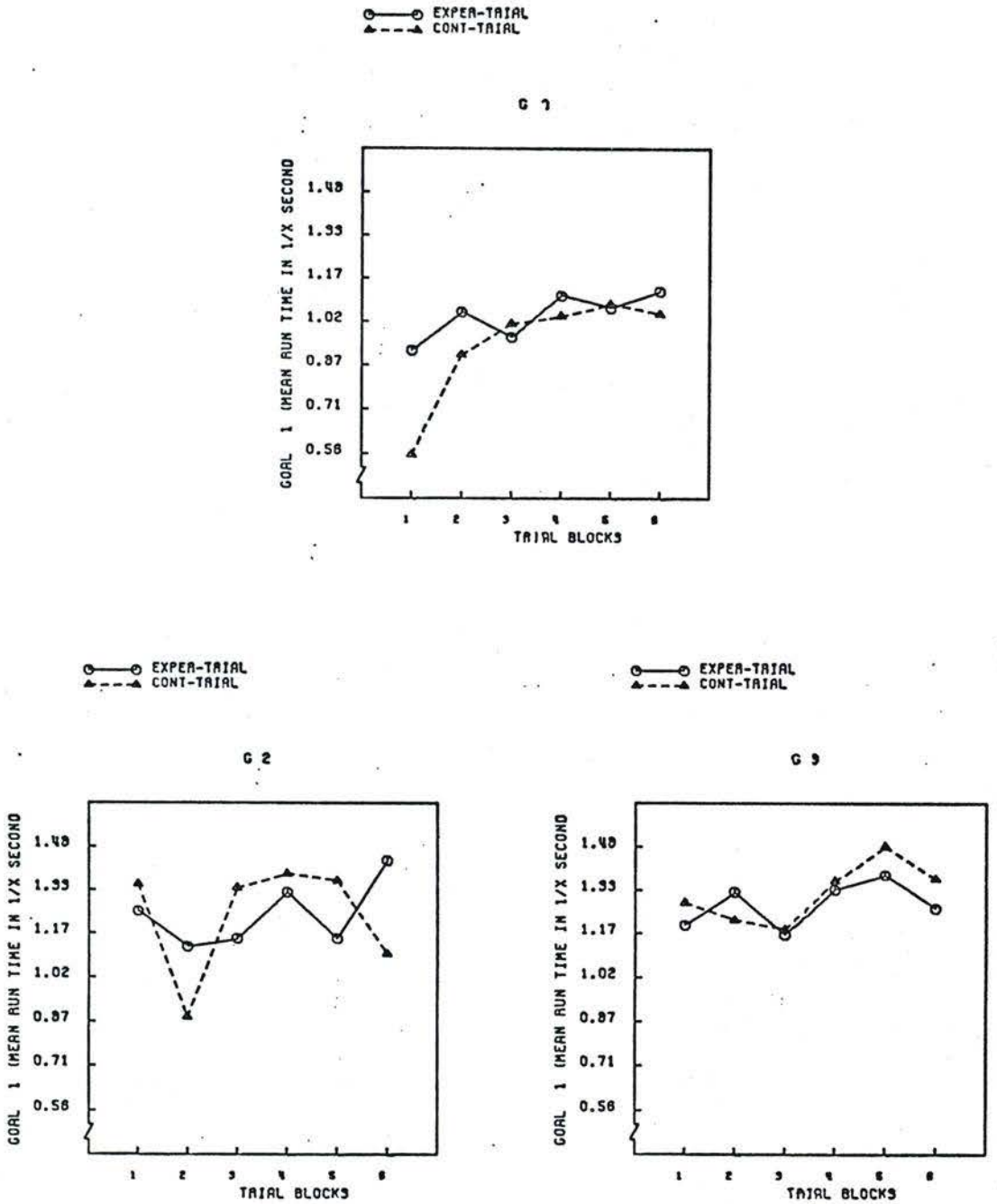

Figure 30. Experiment II. Within-S comparison of Phase III Experimental and Control trials for Conflict (G 1), Control (G 2), and Frustration (G 3) groups. Mean 1/run times of dependent variable Goal 1.

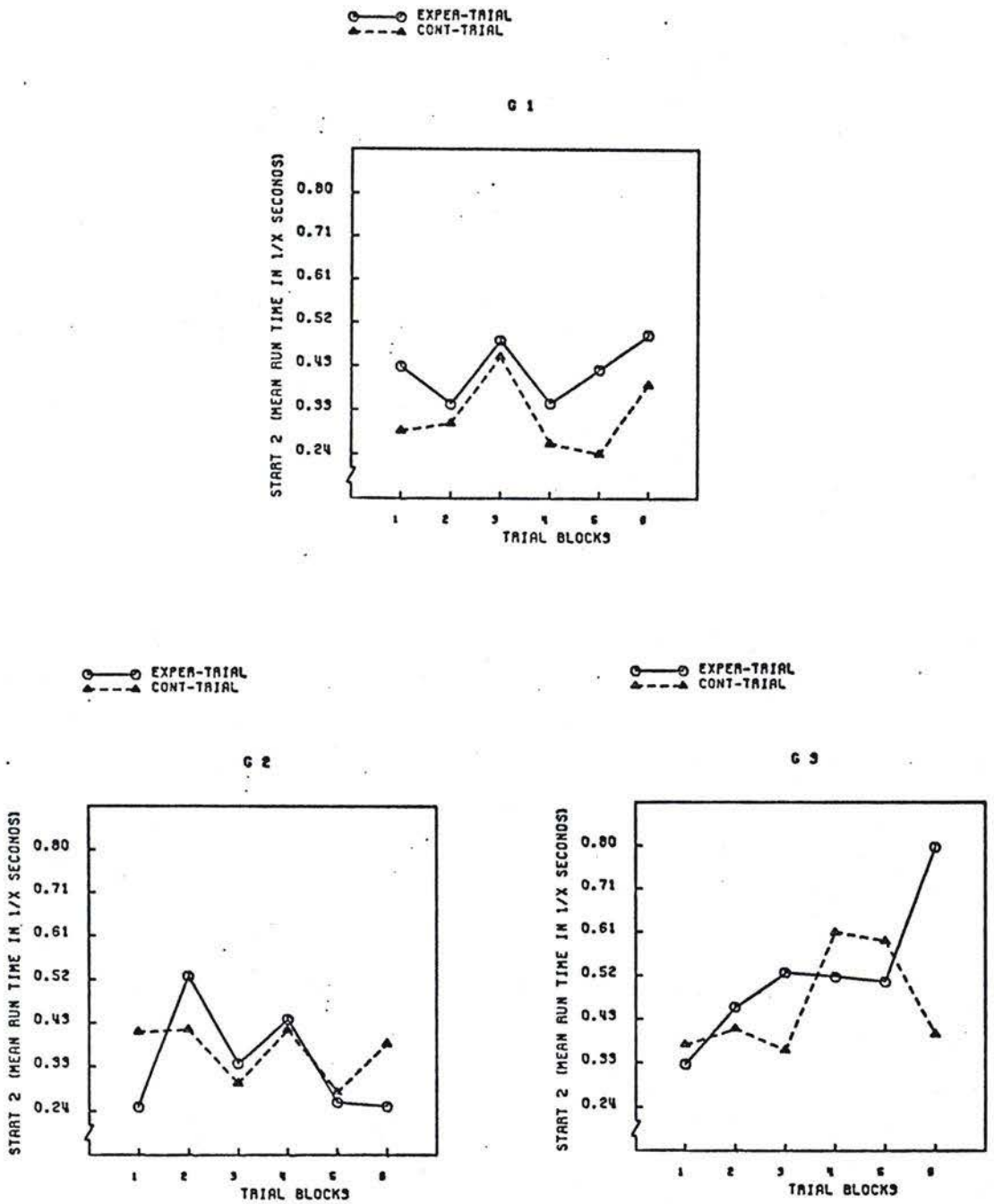

Figure 31. Experiment II. Within-S comparison of Phase III Experimental and Control trials for Conflict (G 1), Control (G 2), and Frustration (G 3) groups. Mean 1/run times of dependent variable Start 2.

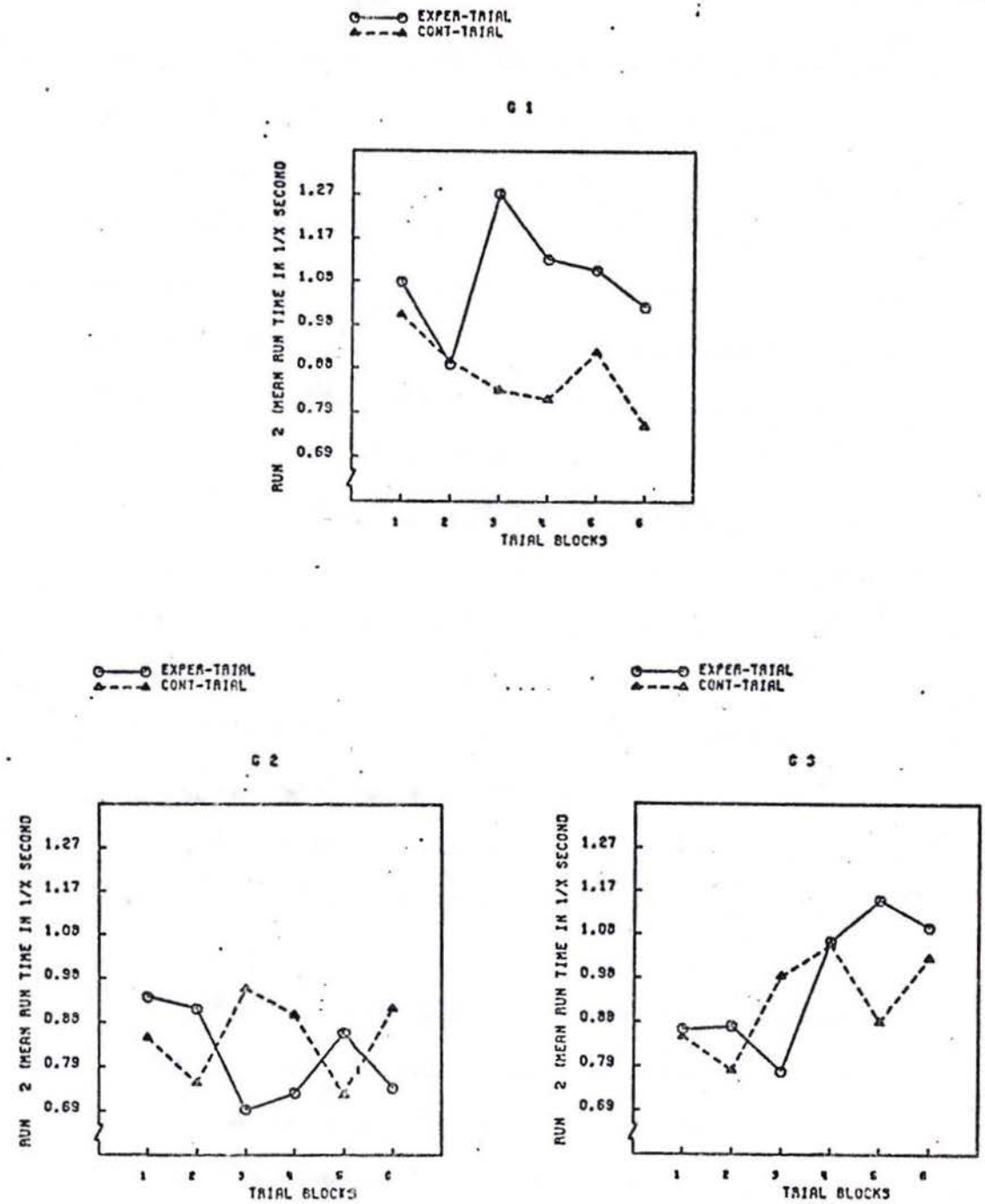

Figure 32. Experiment II. Within-S comparison of Phase III Experimental and Control trials for Conflict (G 1), Control (G 2), and Frustration (G 3) groups. Mean 1/run times of dependent variable Run 2.

Frustration group started faster on Experimental trials than on Control trials. This difference was primarily apparent on the second Block and tended to disappear with further practice. The reason for this difference is somewhat unclear, because precautions were taken to prevent anticipatory discrimination between Control (CR) trials and Experimental (nonreward) trials, by randomly interspersing Control trials within the Experimental trials sequence.

Post Hoc Test of Discrimination

The results of the four discrimination test trials were generally as expected. As can be seen in Table XXXIX only two Ss showed positional preference and four Ss made an error. All but two Ss correctly chose S+ on the initial trial. From these data one can conclude that the procedure of guiding a S's response consistently to the relevant stimulus was successful in creating a relatively high level of stimulus control.

An additional check was made on the position preference exhibited by Ss in the Conflict Group on Experimental trials of Phase III. It was found that seven out of nine Ss chose the left side of GB 1 on at least five of the six trials. This is an interesting finding in that only one S in the Conflict Group showed a positional preference on the discrimination test. This would seem to indicate that given a choice between two relatively equal alternatives, positional preferences are learned, or at least used, as a solution to the conflict. On the other hand, from the data of Phase III,

it would seem that use of a positional habit as a solution to conflict in no way reduces the effect of conflict on the general level of motivation.

DISCUSSION

Unfortunately, Experiment I was not satisfactory in establishing experimental operations of approach-approach conflict and continuous reward unconfounded with the effects of nonreward; the confounding of reward and nonreward discriminanda was attributed to generalization to S+ of nonreward effects arising from a training procedure which forced actual experience of nonreward to S-, before S+ and S- were discriminable to an S. Hence, Experiment II was designed so that Ss would be consistently guided to S_L occasioning continuous reward, without any experience to S- occasioning nonreward. This procedure precluded the possibility that any nonreward effects associated with S- could influence behavior presumed to be under the control of approach-approach conflict or continuous reward. In addition, two phases of acquisition trials were run to insure adequate stimulus control before the institution of experimental conditions. The procedural changes employed in Experiment II were sufficient to produce significant differential effects between groups.

Overall analyses of the mixed-design tested the hypotheses that operations of nonreward and approach-approach conflict would elicit similar motivational effects, reflected in performance in the first and second alleys of the double runway maze. Specifically, Frustration and Conflict groups were expected to

show an immediate increase in Alley 2 running speed, relative to the speed of the Continuous Reward Control group. This hypothesis was confirmed. However, the increments did not occur immediately. Significant differences in Alley 2 running speed developed only after two experimental Blocks. Significantly increased running speed in the Conflict group occurred on the third Block. The frustration group's speed increased one Block later, but did not become significantly faster than the Control group until Blocks five and six. Increases in Frustration and Conflict group running speed were first detected in the Run 2 section of the second alley: not until the fifth Block was an increase noted in the vigor of starting into Alley 2.

Several conclusions are indicated regarding Alley 2 performance: first, the procedural changes instituted in Experiment II were sufficient to produce significant between-group effects; second, increments in the general level of motivation were produced by the operations of approach-approach conflict and frustrative nonreward. However, the data indicate that conflict may produce an increment faster than nonreward and that the effect tends to move backward along the behavioral sequence after practice; and finally, that differential effects (between conflict and frustration) may develop only with increased experience with these experimental conditions. This conclusion is limited by a methodological problem which was a necessary, but unfortunate, occurrence during the experiment.

Differential effects of experimental operations were not observed in Alley 1 behavior. While faster average approach times were noted, no significant differences between groups were found. The rank order of experimental groups on Goal 1 was as originally predicted; the Conflict group consistently showed a slower approach to goal than the Frustration and Control groups; Frustration and Control approaches were almost indistinguishable. This finding is in contrast to those of the Experiment I between-and within-S findings, and even the within-S finding for the Conflict group in this experiment. In both cases the Conflict group approached the goal relatively faster during conflict operations, although in the present experiment the differences in speed of approach during Experimental and Control trials disappeared after the second Block. The fact that no differential effects were observed in Alley 1 behavior is not especially surprising. In general, for Alley 1 it is very likely that more than six blocks of two trials are necessary to produce differential effects of any magnitude between groups. Had the experimental phase been continued experimental conditions would probably have affected Alley 1 behavior.

Control trials were randomly interspersed within the Experimental trial sequence. Performance of groups on the former provides a baseline with which performance on Experimental trials may be compared. Therefore, separate overall analyses of data from Control trials provide additional comparative support for the reality of effects observed on Experimental trials.

As predicted, no differential effects were found between groups on analyses of Control trial data. The only measure which recorded any difference at all between groups was Goal 1. The Conflict group was slower than the other in approaching the first goal. This duplicated the effect found on Experimental trials, except that on the first Control trial following initiation of approach-approach conflict, Conflict Ss showed significantly slower approach to the goal. (Within the Conflict Ss, the contrast between the continuous reward and conflict operations apparently produced a significant response decrement which the Ss never entirely overcame). It can be concluded that the lack of significant inter-group differences on Control trials provides additional support for the reality of the Experimental trial effects.

As previously mentioned, the lag in appearance of differential group effects was not expected. Possibly it depended upon some degree of experience with conflict or nonreward - required in order for these to exact a measurable effect -- or it may have been due to the necessary, but unfortunate, change in daily rations. Unfortunately, this question can not be answered without replication.

Apart from the question of the latency of experimental effects, it was asked: If the first two blocks of Experimental trials (which were confounded by a change in deprivation rations) were ignored, would group performance be as originally predicted? Accordingly, a set of analyses which used only the last four blocks of Experimental trials were run. No significant

differences were found in measures of the first alley, except those of the Blocks main effects. This replicates findings of the complete design. The differential effect of experimental operations was still emerging with practice on Start 2. This effect, which only approached significance on the complete analysis, was found to be significant when only the final four blocks were considered. The clear difference expected at the beginning of experimental operations emerged on Run 2 only during the last four blocks. The performance of these groups was as expected; Conflict produced the fastest running in Alley 2, followed by Frustration, then Control. Findings from this set of analyses provide additional support for the overall findings. However, as stated, they provide little additional information which might help clarify alternative interpretations of the lag in experimental effects.

The design of Experiment II also provided an opportunity for within-S examination of the hypothesis that conflict would resemble frustrative nonreward in its motivational increment of subsequent running speed. Each S was run under experimental and control conditions. The within-S analyses tested the hypothesis that differential effects observed between-groups on Experimental trials would also be observed within-groups between Control and Experimental trials. The hypothesis was confirmed only for the Conflict and Control groups. The Conflict group showed faster running in the Run 2 section of Alley 2, following conflict and slower approach to goal in Alley 1; a similar effect occurred in Experiment I. For the

Control group, significant interactions between Trial Conditions and practice were found on Run 1 and Goal 1 measures of first alley performance, the result of significant crossovers in alternating directions from block to block. These effects are interpreted as inconsistent variation detected by a rather sensitive analysis. The Frustration group did not show a within-S frustration effect, probably because increased vigor of responding following nonreward did not develop until the fourth block. Possibly several trials are necessary before a frustration effect will be observed within-Ss. An unexpected finding was that the Frustration group consistently started into Alley 1 faster on Experimental trials than on Control trials. The Ss in this group should not have been able to distinguish between Experimental and Control trials but it seems that somehow they did. The reason for faster starts on Experimental trials is unclear; moreover, logic would suggest that starting, if any different, should be slower since responses were nonrewarded. Precautions were taken to prevent cueing of experimental conditions of nonreward, even to the point of randomly interspersing Control trials within the Experimental trials sequence, running Ss in random order, and screening the dispensing of pellets from view. There is always a possibility that some inadvertent cue from the experimenter produced the effect.

The post hoc discrimination test checked the success of the guiding procedure for creating stimulus control of responding. The results of the test were generally as expected.

Only two Ss exhibited positional preferences, and another two made discrimination errors. So the procedure was successful in establishing discrimination. Interestingly, during the experiment the Conflict Ss tended to have a left side positional preference during choice trials. However, this position preference was not carried over to the discrimination test. From the data of Experiment I and II it is evident that Ss used positional habits as a solution to the approach-approach conflict in GB 1. It is not clear from Experiment II if these positional preferences were learned. What does seem apparent is that the use of positional preference as a solution to conflict could not entirely have reduced the effect of conflict in producing an increment in the general level of motivation.

To summarize: the hypothesis was supported that operations of both approach-approach conflict and frustrative-nonreward would result in an increment in the general level of motivation, as measured by an increase in the running speed of Ss in Alley 2. However, the finding that this effect would require practice in order to develop was not predicted, though not theoretically precluded either. Possible reasons could be inherent in the experimental methodology, or due to the unfortunate necessity of increasing daily deprivation rations. An answer to this question must wait until replication.

The within-S analyses added further support to the main thesis. Results for the Conflict and Control groups indicate that between-S results were replicated within-Ss. However, the

Frustration group did not show a within-S frustration effect; such an effect seems to require time to develop for it to be evident within-Ss.

Evidence of successful acquisition of discrimination was found on the post hoc discrimination test. However, a position preference was found in the Conflict group during experimental trials. These preferences did not transfer to the discrimination test. The use of a positional habit was viewed as a solution to conflict which did not reduce the energizing effects of conflict below the threshold of detectability.

Chapter IV

Conclusions

The present investigation compared motivational properties of frustrative-nonreward, conflict involving nonreward, and conflict unconfounded with nonreward. The main hypothesis was that each of these experimental operations would result in an increase in the general level of motivation of the subject, as measured by an increase in running speed in the second alley of a double-alley apparatus. The conclusions of the present study are based on two different experimental designs; one in which experimental operations were interspersed during discrimination training, the other, in which experimental operations followed the acquisition of discriminated approach.

The findings of each experiment confirm that operations which produce "pure" conflict unconfounded by nonreward can increase the general level of motivation, analogously to the effects of nonreward. Support for this conclusion comes from the within-S analyses of Experiment I and the between-S analyses of Experiment II. The reason for the quite different sources of support given by each experiment may be explained by the differences between the two experiments' procedures for developing stimulus control. The procedure for discrimination training in Experiment I involved guided trials to S- associated with nonreward. There is a good likelihood that this training procedure was not successful, allowing the aversive effects

inherent in nonreward, associated with S- to generalize to the continuously rewarded S+. Consequently, rather than S+ being conditioned to continuous reward in Groups C and O, it was associated with partial reward. The differential effects of experimental operations would thereby have been reduced so that between-group differences were largely washed out. The training procedure adopted in Experiment II consistently guided approach responses to the lighted goal box chamber (S+) and eliminated any guided trials to S-. This procedure successfully precluded any possibility that nonreward associated with S- would influence behavior presumed to be under the control of approach-approach conflict or continuous reward.

While an increment in the general level of motivation was found as the result of approach-approach conflict and frustrative-nonreward, differences in the effect of each operation were apparent. The first difference was that experimental operations of conflict and frustration produced a "conflict effect" (CE) and a frustration effect (FE) whose temporal profiles were rather different. In Experiment I, the Conflict only (C) and the Frustration plus Conflict (FC) groups showed a gradual increase with practice which became statistically significant around the tenth block of the fifteen block experiment. The Frustration only (F) group showed no significant increase in FE until around the eleventh block. Experiment II found the increase to occur first in the Conflict group then in the Frustration group.

The effect also apparently moved backwards, with practice, along the response sequence; it was first noted in the Run 2 section, then in the Start 2 section of the second alley. The implications of these findings are that conflict may increase motivation before frustrative-nonreward is able to, provided that learning is not complicated by nonreward. In order for nonreward to be frustrative, some experience with it in the context of reward is necessary. Conflict between two quickly-learned approach tendencies would not require such a time-lag. There is also some indication that approach-approach conflict elicited a larger increment in motivation level than frustrative-nonreward. This conclusion holds for the Run 2 data of both experiments. It should be pointed out, however, that the magnitude of FE is dependent on the size of reward. Since the size of the reward used in the present investigation was small the conclusion might not hold for a larger size of reward. The conclusion may also be dependent on the criterion region of Alley 2, since in Experiment II the Frustration group did leave the first Goal Box faster than the Conflict group. A possibility that CE requires an intra-trial post-conflict warm-up may account for the differences in starting speed.

The second difference between the two basic operations of conflict and frustration was seen in the behavior occurring in Alley 1. The operations of approach-approach conflict produced faster goal entry than did trials not involving these operations. Although in Experiment II this difference tended

to disappear quickly, in Experiment I the effect was maintained throughout the experiment. Interestingly, during Experiment I approach to goal was faster for Conflict than for Frustration. In Experiment II, however, the Frustration group approached the goal faster than the Conflict group, although the difference was not significant and there was some indication that the speed of approach of the two groups were converging. These findings strongly imply two points: first, the experimental phase of Experiment II was not long enough for approach-avoidance conflict to develop in the Frustration group; and second, while approach-approach conflict can produce faster approach, it tends to also produce a decrement in approach on subsequent trials not employing conflict operations. The contrast in the findings of the two experiments raises the question as to what differential elements of the procedures in Experiments I and II produced the differences. At this point it is argued that the difference is accounted for by the introduction of experimental operations <u>during</u> acquisition of discrimination and with generalized nonreward associated with S-, in Experiment I. In Experiment II the experimental operations <u>followed</u> discrimination, and without generalized nonreward.

The <u>post hoc</u> tests of discrimination training and checks of the position choices on trials involving free-choice of the two experiments produced some interesting findings. First of all, only training operations which did not guide a subject to an alternate, nonrewarded discriminative stimulus,

produced accurate stimulus control in the post-experimental test of discrimination. Second, there is some indication that positional preferences were used as a solution to conflict involving two relatively equal alternatives. The rationale in both experiments was to equate position preference by forced practice to the less-favored Goal Box 1 side, but in execution this intention was not realized. Data from Experiment I suggests that a positional habit was learned during the course of the experiment but there is not sufficient data from Experiment II for conclusive evidence. A comparison of the positional preferences shown during the actual experiments with those shown during the post-experimental discrimination task revealed that positional preferences were not carried over to the discrimination test; had they been, the subject probably could not have been credited with having learned the discrimination. It was also concluded that positional preference did not seem to reduce conflict effects.

Chapter I outlined in some detail two of the best motivational-behavioral theories of frustration extent in the frustration literature, those of Amsel and of Brown and Farber. The two theories are isomorphic on most points: both theories regard frustration as having two primary effects: (1) it results in an increment to the general level of motivation, and (2) it provides distinctive internal stimuli. However, they differ on the key point of the antecedent conditions which are postulated to produce frustration. Amsel defines frustration as the consequence of nonreward trials

following the experience of rewarded trials.[2] This is a clear and precise operational definition of conditions antecedent to frustration. Hence, Amsel has provided one basic operation antecedent to frustration, rather than an elaborate list of variables and conditions that may lead to frustration. On the other hand, Brown and Farber suggest that frustration may result from operations which set the occasion for the simultaneous activation of any competitive excitatory or excitatory-inhibitory tendencies. Literature was reviewed which presented findings inconsistent with predictions from Amsel's position. It was suggested that several of these inconsistencies and ambiguities arise from the precise, but restricted, operational definition of Amsel and, thus, might be resolved by adopting the position of Brown and Farber.

Unfortunately, research had not yet provided a conclusive demonstration that "frustration-like" effects could result from the simultaneous activation of two competive excitatory tendencies, unconfounded with elements of nonreward. The present investigation provides this demonstration.

Several conclusions emerge: (1) conflict operations, without elements of nonreward, are capable of producing "frustration-like" effects; (2) given the right circumstances, Amsel's operations may be subsumed under those of Brown and

[2]It should be noted that Brown and Farber anticipated the operation of frustrative-nonreward in their 1951 paper (p. 481) and justifiably included it as another operation defining conflict.

Farber (although it is recognized that primary aversive properties of nonreward may provide an additional increment in motivation beyond that produced by conflict without nonreward); (3) the Brown-Farber position is more parsimonious than Amsel's, encompassing a larger set of antecedent conditions defining frustrating situations within the one operation of conflict, without the necessity of additional assumptions to account for inconsistent findings; and (4) while the Brown-Farber position is more general, it need not be any less precise than Amsel's operational definition.

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Appendix A

Tables for Experiment I and Experiment II

Table IV

Experiment I. Multivariate Analyses of Variance Summary of the Difference between Experimental Groups and Stimuli over the Complete Set of Criterion Trial Blocks using Dependent Measures of the First Alley. Only the Largest Roots of the Multivariate Analyses are Reported.

		Start 1			Run 1			Goal 1		
Source	df	MS	F	p<	MS	F	p<	MS	F	p<
Between Groups										
Groups	3	.230	1.382	.284	.044	1.294	.311	.034	.606	.621
Stimuli	1	.217	1.305	.270	.027	.794	.386	.002	.043	.839
Groups X Stimuli	3	.348	2.094	.141	.049	1.444	.267	.067	1.212	.337
Within Cells	16	.166			.034			.055		
Within Groups										
Blocks	14/3.000		4.909	.108		60.118	.003*		11.984	.032*
Groups X Blocks	42/9.665		1.007	.537		3.936	.014*		1.172	.421
Stimuli X Blocks	14/3.000		.539	.816		8.451	.052		.206	.984
Grps. X Stimuli X Blks.	42/9.665		1.079	.483		3.373	.024*		.637	.848

* Statistically Significant at p< .05.

Table V

Experiment I. Multivariate Analyses of Variance Summary of the Difference between Experimental Groups and Stimuli over the Complete Set of Criterion Trial Blocks using Dependent Measures of the Second Alley. Only the Largest Roots of the Multivariate Analyses are Reported.

		Start 2			Run 2		
Source	df	MS	F	p <	MS	F	p <
Between Groups							
Groups	3	.061	1.181	.348	.090	2.072	.144
Stimuli	1	.057	1.106	.309	.030	.688	.419
Groups X Stimuli	3	.059	1.139	.363	.090	2.087	.142
Within Cells	16	.052			.043		
Within Groups							
Blocks	14/3.000		2.837	.212		4.671	.115
Groups X Blocks	42/9.665		.436	.969		.579	.892
Stimuli X Blocks	14/3.000		.709	.719		.339	.931
Groups X Stimuli X Blocks	42/9.665		.491	.945		.560	.905

Table VI

Experiment I. Newman-Keuls Multiple Comparisons for Differences between Experimental Group at the First, Middle, and Final Five Trial Block Phases of the Experiment using Start 1 as the Dependent Variable.

First Five Trial Blocks

$F = .33$ $df = 3/20$ $p < .806$

Groups		C	O	F	FC
	Means	1.031	1.018	.962	.834
Group FC	.834	.198	.184	.128	----
Group F	.962	.069	.056	----	
Group O	1.018	.014	----		
Group C	1.031	----			

The Multiplier is .15779

Middle Five Trial Blocks

$F = .82$ $df = 3/20$ $p < .498$

Groups		O	C	F	FC
	Means	1.752	1.576	1.341	1.340
Group FC	1.340	.412	.236	.001	----
Group F	1.341	.411	.236	----	
Group C	1.576	.176	----		
Group O	1.752	----			

The Multiplier is .22123

Final Five Trial Blocks

$F = 2.04$ $df = 3/20$ $p < .141$

Groups		O	C	F	FC
	Means	2.116	1.905	1.530	1.451
Group FC	1.451	.666	.455	.070	----
Group F	1.530	.587	.376	----	
Group C	1.905	.211	----		
Group O	2.116				

The Multiplier is .22016

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* Significant at $p < .05$.

Table VII

Experiment I. Newman-Keuls Multiple Comparisons for Differences between Experimental Groups at the First, Middle, and Final Five Trial Block Phases of the Experiment using Run 1 as the Dependent Variable.

First Five Trial Blocks

$F = .63$ $df = 3/20$ $p < .603$

Groups		F	O	FC	C
	Means	.500	.455	.376	.341
Group C	.341	.159	.114	.035	----
Group FC	.376	.124	.078	----	
Group O	.455	.046	----		
Group F	.500	----			

The Multiplier is .09115

Middle Five Trial Blocks

$F = 1.59$ $df = 3/20$ $p < .223$

Groups		O	F	C	FC
	Means	.745	.674	.593	.495
Group FC	.495	.250	.179	.098	----
Group C	.593	.152	.081	----	
Group F	.674	.071	----		
Group O	.745				

The Multiplier is .08533

Final Five Trial Blocks

$F = 2.25$ $df = 3/20$ .113

Groups		O	C	F	FC
	Means	.991	.845	.785	.718
Group FC	.718	.273	.126	.067	----
Group F	.785	.206	.059	----	
Group C	.845	.147	----		
Group O	.991	----			

The Multiplier is .07753

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* Significant at $p < .05$.

Table VIII

Experiment I. Newman-Keuls Multiple Comparisons for Differences between Experimental Groups at the First, Middle, and Final Five Trial Block Phases of the Experiment using Goal 1 as the Dependent Variable.

First Five Trial Blocks

$F = .38$ $df = 3/20$ $p < .771$

Groups		F	O	FC	C
	Means	.474	.435	.402	.341
Group C	.341	.133	.094	.061	----
Group FC	.402	.072	.033	----	
Group O	.435	.039	----		
Group F	.474	----			

The Multiplier is .09183

Middle Five Trial Blocks

$F = .33$ $df = 3/20$ $p < .804$

Groups		F	C	O	FC
	Means	.875	.869	.791	.713
Group FC	.713	.163	.156	.079	----
Group O	.791	.084	.077	----	
Group C	.869	.007	----		
Group F	.875	----			

The Multiplier is .13320

Final Five Trial Blocks

$F = 1.64$ $df = 3/20$ $p < .212$

Groups		F	C	O	FC
	Means	1.170	1.045	1.041	.856
Group FC	.856	.314	.189	.185	----
Group O	1.041	.129	.005	----	
Group C	1.045	.125	----		
Group F	1.170	----			

The Multiplier is .10114

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* Significant at $p < .05$.

Table IX

Experiment I. Newman-Keuls Multiple Comparisons for Differences between Experimental Groups at the First, Middle, and Final Five Trial Block Phases of the Experiment using Start 2 as the Dependent Variable.

First Five Trial Blocks

$F = 1.53$ $df = 3/20$ $p < .237$

Groups		F	O	FC	C
	Means	.451	.269	.150	.083
Group C	.083	.368	.185	.067	----
Group FC	.150	.301	.119	----	
Group O	.269	.182	----		
Group F	.451	----			

The Multiplier is .13037

Middle Five Trial Blocks

$F = 1.43$ $df = 3/20$ $p < .263$

Groups		C	O	F	FC
	Means	.509	.454	.315	.264
Group FC	.264	.245	.189	.051	----
Group F	.315	.194	.139	----	
Group O	.454	.055	----		
Group C	.509	----			

The Multiplier is .09598

Final Five Trial Blocks

$F = 2.08$ $df = 3/20$ $p < .134$

Groups		C	O	F	FC
	Means	.984	.655	.563	.446
Group FC	.446	.537	.209	.116	----
Group F	.563	.421	.092	----	
Group O	.655	.329	----		
Group C	.984	----			

The Multiplier is .15991

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* Significant at $p < .05$.

Table X

Experiment I. Newman-Keuls Multiple Comparisons for Differences between Experimental Groups at the First, Middle, and Final Five Trial Block Phases of the Experiment using Run 2 as the Dependent Variable

First Five Trial Blocks

$F = 2.20$ $df = 3/20$ $p < .119$

Groups		F	O	C	FC
	Means	.622	.616	.385	.384
Group FC	.384	.238	.232	.001	----
Group C	.385	.237	.231	----	
Group O	.616	.005	----		
Group F	.622	----			

The Multiplier is .09115

Middle Five Trial Blocks

$F = 1.31$ df 3/20 $p < .300$

Groups		O	F	C	FC
	Means	.781	.767	.663	.527
Group FC	.527	.254	.240	.136	----
Group C	.663	.118	.104	----	
Group F	.767	.014	----		
Group O	.781	----			

The Multiplier is .10268

Final Five Trial Blocks

$F = 1.65$ $df = 3/20$ $p < .209$

Groups		O	F	C	FC
	Means	.926	.868	.842	.618
Group FC	.618	.308	.250	.224	----
Group C	.842	.085	.026	----	
Group F	.868	.059	----		
Group O	.926	----			

The Multiplier is .10499

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* Significant at $p < .05$.

Table XI

Experiment I. Within-S Analyses of Variance Summary of Comparisons between Rewarded vs Nonrewarded Training Trials over Trial Blocks using Start 1 as the Dependent Variable.

		Group C			Group O			Group FC			Group F		
Source	df	MS	F	p	MS	F	p	MS	F	p	MS	F	p
Trial Blocks	14	1.95	13.498	.000*	3.29	15.827	.000*	.90	4.698	.000*	1.56	8.326	.000*
Error	70	.14			.21			.19			.19		
Trial Conditions	1	.12	2.105	.207	.11	2.134	.204	.07	.470	.524	.71	19.824	.007*
Error	5	.05			.05			.15			.04		
Blocks X Conditions	14	.02	.265	.996	.09	.958	.503	.04	.574	.877	.10	1.478	.143
Error	70	.07			.09			.07			.07		

* Statistically Significant at $p < .05$.

Table XII

Experiment I. Within-S Analyses of Variance Summary of Comparisons between Rewarded vs Nonrewarded Training Trials over Trial Blocks using Run 1 as the Dependent Variable.

		Group C			Group O			Group FC			Group F		
Source	df	MS	F	p	MS	F	p	MS	F	p	MS	F	p
Trial Blocks	14	.46	11.026	.000*	.53	10.994	.000*	.28	6.442	.000*	.45	5.921	.000*
Error	70	.04			.05			.04			.08		
Trial Conditions	1	.04	2.427	.180	.00	.066	.807	.02	.279	.620	.17	5.157	.072
Error	5	.02			.02			.06			.03		
Blocks X Conditions	14	.02	.933	.529	.05	2.234	.014*	.02	1.129	.350	.03	1.114	.362
Error	70	.02			.02			.02			.03		

* Statistically Significant at $p < .05$.

Table XIII

Experiment I. Within-S Analyses of Variance Summary of Comparisons between Rewarded vs Nonrewarded Training Trials over Trial Blocks using Goal 1 as the Dependent Variable.

		Group C			Group O			Group FC			Group F		
Source	df	MS	F	p	MS	F	p	MS	F	p	MS	F	p
Trial Blocks	14	.75	16.122	.000*	.53	15.259	.000*	.43	8.771	.000*	1.14	7.707	.000*
Error	70	.05			.03			.05			.15		
Trial Conditions	1	.00	.092	.774	.09	1.821	.235	.08	2.240	.195	.01	.097	.768
Error	5	.04			.05			.03			.11		
Blocks X Conditions	14	.06	2.804	.002*	.07	3.165	.001*	.03	1.411	.172	.06	.788	.678
Error	70	.02			.02			.02			.08		

* Statistically Significant at $p < .05$.

Table XIV

Experiment I. Within-S Analyses of Variance Summary of Comparisons between Rewarded vs Nonrewarded Training Trials over Trial Blocks using Start 2 as the Dependent Variable.

		Group C			Group O			Group FC			Group F		
Source	df	MS	F	p	MS	F	p	MS	F	p	MS	F	p
Trial Blocks	14	.70	3.999	.000*	.44	4.542	.000*	.17	1.869	.045*	.19	1.753	.064
Error	70	.18			.10			.09			.11		
Trial Conditions	1	.10	2.841	.153	.07	.915	.383	.08	.830	.404	.33	5.658	.063
Error	5	.04			.08			.10			.06		
Blocks X Conditions	14	.13	1.362	.195	.20	2.906	.002*	.07	2.782	.002*	.04	.909	.553
Error	70	.10			.07			.03			.04		

* Statistically Significant at $p < .05$.

Table XV

Experiment I. Within-S Analyses of Variance Summary of Comparisons between Rewarded vs Nonrewarded Training Trials over Trial Blocks using Run 2 as the Dependent Variable.

		Group C			Group O			Group FC			Group F		
Source	df	MS	F	p	MS	F	p	MS	F	p	MS	F	p
Trial Blocks	14	.32	9.279	.000*	.32	6.320	.000*	.09	.975	.487	.31	5.090	.000*
Error	70	.03			.05			.09			.06		
Trial Conditions	1	.03	1.588	.263	.09	1.759	.242	.09	11.757	.019*	.15	5.157	.072
Error	5	.02			.05			.01			.03		
Blocks X Conditions	14	.02	1.180	.310	.09	6.698	.000*	.03	1.363	.195	.03	1.868	.045*
Error	70	.02			.01			.02			.02		

* Statistically Significant at $p < .05$.

Table XVI

Experiment I. Within-S Analyses of Variance Summary of Comparisons between Rewarded Training Trials vs Criterion Trials over Trial Blocks using Start 1 as the Dependent Variable.

		Group C			Group O			Group FC			Group F		
Source	df	MS	F	p	MS	F	p	MS	F	p	MS	F	p
Trial Blocks	14	2.08	13.543	.000*	3.32	11.826	.000*	1.08	6.024	.000*	1.41	7.890	.000*
Error	70	.15			.28			.18			.18		
Trial Conditions	1	.04	.726	.433	.44	3.514	.120	.21	8.079	.036*	.03	.571	.484
Error	5	.05			.13			.03			.06		
Blocks X Conditions	14	.10	.822	.643	.15	1.532	.122	.11	1.145	.336	.09	.783	.684
Error	70	.13			.10			.09			.11		

* Statistically Significant at $p < .05$.

Table XVII

Experiment I. Within-S Analyses of Variance Summary of Comparisons between Rewarded Training Trials vs Criterion Trials over Trial Blocks using Run 1 as the Dependent Variable.

		Group C			Group O			Group FC			Group F		
Source	df	MS	F	p	MS	F	p	MS	F	p	MS	F	p
Trial Blocks	14	.54	15.570	.000*	.56	8.078	.000*	.30	8.007	.000*	.36	6.658	.000*
Error	70	.03			.07			.04			.05		
Trial Conditions	1	.00	.045	.840	.00	.040	.850	.01	.221	.658	.01	.074	.797
Error	5	.02			.03			.03			.09		
Blocks X Conditions	14	.06	2.104	.022*	.09	1.197	.297	.03	1.363	.195	.02	.817	.649
Error	70	.03			.07			.02			.03		

* Statistically Significant at $p < .05$.

Table XVIII

Experiment I. Within-S Analyses of Variance Summary of Comparisons between Rewarded Training Trials vs Criterion Trials over Trial Blocks using Goal 1 as the Dependent Variable.

		Group C			Group O			Group FC			Group F		
Source	df	MS	F	p	MS	F	p	MS	F	p	MS	F	p
Trial Blocks	14	1.04	15.971	.000*	.75	12.610	.000*	.50	10.139	.000*	1.20	9.217	.000*
Error	70	.07			.06			.05			.13		
Trial Conditions	1	2.24	48.580	.001*	1.11	39.604	.002*	1.01	13.238	.015*	.23	8.282	.035*
Error	5	.05			.03			.08			.03		
Blocks X Conditions	14	.04	1.004	.459	.08	1.704	.074	.05	1.337	.209	.02	.381	.976
Error	70	.04			.05			.04			.06		

* Statistically Significant at $p < .05$.

Table XIX

Experiment I. Within-S Analyses of Variance Summary of Comparisons between Rewarded Training Trials vs Criterion Trials over Trial Blocks using Start 2 as the Dependent Variable.

		Group C			Group O			Group FC			Group F		
Source	df	MS	F	p	MS	F	p	MS	F	p	MS	F	p
Trial Blocks	14	1.23	4.021	.000*	.39	2.894	.002*	.13	2.307	.011*	.24	1.724	.070
Error	70	.30			.14			.06			.14		
Trial Conditions	1	1.18	6.919	.047*	.28	5.616	.064	.13	.996	.364	.95	6.495	.051*
Error	5	.17			.05			.13			.15		
Blocks X Conditions	14	.21	1.780	.059	.10	.920	.542	.10	2.259	.013*	.11	1.173	.314
Error	70	.12			.11			.04			.09		

* Statistically Significant at $p < .05$.

Table XX

Experiment I. Within-S Analyses of Variance Summary of Comparisons between Rewarded Training Trials *vs* Criterion Trials over Trial Blocks using Run 2 as the Dependent Variable.

		Group C			Group O			Group FC			Group F		
Source	df	MS	F	p	MS	F	p	MS	F	p	MS	F	p
Trial Blocks	14	.39	10.108	.000*	.31	4.764	.000*	.11	1.661	.084	.19	4.831	.000*
Error	70	.04			.06			.07			.04		
Trial Conditions	1	.02	.753	.425	.06	2.304	.190	.00	.079	.789	.42	5.190	.072
Error	5	.03			.02			.04			.08		
Blocks X Conditions	14	.07	2.132	.020*	.05	1.400	.177	.03	1.169	.318	.02	1.078	.392
Error	70	.03			.03			.02					

* Statistically Significant at $p < .05$.

Table XXI

Experiment I. Within-S Analyses of Variance Summary of Comparisons between Rewarded Training Trials vs Criterion Trials over the Final Five Trial Blocks using Start 2 as the Dependent Variable.

		Group C			Group O			Group FC			Group F		
Source	df	MS	F	p	MS	F	p	MS	F	p	MS	F	p
Trial Blocks	4	.57	.971	.445	.07	.719	.589	.07	1.375	.278	.17	2.370	.087
Error	20	.59			.09			.05			.07		
Trial Conditions	1	2.65	15.420	.011*	.44	3.490	.120	.92	8.214	.035*	.69	14.528	.013*
Error	5	.17			.12			.11			.05		
Blocks X Conditions	4	.14	.646	.636	.16	1.865	.156	.02	.998	.432	.02	.184	.944
Error	20	.22			.09			.02			.10		

* Statistically Significant at $p < .05$.

Table XXII

Experiment I. Within-S Analyses of Variance Summary of Comparisons Between Rewarded Training Trials vs Criterion Trials over the Final Five Trial Blocks using Run 2 as the Dependent Variable.

		Group C			Group O			Group FC			Group F		
Source	df	MS	F	p	MS	F	p	MS	F	p	MS	F	p
Trial Blocks	4	.03	1.085	.391	.09	1.254	.321	.01	.171	.951	.03	.773	.555
Error	20	.02			.07			.05			.04		
Trial Conditions	1	.19	7.936	.037*	.20	9.075	.030*	.10	2.647	.165	.21	3.122	.122
Error	5	.02			.02			.04			.06		
Blocks X Conditions	4	.03	.865	.502	.03	.918	.473	.01	.604	.665	.03	1.365	.281
Error	20	.03			.03			.02			.02		

* Statistically Significant at $p < .05$.

Table XXIII

Experiment I. Post Hoc Test of Discrimination of Rewarded Stimulus in a Free-Choice situation. An Error is defined as one wrong choice, while a Position Habit is defined as two or more wrong choices.

Experimental	Ratio of Ss with Position Habits	Ratio of Ss Showing Errors	Ratio of Correct S+ Choices on the First Trial
Conflict	6/6	0/6	4/6
CR Control	6/6	0/6	3/6
Frustration-Conflict	5/6	1/6	5/6
Frustration	0/6	0/6	6/6

Table

Experiment I. A Summary of the Goal Box 1 Side Entered on Free-Choice Criterion Trials for Group C and Group FC.

Group	S#	BLOCKS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Ss Stimulus Condition
C	2	R	R	R	L	R	L	L	L	R	R	L	L	L	L	L	L+/D-
	19	L	R	L	R	R	R	R	R	L	R	R	R	R	R	R	D+/L-
	23	R	L	R	L	R	R	R	R	L	R	R	R	R	R	L	L+/D-
	10	L	R	R	R	R	L	L	L	R	R	R	R	R	R	R	D+/L-
	13	R	L	L	R	L	L	R	R	L	L	L	L	L	L	L	L+/D-
	12	R	R	R	R	L	L	L	L	L	L	L	L	L	L	L	D+/L-
FC	5	L	L	R	R	R	L	R	R	R	R	L	R	R	R	L	L±/D±
	4	R	L	L	L	L	L	R	L	L	L	R	L	L	L	R	D±/L±
	11	L	R	R	L	R	L	R	R	R	R	R	L	R	R	R	L±/D±
	8	R	L	L	L	L	R	L	L	L	L	L	L	R	L	R	D±/L±
	14	R	R	L	L	R	L	L	L	L	L	L	L	L	L	L	L±/D±
	9	R	L	R	R	R	L	R	R	R	L	L	L	L	L	L	D±/L±

N.B. R = Right Side and L = Left Side of GB 1. Stimulus Condition refers to the Stimuli used during discrimination training trials.

Table XXV

Experiment II. Multivariate and Univariate Analyses of Variance Summary of the Difference between Experimental Groups over the Complete Set of Blocks in Phase III using Start 1 as the Dependent Variable.

Analyes of Experimental Trials

Source	df	MS	F	p<
Groups	2	.096	.218	.805
Within Cells	24	.438		
Blocks	5/20		3.886	.013
Linear	1/24	.036	.080	.780
Quadratic	1/24	.374	1.557	.224
Cubic	1/24	.038	.192	.666
4th	1/24	.439	2.091	.161
5th	1/24	2.876	17.211	.001
Groups X Blocks	10/40		.653	.760
Linear	2/24	.140	.309	.737
Quadratic	2/24	.100	.416	.665
Cubic	2/24	.251	1.269	.299
4th	2/24	.076	.360	.701
5th	2/24	.267	1.599	.223

Analyses of Control Trials

Source	df	MS	F	p<
Groups	2	.098	.189	.829
Within Cells	24	.520		
Blocks	5/20		1.038	.454
Linear	1/24	.095	.204	.656
Quadratic	1/24	.895	3.479	.074
Cubic	1/24	.551	1.989	.171
4th	1/24	.000	.002	.963
5th	1/24	.032	.101	.753
Groups X Blocks	10/40		1.259	.286
Linear	2/24	.739	1.589	.225
Quadratic	2/24	.184	.715	.499
Cubic	2/24	.312	1.125	.341
4th	2/24	.223	1.267	.300
5th	2/24	.854	2.736	.085

Table XXVI

Experiment II. Multivariate and Univariate Analyses of Variance Summary of the Difference between Experimental Groups over the Complete Set of Blocks in Phase III using Run 1 as the Dependent Variable.

Analyses of Experimental Trials

Source	df	MS	F	p<
Groups	2	.050	.475	.627
Within Cells	24	.106		
Blocks	5/20		3.564	.018
Linear	1/24	.098	1.201	.284
Quadratic	1/24	.609	9.158	.006
Cubic	1/24	.050	1.304	.265
4th	1/24	.008	.303	.578
5th	1/24	.626	12.147	.002
Groups X Blocks	10/40		.676	.740
Linear	2/24	.106	1.292	.293
Quadratic	2/24	.049	.735	.490
Cubic	2/24	.020	.534	.593
4th	2/24	.038	1.352	.278
5th	2/24	.022	.435	.652

Analyses of Control Trials

Source	df	MS	F	p<
Groups	2	.071	.581	.567
Within Cells	24	.123		
Blocks	5/20		2.708	.050
Linear	1/24	.106	1.839	.188
Quadratic	1/24	.092	1.055	.315
Cubic	1/24	.848	11.710	.002
4th	1/24	.012	.175	.679
5th	1/24	.200	3.117	.090
Groups X Blocks	10/40		1.479	.183
Linear	2/24	.132	2.296	.122
Quadratic	2/24	.006	.064	.938
Cubic	2/24	.139	1.914	.169
4th	2/24	.037	.548	.585
5th	2/24	.061	.948	.401

Table XXVII

Experiment II. Multivariate and Univariate Analyses of Variance Summary of the Difference between Experimental Groups over the Complete Set of Blocks in Phase III using Goal 1 as the Dependent Variable.

Analyses of Experimental Trials

Source	df	MS	F	p<
Groups	2	.144	1.217	.314
Within Cells	24	.119		
Blocks	5/20		1.682	.185
Linear	1/24	.394	5.917	.023
Quadratic	1/24	.018	.088	.769
Cubic	1/24	.002	.051	.822
4th	1/24	.000	.000	.987
5th	1/24	.258	2.534	.125
Groups X Blocks	10/40		.838	.596
Linear	2/24	.013	.194	.825
Quadratic	2/24	.084	.421	.661
Cubic	2/24	.017	.375	.691
4th	2/24	.171	2.021	.155
5th	2/24	.001	.009	.991

Analyses of Control Trials

Source	df	MS	F	p<
Groups	2	.351	2.751	.084
Within Cells	24	.127		
Blocks	5/20		1.922	.135
Linear	1/24	.926	5.232	.031
Quadratic	1/24	.262	1.545	.226
Cubic	1/24	.555	4.005	.057
4th	1/24	.034	.298	.590
5th	1/24	.036	.388	.539
Groups X Blocks	10/40		1.230	.302
Linear	2/24	.247	1.398	.267
Quadratic	2/24	.173	1.024	.374
Cubic	2/24	.432	3.113	.063
4th	2/24	.231	2.030	.153
5th	2/24	.068	.730	.492

Table XXVIII

Experiment II. Multivariate and Univariate Analyses of Variance Summary of the Difference between Experimental Groups over the Complete Set of Blocks in Phase III Using Start 2 as the Dependent Variable.

Analyses of Experimental Trials

Source	df	MS	F	p<
Groups	2	.072	.799	.462
Within Cells	24	.090		
Blocks	5/20		1.553	.219
Linear	1/24	.209	2.767	.109
Quadratic	1/24	.005	.076	.785
Cubic	1/24	.247	5.836	.024
4th	1/24	.011	.116	.736
5th	1/24	.007	.096	.759
Groups X Blocks	10/40		1.995	.060
Linear	2/24	.337	4.462	.023
Quadratic	2/24	.129	1.979	.160
Cubic	2/24	.035	.824	.451
4th	2/24	.041	.450	.643
5th	2/24	.140	1.938	.166

Analyses of Control Trials

Source	df	MS	F	p<
Groups	2	.042	.461	.636
Within Cells	24	.092		
Blocks	5/20		.204	.957
Linear	1/24	.017	.255	.618
Quadratic	1/24	.015	.232	.635
Cubic	1/24	.001	.008	.929
4th	1/24	.010	.201	.658
5th	1/24	.047	.421	.523
Groups X Blocks	10/40		1.221	.308
Linear	2/24	.057	.872	.431
Quadratic	2/24	.062	.986	.388
Cubic	2/24	.194	2.714	.087
4th	2/24	.045	.933	.407
5th	2/24	.115	1.033	.371

Table XXIX

Experiment II. Multivariate and Univariate Analyses of Variance Summary of the Difference between Experimental Groups over the Complete Set of Blocks in Phase III using Run 2 as the Dependent Variable.

Analyses of Experimental Trials

Source	df	MS	F	p<
Groups	2	.165	1.883	.174
Within Cells	24	.088		
Blocks	5/20		1.471	.243
Linear	1/24	.078	.729	.402
Quadratic	1/24	.002	.029	.866
Cubic	1/24	.255	4.980	.035
4th	1/24	.012	.222	.642
5th	1/24	.002	.030	.863
Groups X Blocks	10/40		2.153	.042
Linear	2/24	.365	3.417	.049
Quadratic	2/24	.121	1.681	.207
Cubic	2/24	.019	.365	.698
4th	2/24	.261	4.659	.020
5th	2/24	.170	2.277	.124

Analyses of Control Trials

Source	df	MS	F	p<
Groups	2	.015	.139	.871
Within Cells	24	.111		
Block	5/20		.509	.766
Linear	1/24	.003	.024	.877
Quadratic	1/24	.001	.007	.933
Cubic	1/24	.009	.177	.678
4th	1/24	.283	2.662	.116
5th	1/24	.004	.086	.772
Groups X Blocks	10/40		.897	.545
Linear	2/24	.192	1.578	.227
Quadratic	2/24	.018	.207	.814
Cubic	2/24	.051	1.028	.373
4th	2/24	.210	1.977	.160
5th	2/24	.008	.159	.854

Table XXX

Experiment II. Multivariatae and Univariate Analyses of Variance Summary of the difference between Experimental Groups over the Final Four Experimental Blocks in Phase III. Measures of the First Alley Component.

	Start 1				Run 1				Goal 1			
Source	df	MS	F	p<	df	MS	F	p<	df	MS	F	p<
Groups	2	.150	.294	.748	2	.092	.758	.479	2	.128	1.000	.383
Within Cells	24	.512			24	.121			24	.128		
Blocks	3/22		4.729	.011	3/22		6.513	.003	3/22		1.343	.286
Linear	1/24	1.000	2.648	.117	1/24	.942	20.702	.001	1/24	.317	1.910	.180
Quadratic	1/24	.889	3.601	.070	1/24	.087	2.684	.114	1/24	.048	1.411	.247
Cubic	1/24	.834	3.528	.073	1/24	.284	7.565	.011	1/24	.152	1.289	.267
Groups X Blocks	6/44		.461	.833	6/44		.625	.709	6/44		.797	.577
Linear	2/24	.130	.344	.713	2/24	.026	.578	.569	2/24	.013	.077	.926
Quadratic	2/24	.091	.369	.695	2/24	.002	.070	.932	2/24	.086	2.546	.099
Cubic	2/24	.297	1.257	.303	2/24	.016	.423	.660	2/24	.078	.662	.525

Table XXXI

Experiment II. Multivariate and Univariate Analyses of Variance Summary of the difference between Experimental Groups over the Final Four Experimental Blocks in Phase III. Measures of the Second Component.

Analysis of Start 2

Source	df	MS	F	p<
Groups	2	.160	1.488	.246
Within Cells	24	.108		
Blocks	3/22		1.636	.210
Linear	1/24	.032	.437	.515
Quadratic	1/24	.122	2.628	.118
Cubic	1/24	.044	.627	.436
Groups X Blocks	6/44		2.820	.021
Linear	2/24	.175	2.389	.113
Quadratic	2/24	.102	2.184	.134
Cubic	2/24	.052	.743	.486

Analysis of Run 2

Source	df	MS	F	p<
Groups	2	.334	3.410	.050
Within Cells	24	.098		
Blocks	3/22		2.316	.104
Linear	1/24	.043	.440	.514
Quadratic	1/24	.146	3.516	.073
Cubic	1/24	.035	.508	.483
Groups X Blocks	6/44		1.952	.093
Linear	2/24	.373	3.779	.037
Quadratic	2/24	.095	2.292	.123
Cubic	2/24	.017	.247	.783

Table XXXII

Experiment II. Summary of Block by Block One-way Analyses of Variance Comparisons of the Performance of Experimental Groups on the Five Dependent Variables. Phase III Experimental and Control Trials are Tabled.

Block	Type of Trial	Dependent Variable: Start 1 df	Start 1 F	Start 1 p	Run 1 F	Run 1 p	Goal 1 F	Goal 1 p	Start 2 F	Start 2 p	Run 2 F	Run 2 p
1	Exper.	2/24	.03	.969	.45	.641	1.39	.268	.73	.490	.76	.477
	Control	2/24	.08	.927	1.02	.377	7.36	.003*	.22	.801	.37	.694
2	Exper.	2/24	.46	.635	.38	.686	1.01	.380	.43	.655	.02	.979
	Control	2/24	1.28	.296	.31	.734	1.49	.245	.29	.753	.27	.769
3	Exper.	2/24	.14	.871	.44	.650	.41	.671	.55	.583	5.03	.015*
	Control	2/24	.82	.454	.02	.979	.74	.488	.40	.678	.28	.759
4	Exper.	2/24	.26	.770	.46	.639	.85	.439	.37	.694	2.59	.096
	Control	2/24	.83	.448	1.16	.330	1.56	.230	1.06	.361	.98	.389
5	Exper.	2/24	.65	.532	1.00	.382	1.36	.275	1.23	.311	1.58	.227
	Control	2/24	.05	.952	1.47	.250	1.83	.182	2.42	.110	.52	.599
6	Exper.	2/24	.44	.651	.89	.423	.94	.404	3.91	.034*	2.41	.111
	Control	2/24	.76	.480	.90	.420	.96	.395	.00	.998	1.02	.377

*Statistically Significant at $p < .05$.

Table XXXIII

Experiment II. Multiple Comparisons between Means of Experimental Groups for Trials in Phase III that were found to be Statistically Significant.

Control Trial of Block 1. Dependent Variable Goal 1.

$F = 7.36$ $df = 2/24$ $p < .003$

Newman-Keuls Comparison Between Ordered Means

		1	2	3
	Means	1.347	1.284	.558
Conflict	.558	.788*	.726*	----
Frustration	1.284	.063	----	
CR Control	1.347	----		

Experimental Trial of Block 3. Dependent Variable Run 2.

$F = 5.03$ $df = 2/24$ $p < .015$

Newman-Keuls Comparison Between Ordered Means

		1	2	3
	Means	1.273	0.776	0.693
CR Control	.693	.579*	.083	----
Frustration	.776	.496*	----	
Conflict	1.273	----		

Experimental Trial of Block 6. Dependent Variable Start 2.

$F = 3.91$ $df = 2/24$ $p < .034$

Newan-Keuls Comparison Between Ordered Means

		1	2	3
	Means	0.798	0.494	0.251
CR Control	.251	.548*	.243	----
Conflict	.494	.305	----	
Frustration	.798	----		

* $p < .05$

Experiment II. Within-S Analyses of Variance Summary of Phase III Trials Condition X Trials Blocks using Start 1 as the Dependent Variable.

Conflict Group

Source	df	MS	F	p <
Trials Blocks	5	.30	1.341	.267
Error	40	.22		
Trials Conditions	1	.00	.011	.919
Error	8	.32		
Blocks X Conditions	5	.41	1.896	.117
Error	40	.22		

Continuous Reward Group

Trials Blocks	5	.70	1.363	.259
Error	40	.51		
Trials Conditions	1	.02	.062	.810
Error	8	.28		
Blocks X Conditions	5	.15	.617	.688
Error	40	.24		

Frustration Group

Trials Blocks	5	.48	2.732	.032
Error	40	.17		
Trials Conditions	1	1.08	14.724	.005
Error	8	.07		
Blocks X Conditions	5	.30	1.015	.422
Error	40	.29		

Table XXXV

Experiment II. Within-S Analyses of Variance Summary of Phase III Trials Condition X Trials Blocks using Run 1 as the Dependent Variable.

Conflict Group

Source	df	MS	F	p <
Trials Blocks	5	.05	.716	.615
Error	40	.07		
Trials Conditions	1	.11	1.067	.332
Error	8	.10		
Blocks X Conditions	5	.10	1.597	.183
Error	40	.07		

Continuous Reward Group

Trials Blocks	5	.17	1.811	.133
Error	40	.10		
Trials Conditions	1	.04	1.153	.314
Error	8	.04		
Blocks X Conditions	5	.19	3.711	.007
Error	40	.05		

Frustration Group

Trials Blocks	5	.22	4.745	.002
Error	40	.05		
Trials Conditions	1	.03	.361	.565
Error	8	.09		
Blocks X Conditions	5	.02	.723	.610
Error	40	.03		

Experiment II. Within-S Analyses of Variance Summary of Phase III Trials Condition X Trials Blocks using Goal 1 as the Dependent Variable.

Conflict Group

Source	df	MS	F	p <
Trials Blocks	5	.32	2.451	.050
Error	40	.13		
Trials Conditions	1	.27	9.096	.017
Error	8	.03		
Blocks X Conditions	5	.10	1.172	.340
Error	40	.08		

Continuous Reward Group

Trials Blocks	5	.26	2.031	.095
Error	40	.13		
Trials Conditions	1	.000	.007	.934
Error	8	.11		
Blocks X Conditions	5	.23	2.470	.048
Error	40	.09		

Frustration Group

Trials Blocks	5	.14	1.016	.421
Error	40	.14		
Trials Conditions	1	.04	.529	.488
Error	8	.08		
Blocks X Conditions	5	.03	.184	.967
Error	40	.14		

Table XXXVII

Experiment II. Within-S Analyses of Variance Summary of Phase III Trials Condition X Trials Blocks using Start 2 as the Dependent Variable.

Conflict Group

Source	df	MS	F	p <
Trials Blocks	5	.08	1.106	.373
Error	40	.07		
Trials Conditions	1	.25	3.564	.096
Error	8	.07		
Blocks X Conditions	5	.01	.210	.956
Error	40	.07		

Continuous Reward Group

Trials Blocks	5	.10	1.435	.233
Error	40	.07		
Trials Conditions	1	.01	.222	.650
Error	8	.06		
Blocks X Conditions	5	.05	.971	.447
Error	40	.05		

Frustration Group

Trials Blocks	5	.16	2.545	.043
Error	40	.06		
Trials Conditions	1	.12	2.398	.160
Error	8	.05		
Blocks X Conditions	5	.17	1.676	.163
Error	40	.10		

Table XXXVIII

Experiment II. Within-S Analyses of Variance Summary of Phase III Trials Conditions X Trials Blocks using Run 2 as the Dependent Variable.

Conflict Group

Source	df	MS	F	p <
Trials Blocks	5	.09	.803	.555
Error	40	.11		
Trials Conditions	1	1.19	10.570	.012
Error	8	.11		
Blocks X Conditions	5	.12	1.266	.298
Error	40	.09		

Continuous Reward Group

Trials Blocks	5	.02	.378	.861
Error	40	.05		
Trials Conditions	1	.04	1.024	.341
Error	8	.04		
Blocks X Conditions	5	.16	2.327	.060
Error	40	.07		

Frustration Group

Trials Blocks	5	.20	2.966	.023
Error	40	.07		
Trials Conditions	1	.05	.432	.529
Error	8	.11		
Blocks X Conditions	5	.11	1.589	.185
Error	40	.07		

Table XXXIX

Experiment II. Post Hoc Test of Discrimination of Rewarded Stimulus in a Free-Choice situation. An Error is defined as one wrong choice, while A Position Habit is defined as two or more wrong choices.

Experimental Groups	Ratio of Ss with Position Habits	Ratio of Ss Showing Errors	Ratio of Correct S^+ Choices on the First Trial
Conflict	1/9	1/9	9/9
CR Control	1/9	2/9	7/9
Frustration	0/9	1/9	9/9

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MOTIVATIONAL PROPERTIES OF FRUSTRATIVE NONREWARD, CONFLICT INVOLVING NONREWARD, AND CONFLICT UNCONFOUNDED WITH NONREWARD

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1 MARCH 1974
Date