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ABSTRACT

Junior high schools boys performed forty trials on a ball roll up game in order to determine whether competition, initial ability level, and social reinforcement interact to influence the performance of a perceptual motor task. The analysis of the data demonstrated: (a) the competition, initial ability level, and social reinforcement factors did not interact with one another; (b) social reinforcement (reproof) facilitated performance, while competition had no effect; (c) competition hindered learning in later performance; and (d) the competition groups had a greater tonic heart rate (increase from basal) than the noncompetitive group. The results of the study suggest that social factors (i.e., social reinforcement, competition) have a greater effect in later performance after some initial learning of the perceptual motor skill has occurred. (Author/JD)

THE EFFECTS OF COMPETITION AND SOCIAL REINFORCEMENT UPON PERCEPTUAL MOTOR PERFORMANCE

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Abstract

Junior high school boys (180) performed forty trials on the ball roll up game in order to determine whether competition, initial ability level and social reinforcement interact to influence the performance of a novel perceptual motor task.

The experimental design was a 3 x 2 x 3 x 8 factorial design with repeated measures on the last factor (initial ability level x competition x social reinforcement x blocks of trials). Subjects were nested within the first three factors.

The analysis of the data demonstrated: (a) the competition, initial ability level and social reinforcement factors did not interact with one another; (b) social reinforcement (reproof) facilitated performance ($p < .05$), while competition had no effect; (c) competition hindered learning ($p < .05$) in later performance (stages five to eight); and (d) the competition groups had a greater tonic heart rate (increase from basal) than the non-competitive group ($p < .05$).

The results of the study suggests that social factors (i.e., social reinforcement, competition) have a greater effect in later performance after some initial learning of the perceptual motor skill has occurred.

The Effects of Competition and Social Reinforcement Upon Perceptual Motor Performance

by

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Since Triplett (1897) found that competition improved the speed of winding a fishing reel, psychologists have been concerned with obtaining a better understanding of this complex social phenomenon. However, based on a review of the relevant literature it is apparent that little real understanding has been gained despite its importance in our society.

A critical factor limiting progress in competition research has been the lack of a theoretical framework to order the past research and guide future investigations. To date, a reward definition of competition (Church, 1968) has received considerable support; however, this definition requires the experimenter to make numerous critical assumptions. As a result, operationalizing a reward definition is extremely difficult, if not impossible. Furthermore, Martens (1975) has suggested that the probable explanation of the diverse findings in competition research simply reflect the manner in which competition has been operationally defined.

In an attempt to further research on competition, Martens (1975) has drawn a parallel between the critical element in social facilitation research, evaluation potential, and the fact that

almost all definitions of competition have included the potential for evaluation. Martens (1975: 71) feels that the primary feature of a competitive situation distinguishing it from other comparison situations is that the criterion for comparison is known by the person (s) in a position to evaluate performance.

Support for Martens' position has been provided by Evans and Bonder (1973) who have demonstrated the importance of impending social comparison in relation to rivalry. The importance of rivalry in competition is well documented (Evans, 1968, 1972, 1973; Wankel, 1971). The main advantage of a social evaluative definition of competition is that it clearly defines the competitive situation in a manner which may be operationalized for experimental research, while maintaining most of the characteristics commonly associated with a competitive situation.

Social facilitation research (Cottrell, Wack, Sekerak and Rittle, 1968; Haas and Roberts, 1973) has demonstrated that an evaluative audience influences performance; therefore, further examination of a social evaluative definition of competition must focus on clarifying the relationship of competition to additional variables found in the learning situation. In recent years competition research has taken this approach, however, without the benefit of a operational definition.

Two additional variables of interest to the physical educator are ability levels and social reinforcement. While Wankel (1969) has demonstrated the importance of initial ability levels in determining the effects of competition (rivalry induced)

on performance, Martens has suggested that lack of ability is a limiting factor preventing social reinforcement effects in complex motor performance. The research of Wankel (1969), Martens, Burwitz and Newell (1972) supports this viewpoint. However, recently Harney and Parker (1972) have shown that with proper experimental procedure social reinforcement will influence performance.

Since Cottrell (1968) proposed a learned source of drive explanation of the social facilitation phenomenon numerous studies (Cottrell et al, 1968; Henchy and Glass, 1968; Paulus and Murdoch, 1971; Criddle, 1971; Good, 1973) have examined this perspective by varying the potential for evaluation in different audience situations. Recently, Wankel (1975) extended this line of research by examining how social reinforcement interacted with audience presence to affect complex motor performance.

The underlying hypothesis in Wankel's (1975) study was that social reinforcement would enchance the ability of an audience to evaluate the subject's performance, thereby, increasing the evaluation potential of the situation. This study considered both the Harney and Parker (1972) and Martens' (1970) explanations for lack of significant social reinforcement effects upon complex motor performance. With regard to the former, the study examined the "frequency and intensity of reinforcement" explanation by investigating the effects of continuous reinforcement upon complex motor skills. With regard to the latter, Wankel (1975) incorporated an ability level factor (between subjects) into his design

in order to facilitate "a more clear-cut test of the ability level explanation" (Wankel, 1975: 210). Previous research had treated ability level as a within-subjects factor varying with amounts of practice.

Wankel (1975) did not find an audience presence x social reinforcement interaction, however, it was concluded that the audience treatment may not have been effective. Evidence supporting this conclusion included a nonsignificant audience presence main effect and a nonsignificant audience presence x blocks of trials interaction.

The present study was developed primarily to examine Martens (1975) social evaluative definition of competition because of the ease with which the objective competitive situation may be operationalized as well as its applicability to practical (field) situations involving the learning and performance of perceptual motor skills. However, this study (due to the dependence on social evaluation) could also be considered an extension of the research considered above.

In the present study every effort was made to ensure an effective evaluation treatment. Two coactors kept their own scores and performed before an audience of four visible experts. In addition, a high evaluation potential task (ball roll up game) which had been used effectively in previous social facilitation research (Martens and Landers, 1972; Sasfy and Okun, 1974) was used. In order to examine Martens (1970) explanation for lack of significant social reinforcement effects an ability level factor was added to the design (between subjects). Although Wankel (1975)

had used two ability groups (high, low) with a median split on a stabilometer task; a pilot study (Hrycaiko, 1975) with the ball roll up game indicated that three distinct initial ability levels (high, medium, low) existed. Therefore, three ability levels were examined, thus allowing the experimenter to examine a curvilinear relationship between the ability groups should one exist. Finally, Harney and Parker's (1972) "frequency and intensity" of reinforcement explanation was not considered. Rather, a partition was used to separate the coactors, thus making the subjects dependent on the information (social reinforcement) provided by the experimenter as to their performance on the novel perceptual motor skill. In this manner information would be essential rather than supplementary evaluative information which may or may not be useful (Martens, 1971).

Social facilitation research (Martens and Landers, 1969; Martens and Landers, 1972; Hunt and Hillery, 1973) has demonstrated that an evaluative audience and/or coaction is detrimental to the learning of a complex motor skill. Therefore, the competition treatment would be expected to hinder learning.

It is difficult to predict the interaction effect of social reinforcement and competition. However, performance of the praise and reproof groups would not be expected to differ in that, the evaluation potential of these two treatments would be equal. Noncontingent reinforcement would provide the audience with the same amount of information in both situations.

Method

The Subjects

The one hundred and eighty subjects involved in this study were male, grade seven and eight students. Subjects ranged in age from eleven to fifteen years with the average age being twelve years, eight months.

Junior high school students were particularly appropriate subjects for this study as the physical education program for this age group places particular emphasis on physical activities involving perceptual-motor skills. Only males were utilized in the study to avoid a sex effect. Studies by Strong (1968), Chevrette (1968) and Carment (1970) have shown that males and females react differently to competition.

Experimental Design

The experimental design was a 3 x 2 x 3 x 8 factorial design with repeated measures on the last factor. Factor A was initial ability level (high, medium and low). Factor B was competition (no competition, competition). Factor C was social reinforcement (no reinforcement, praise, reproof). Factor D was the stage factor with eight successive stages comprised of five trials each. Note that the subjects were nested within the levels of ABC.

The dependent variables were learning, performance, and tonic heart rate (in beats per minute). Eighteen independent groups of ten subjects each were established. Each group was tested on

forty trials under one of the eighteen treatment conditions. The forty test scores were sub-divided into eight five trial performance stages.

The Task

The motor task used in this study was the ball "roll up" game which was available commercially. The use of this task in motor skills studies is well documented (Martens and Landers, 1972; Burwitz and Newell, 1972; Dorrance and Landers, 1973; Sasfy and Okun, 1974). The task was especially appropriate for this study in that it could be classed as a high evaluation potential task (as compared to a low evaluation potential task such as a reaction time task), and as such, provided an excellent opportunity to test the effect of evaluation on the learning of a motor skill. The objective, standardization and scoring of performance on this task has been fully described elsewhere (Martens and Landers, 1972; Burwitz and Newell, 1972).

For the present study the scoring procedure was altered slightly. Due to the foam rubber (placed on the game baseboard to eliminate auditory feedback to the subjects from the coactor's ball landing) the ball had a tendency to remain where it landed. Therefore, the holes and the spaces between each hole were scored. The first hole was 1 point, while the successive holes were scored 3, 5, 7, 9, and 11 points respectively. The space before the first hole was scored as zero and the successive spaces were scored 2, 4, 6, 8 and 10 points respectively. This procedure permitted a more

precise measurement of the individual's performance than previous studies which scored performance only in terms of the hole that the subject had successfully passed.

Measurement of Arousal

To aid in determining the effectiveness of the experimental manipulations, tonic heart rate was obtained as a measure of physiological arousal. Tonic heart rate refers to heart rate measured over at least 30 seconds (Elliot, 1969). Heart rate was measured with two portable electrocardiograms which were attached to the coactors throughout the experiment. A 30 second heart rate measure was obtained after each block of five trials.

Methodology

Two hundred and forty-seven male grade seven and eight students performed a five trial pre-test on the ball roll up motor task. The pre-test was conducted in the test room with a single subject and only the experimenter present. The pre-test scores were ranked and the distribution of scores was divided into the top, middle and bottom one-thirds. Subjects ranked in the top one-third were classified as high in initial ability level, while those in the bottom one-third were classified as low in initial ability level. Subjects in the middle one-third were classified as medium in initial ability level.

Within each ability level subjects were randomly paired with a coactor in their class. Subjects who indicated that they had prior experience with the task and subjects who could not be paired with a coactor were deleted from the study. The one hundred and

eighty subjects for the study were obtained by randomly selecting thirty pairs of subjects from each of the three initial ability groups. A further random assignment of these subjects to one of the six treatment groups within each ability level was then performed.

The ability groups which performed the perceptual-motor task in the non-competitive situation and received no social reinforcement were the control groups of the experiment. The remaining fifteen treatment groups consisted of either or both competition and social reinforcement interacting with ability level.

An integral part of this study was the understanding that a competitive situation existed only when an audience was present to evaluate performance. Martens (1975) has defined a competitive situation as one in which the comparison of an individual's performance is made with some standard in the presence of at least one other person who is aware of the criterion for comparison and can evaluate the comparison standard. In this study competition was operationalized by having the coacting subjects perform the task while being observed by a passive audience of four male university graduate students, who were introduced as "experts" in the study of motor skill learning for young boys.

Procedure

Upon their arrival, the two coactors were admitted to the room, seated at the test tables and given a five minute rest period. During the rest period two tonic heart rate measures were obtained.

The first measure was taken after two and one-half minutes and the second measure after five minutes. The average of the two arousal measures served as the subject's basal level for physiological arousal.

Following the five minute rest period a brief set of instructions was read to the subjects. The subjects were told that the basic differences between this test and the previous test (pre-test) was that: (1) they would perform forty trials rather than five trials; (2) they would keep their own score on the score sheets provided; (3) they would perform the task while seated opposite each other at the tables. The experimenter then assured the subjects that paired testing was being done to insure the collection of the necessary data in the shortest possible time.

Tables with partitions (library tables) were used to ensure subjects were unable to observe their coactor's performance. The subjects were told that the partition was necessary when testing two subjects together, so that, performance wasn't hindered by one coactor distracting the other from his task. (In fact, tables with partitions were used specifically to limit the feedback available to the subjects. In this manner subjects could not compare their own performance with their coactor's and with less information available, it was hoped that the reinforcement treatments would be effective because of the subject's dependency on them for information.)

Following the explanation of the partition the experimenter instructed the subjects not to verbalize or interact in any manner once the experiment started. The experimenter explained that this could distract their coactor, hindering his performance and thus ruining the experiment. Finally, the subjects were instructed to begin a trial only when told to do so by the experimenter. In this manner, firm control of the test trials was obtained and ample time was allowed for adequate preparation for each trial.

Following each block of five trials a tonic heart rate measure was taken. Therefore, eight arousal measures for each subject were obtained.

In the audience present condition four observers were introduced to the coactors following the initial instructions. The experimenter briefly explained to the coactors that the gentlemen were research experts whose main area of interest was the study of how young boys learn skills such as the one being learned in this study. The experimenter then stated that the "experts" had requested an opportunity to observe and take a few notes. The experimenter indicated he could see nothing wrong with that and obtained the verbal consent of the coactors.

The observers with pencils and notebooks in hand were seated as close to the subjects as possible, but at a distance which allowed all four observers to oversee the performance of both coactors at once. (Therefore, the observers were visible and evaluating.)

In the social reinforcement condition the social reinforcement was provided by the experimenter. When the audience was present, the observers remained passive. Social reinforcement, as operationalized in this study, consisted of praise and reproof verbally administered.

Considerable research (Martens, 1975: 52) has been produced which terms praise as positive reinforcement and reproof as negative reinforcement. Confusion in terminology has risen because operant reinforcement theory defines reproof as punishment and negative reinforcement as simply the removal of a negative stimulus. In order to avoid this confusion the terms positive and negative reinforcement were avoided. Praise and reproof in the verbal form are very apparent in our learning situations and therefore it is logical to operationalize social reinforcement in this manner and let the researcher interpret reproof as either negative reinforcement or punishment depending upon his theoretical preference.

Praise or reproof were administered after each treatment block of five trials. After the first, third, fifth, and seventh blocks of trials praise was administered in the same order for each pair of coactors as follows: (a) "Good work, boys, you are both doing okay; it's a very tough task; (b) You're both doing very well; (c) You're both certainly doing much better than most boys do, and (d) Excellent, you're both just excellent." Reproof was administered as follows: (a) "Not too good boys; (b) Certainly you both could do better; (c) Boys, you're both doing worse than

most boys do, and finally (d) Very poor boys, very poor." After the second, fourth, and sixth blocks of trials praise or reproof was administered in the form of head nodding or shaking. Reinforcement was given in a calm, matter of fact, manner. No effort was made to arouse or motivate the subjects. After obtaining the stage eight tonic heart rate measure all subjects received praise from the experimenter on their overall performance.

Subjects marked their own score for each trial on a small piece of paper provided. After every five trials the score sheet was turned over and a new one started. At no time during the experiment did the experimenter suggest that the two coactors should compete against one another. Following completion of the forty trials all subjects were required to complete a brief questionnaire which was designed to obtain information on the subjects' efforts and perceptions of the test situation. Following completion of the entire experiment thirty subjects were randomly selected from two classes (fifteen from each of the competitive treatments) and interviewed on tape to obtain further subjective information.

Results

The forty scores for each individual were collapsed into eight five-trial mean scores. These five trial block scores for each subject constituted the performance data for analysis in a 3 x 2 x 3 x 8 (ability level x competition x social reinforcement x blocks of trials) analysis of variance with repeated measures on the last factor.

Significant main effects were obtained for ability level, $F(2, 162) = 7.68$, $P < .001$, social reinforcement, $F(2, 162) = 4.02$, $P < .05$, and blocks of trials, $F(7, 1134) = 21.81$, $P < .001$. The competition effect $F(1, 162) = 1.95$ failed to reach significance, as did all of the interactions.

Duncan's New Multiple Range Test was applied to the three initial ability level group means and also to the three social reinforcement group means. The results indicated that the high ability level subjects performed significantly better than the medium and the low ability level subjects; while the performance of the medium and low ability level subjects did not differ significantly from one another. The social reinforcement group means indicated that the reproof group had performed significantly better than the control group; while the performance of the praise group approached, but did not reach significance.

The subjects improved their performance over the trials. This indicated that learning had occurred.

The absence of a competition main effect indicated that competition did not have a significant effect on the overall performance of the subjects. Similarly, the lack of significant interactions indicated that no combination of two or more factors had a unique effect on performance that could not be determined by examining each factor by itself.

An analysis of variance of the early performance scores (stages one to four) was performed. The results yielded significant differences for the ability level $F(2, 486) = 8.07$, $P < .001$ and blocks of trials $F(3, 486) = 15.01$, $P < .001$, main effects.

The social reinforcement $F(2, 162) = 2.90$, $P < .06$ main effect approached but did not reach significance.

Duncan's New Multiple Range Test was applied to the initial ability level group means. The results indicated that the high ability group had performed better than the medium or low ability groups. The medium and low ability groups did not differ from one another.

An analysis of variance of the later performance scores (stages five to eight) was performed. The results yielded significant differences for the ability level $F(2, 162) = 5.48$, $P < .01$, and social reinforcement $F(2, 162) = 3.72$, $P < .05$ main effects and the competition x blocks of trials $F(3, 486) = 3.53$, $P < .05$ interaction. The trial main effect was not significant.

Duncan's Multiple Range Test was applied to both the ability level group means and the social reinforcement group means. The results indicated that the high ability level group performed better than the low ability group, but was no longer performing significantly better than the medium ability group. There was no difference between the medium and low ability groups. The social reinforcement group means indicated that the reproof group had performed better than the control group, while the praise group was not different from either the reproof or control groups.

The competition x trials interaction is depicted in Figure 1. As is evident from the graph, the significant interaction occurs from the performance of the two competition groups at the last stage. The competition group's performance declines at stages

seven and eight, while the no-competition group's performance improves, finally surpassing the competition group at the last stage. The different effect competition has on the rate of learning for the two groups in the latter stages produced the significant interaction effect.

Finally, the trial main effect did not reach significance. This indicates that the subjects have not improved their performance in the latter stages (learning has not occurred).

An analysis of variance of the tonic heart rate data yielded significant differences on the competition $F(1, 162) = 4.80$, $P < .05$ and blocks of trials $F(7, 1134) = 6.02$, $P < .05$ main effects and the three factor (ability level x competition x social reinforcement) $F(4, 162) = 2.85$, $P < .05$ interaction.

The competition main effect means indicated that the competition group had a higher heart rate increase than the no-competition group. The trial main effect means indicated that the subjects, on the whole, experienced heart rate increases over trials. The significant three factor (ability level x competition x social reinforcement) interaction indicated that the competition x social reinforcement interactions were not of the same form for the different levels of initial ability.

Discussion

The analysis of variance of performance scores indicated that competition did not have a significant effect on performance. This result has been reported in numerous competition studies to date:

Triplett (1897), Evans (1966, 1968), Wankel (1969) and Martens and Landers (1969). In the context of social facilitation research the results indicate social facilitation failed to affect performance.

It is difficult to comprehend why the combination of an evaluative audience plus coaction did not significantly affect performance, although a number of possible explanations do exist. With regard to coaction, it is possible that the presence of the coactor acted as a safety signal and reduced the stress of the evaluative potential of the situation (Davidson and Kelley, 1973). The research of Wankel (1975) and Sasfy and Okun (1974) indicates that it is much more likely that the explanation for the lack of effects lies in the 'audience and subjects' interaction. While Wankel (1975) has indicated a need for research to clarify the situational factors producing audience effects on the performance of young boys; Sasfy et Okun (1974) have suggested that the nature of the task, the quality and the quantity of information available to the audience, in addition to the audience and subjects' characteristics interaction must be considered.

The present study indicates that more emphasis must be given to the nature of the task although the numerous factors considered thus far may all have some effect. The basis for this conclusion is the significant competition x trials interaction in later performance. This result suggests that, particularly for young boys performing a complex motor task, a certain level of skill must be acquired before additional social factors (audience, competition, social reinforcement) can influence performance. The

assumption being made in reaching this conclusion is that the college undergraduates used in most social facilitation studies (Martens and Landers, 1972; Burwitz and Newell, 1972; Dorrance and Landers, 1973; and Sasfy and Okun, 1974) are capable of reaching the level of skill where social factors are able to influence performance, much more readily than the young boys in the studies of Wankel (1975) and Hrycaiko (1975).

The high ability group performed significantly better than the medium or low initial ability groups over the forty trials. However, the medium and low ability were not significantly different from one another. This result suggests that the effectiveness of the pre-test for distinguishing between subjects of different ability levels must be assessed.

An examination of the raw means demonstrated that the high ability group was greatest at each performance stage. Although the five trial pre-test provided strong evidence for the examination of three distinct ability levels, only two exist. The root of the problem may be reflected in the variability of the scores produced by the motor task used. For this reason five initial trials were insufficient to properly assess the subjects' ability.

The non-significant initial ability level x competition interaction indicated that competition had the same effect on the high, medium, and low initial ability levels. The result is similar to that found by Noble, Fuchs, Robel and Chambers (1959) and contrary to the findings of Wankel (1969).

Noble et al (1958) examined individual and social groups utilizing two perceptual-motor tasks, eye-hand coordination (pursuit task) and intermittant selective responding (discrimination task). Performance on the pursuit task did not change, while discrimination speed was facilitated, presumably due to social competition. The effect was independent of initial ability.

Initial ability and competition interacted in a study (Wankel, 1969) examining the performance of young boys on a stabilometer. A recent study (Wankel, 1975) using the same motor task did not find a significant interaction between initial ability level and audience presence. The problem with reaching any conclusions from the latter study was that the audience main effect was not significant (although the ability level x trials interaction was significant) thereby possibly limiting any potential ability level x audience interactions. It seems quite likely, in the present study, that an ability level x incentive interaction may be dependent on the nature of the task.

The significant social reinforcement effect was due to the performance of the reproof group. The reproof group performed better over the forty trials than the control group, while the praise group performance was not different from either the control or the reproof group.

A number of studies (Kennedy and Willcutt, 1969; Marshall, 1965; Harney and Parker, 1972; Catano, 1975) have indicated that social reinforcement enhances performance. Research examining the

value of reproof has produced results indicating both improvements (Marshall, 1965; Harney and Parker, 1972) and decrements in performance (Kennedy and Willcutt, 1964).

With regard to the question of how social reinforcement affects complex motor performance; the results of this study may be interpreted in terms of an information-feedback-incentive mechanism (Catano, 1975). This may be explained as follows: The subject is in a situation with no standard against which to evaluate the quality of his performance, therefore, verbal reproof is informative and suggests his performance is not up to the standards of other subjects (with the exception of his coactor). The failure of praise to affect performance is contrary to the literature (Harney and Parker, 1972; Catano, 1975). It is very likely that the subject rejected the information as discrepant feedback, because the task was very difficult and performance even for the high ability subjects was not very good in relation to the performance possible on the task.

The early and later performance data analyses provide support for Martens' (1970) assumption that social reinforcement affects performance more readily in later trials because of the subjects' inability to significantly influence his performance until after considerable learning has occurred. This interpretation could be criticized because of a lack of a social reinforcement x ability level interaction; the assumption being that high ability subjects should reach the level of learning at which social reinforcement may be effective (subject is able to influence his performance) before the low ability subjects. The results of the present study

indicate that the rate of learning is very similar (not significantly different) for the different ability levels and the ability levels are also affected similarly by social reinforcement. This finding suggests that the amount of initial learning required for subjects to be able to influence their performance is quite similar between ability groups, although their actual level of performance may be quite different (ie., the performance level at which high initial ability subjects can influence their performance is significantly greater than the performance level at which low initial ability subjects can influence their performance).

It could be argued alternatively that noncontingent social reinforcement did not provide informative cues to the subjects on how they could improve their performance, and as a result, only motivated subjects. The motivational aspect of social reinforcement would then have produced the significant performance changes by creating interest in the task during later performance, when the intrinsic interest of the task had waned. The motivation interpretation is not favored for a number of reasons: to begin with, the manner in which social reinforcement was given, a calm, direct, monotone voice with no attempt to arouse or motivate the subjects (ie., a simple statement of fact); secondly, the experimental manipulation using a partition to limit feedback proved very effective as was demonstrated by the post-experiment interviews; finally, arousal data did not support a motivation interpretation for the social reinforcement treatments.

The lack of a competition x social reinforcement or an ability level x competition x social reinforcement interaction does not necessarily indicate that these interactions are not likely to occur. The fact that the competition main effect was not significant suggests that these effects have not been adequately tested. Future studies must be directed towards examining the interaction of significant main effects.

The three main factors and their interactions had no effect on the rate of the subjects' learning over the forty trials. This result indicated that the treatment groups all improved an equal amount. The non-significant ability level x blocks of trials and competition x blocks of trials interactions were contrary to the findings of Wankel (1969), although numerous competition studies (Triplett, 1897; Strong, 1963; and Evans 1966, 1968) have reported non-significant competition effects on learning. In addition, Noble et al (1958) failed to find an ability level x blocks of trials interaction with two perceptual-motor tasks. The non-significant ability level x competition x blocks of trials interaction supported the findings of Wankel (1969).

The non-significant social reinforcement x blocks of trials interaction supported the results of Catano (1975) who found that subjects receiving praise made fewer errors; however, their rate of learning was not affected. Additional support for this finding has been reported by Harney and Parker (1972). Conflicting results were found by Wankel (1975) who indicated that social reinforcement improved the rate of learning for the positive reinforcement group compared to the control group over trials. The lack of

significant social reinforcement x ability level x blocks of trials and social reinforcement x competition (audience) effects were similar to the findings of Wankel (1975).

Examination of the tonic heart rate mean deviation scores revealed a significantly higher heart rate for the competition treatment group than the no-competition treatment group. The result is similar to the findings of Evans (1971, 1972, 1973) and Wankel (1971) for the effects of rivalry; Evans (1973, 1974) for the effects of social comparison; and Hrycaiko (1975) for the effects of an audience. The result is contrary to the findings of Evans (1968) and Wankel (1971) for the effects of heart rate on social facilitation. The lack of an accompanying competition effect on performance scores (along with the heart rate effect) parallels the findings of Evans (1968) and Hrycaiko (1975).

Elliot (1969: 226) has suggested that one of the most consistent accelerators of heart rate is incentive for perceptual motor performance. Based on this conclusion Evans (1971, 1972, 1973, 1974) has concluded that rivalry and social comparison are incentives. Similarly, it can be concluded in the present study that social evaluative competition can be considered an incentive.

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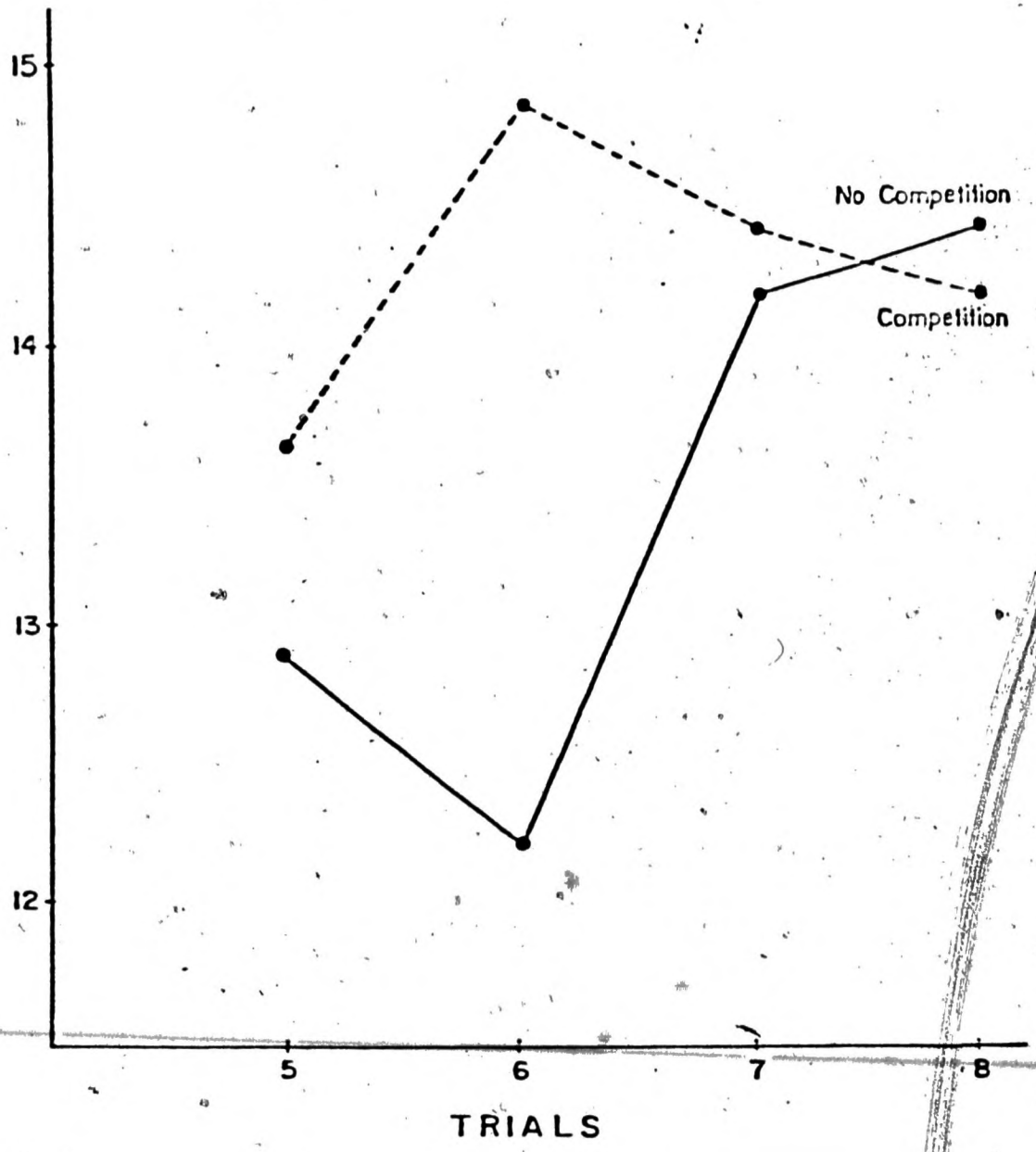

Figure 1 Competetion X Trials (Later Performance) Interaction