The University of Manitoba

Standardized Coaching Sessions and a Self-Evaluation Package for Improving Performance of Figures by Young Figure Skaters

by

Sujatha M. Srikameswaran

A Thesis
Submitted to the Faculty of Graduate Studies
In Partial Fulfillment of the Requirements for the
Degree of Doctor of Philosophy

Department of Psychology
Winnipeg, Manitoba
September, 1989

ISBN 0-315-63371-9

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ABSTRACT

This study examined the effectiveness of behavioral strategies for improving performance of figures by young figure skaters. A behavioral package consisting of skill selection, a standardized coaching session providing corrective feedback from the coach, subject self-monitoring and self-evaluation during practice, self-managed mastery criteria (or goals), and demonstration of mastery to the coach and author was used to improve performance of targeted components of figures by figure skaters. Subjects were four adolescent figure skaters who were preparing for their formal figures' tests. A multiple baseline across components of figures design, with replications across subjects was used. A follow-up phase consisting of a trial judging session was also included. Dependent measures targeted for change were incorrectly performed components of figures. Data were taken on non-targeted components of figures to assess whether response generalization had occurred. The trial judging or follow-up phase was used to assess stimulus generalization. The behavioral package was clearly effective in improving three out of four subjects performance of targeted components of figures. Improvement relative to baseline levels was observed in the fourth subject. Performance of non-targeted components during treatment and follow-up were consistently above baseline levels, however performance improvements on these components was not nearly as great as on targeted components. Performance gains for eight of the twelve categories of components were maintained in the follow-up phase. Social validity data indicated that three of the four subjects, and the coach, felt that the package had helped to improve their performance of figures.

ACKNOWLEDGEMENTS

I would like to thank Dr. Garry Martin, my advisor, for his support and advice through all stages of this research. I would also like to thank the other members of my committee, Dr.J. Pear, Dr.M. LeBow, and Dr.D. Hrycaiko, as well as Dr.R. Tait, for their advice and constructive criticisms.

I would like to express my gratitude to Faye Marshall and Dr. Helmut May of the Kerrisdale Figure Skating Club for their commitment and cooperation. A special thank you goes to the skaters (and their parents) who participated in this project. I would also like to acknowledge the contributions of Brenda Maher, the Manitoba Brown and Gold team, and the Manitoba and B.C. chapters of the Canadian Figure Skating Association.

I owe a great debt to Cheryl Kelsey and Louise Kawakami for their assistance in data collection, and to Maureen Knight and Nonie Robertson for their contributions.

This research would not have been completed without the unfailing support of my parents, my sister, and my friends in B.C., Manitoba, and Ontario. To them, I would like to express my thanks and love.

Table of Contents

List of Tables

List of Figures

INTRODUCTION

Behavior modification is a psychological approach which has been described as having the following defining characteristics:

"1. It places a strong emphasis on defining problems in terms of behavior that can be measured in some way and accepting changes in the behavioral measure of the problem as the best indicator of the extent to which the problem is being helped.

2. Its treatment procedures and techniques are ways of rearranging an individual's environment and daily activities to help that individual function more fully.

3. Its methods and rationale can be described precisely.

4. Its techniques stem from basic laboratory research in the field known as experimental psychology.

5. Within experimental psychology, the psychology of learning in general, and the principles of operant and Pavlovian conditioning in particular, have thus far been most useful to the field of behavior modification.

6. It emphasizes scientific demonstration that a particular intervention was responsible for a particular behavior change.

7. It places high value on accountability for everyone: client, staff, administrators, consultants, etc." (Martin and Pear, 1988, p.419)

Behavior modification strategies have been applied to diverse populations and to address a variety of concerns or problems. Behavioral strategies have been used to change the behaviors of individuals of all ages, from children (Graziano, DeGiovanni, & Garcia, 1979) to geriatric individuals (e.g., Foxx & Shaeffer, 1981), and of different levels of functioning, such as moderately mentally handicapped adults (e.g., Srikameswaran & Martin, 1986) to gifted

children (e.g., O'Leary & Dubey,1979). Behavior modification strategies have been successfully applied to diverse areas, including the treatment of eating disorders (e.g., Brownell & Stunkard, 1978), sexual dysfunction (Rekers & Milner, 1978), and phobias (e.g., Murphy & Bootzin, 1973)). In contrast to these applications, the history of the use of behavioral principles and methodology in sport and physical education is both recent and brief (Martin, 1984).

Rushall and Pettinger (1969) were the first to publish research that utilized a behavioral approach in sport. Their research compared the effects of a variety of reinforcement contingencies on the number of laps swum by members of an age-group swimming team. This research demonstrated that reinforcement strategies that utilized food and monetary rewards resulted in more laps swum than attention from the coach or the control contingencies. Subsequent to this research, Rushall and Siedentop (1972) published The Development and Control of Behavior in Sport and Physical Education , a book that described how operant conditioning strategies could be used to shape, improve, and maintain athletic skills, and suggested how practiced skills could be generalized to competitive settings. Since the publication of this book, several other books have adopted a behavioral approach and suggested behavioral strategies for use in athletic environments. Eysenck, Nias, and Cox (1982) suggested that "behavior modification... could be of considerable importance in leading to greater achievement in sport" (p.48). Cox (1989) broadened this perspective further by describing a variety of behavioral procedures for promoting adherence to treatment programs in both sport and in the promotion of healthy lifestyles.

Several reviews have summarized the increasing number of articles that have been published during the last decade concerning the application of behavior modification principles and procedures in the area of sports and physical education (Donahue, Gillis & King, 1980; Hrycaiko & Martin, 1983; Martin, 1984). Martin

and Lumsden (1987) identified five general categories in which research has been published: (1) skill development; (2) motivation for practice and endurance training; (3) transfer of practice performance of skilled athletes to competition; (4) decreasing problem behaviors; and (5) improving coaching behaviors. This research is concerned with the first three categories: (1) the development of athletic skills, (2) the maintenance and/or motivation of athletic behavior, and (3) the transference of practice performance of skilled athletes to competition.

Development and Maintenance of Athletic Skills

Operant techniques have been widely used to develop and improve motor behaviors in a variety of settings (Martin & Pear, 1988). Until recently, however, there were few studies that utilized operant technology to teach complex sports skills. An example of one such study is that described by Fueyo, Saudargas, and Bushell (1975), who found task-specific praise plus corrections to be more effective than non-task-specific praise for improving the performance of the elementary backstroke and sidestroke by four mentally handicapped children. The former strategy yielded an average of 91.5% correct performance of the swimming skill, versus an average of 41.5% correct performance with the latter strategy.

Buzas and Allyon (1981) utilized a differential reinforcement procedure to develop three tennis skills: forehand, back-hand and the serve. The strategy of praising appropriate performance while ignoring errors in a typical tennis class increased correct execution of all three tennis skills two to four times over baseline performance.

In another study, Simek and O'Brien (1978) provided 6 golfers with feedback from a clicker noise maker when they made inappropriate head movements while attempting to putt. They found that providing immediate feedback for inappropriate movements decreased those movements, and resulted in a statistically significant increase in the number of putts holed.

Studies such as the examples described above utilized treatments that involve the manipulation of only a few variables. Azrin (1977) has suggested that treatment programs in applied settings should include as many treatment components as appear necessary to achieve the desired behavioral changes. This "outcome-oriented" approach measures success in terms of the following criteria: "speed of effect, percentage of patients benefited, degree of benefit, cost, durability over time, and social acceptability" (p.145). Several studies have utilized this behavioral package approach to facilitate athletic skill development.

Komaki and Barnett (1977) used verbal feedback, checklist feedback, and praise to improve play execution of the offensive backfield on a youth football team. The coach provided verbal feedback to the players to inform them what they had done correctly and incorrectly. Visual feedback was provided to the players in the form of a checklist that listed stages of various plays that had been executed well, as well as the stages that needed improvement. Performance gains averaging 20% were seen after the introduction of the intervention package.

Allison and Allyon (1980) used instructions, feedback, reinforcement, positive practice, and time-out procedures consisting of coach's instructions to the athlete to "freeze" whenever he/she executed a skill incorrectly, to increase correct execution of skills in three sports. Skills to be improved included blocking in football, front hand springs and reverse kips in gymnastics, and the forehand and backhand serve in tennis. Results showed tenfold gains in skills in each sport. This behavioral package with the "freeze" technique has also been used to decrease errors in soccer (Rush & Allyon, 1984); sprinting errors in track (Shapiro & Shapiro, 1985); and skill errors in classical ballet (Fitterling & Allyon, 1983).

Koop and Martin (1983) used an error correction procedure to reduce swim stroke errors with beginning age-group swimmers. Checklists containing

drawings and instructions for correct behaviors on each targeted swim stroke were posted for subjects to follow. The experimenter modelled the correct swimming stroke, and subjects had the opportunity to practice the correct stroke in a training pool. If an error was observed, the subject was stopped at the end of the lap, and given instructional feedback prior to continuing. Positive consequences were provided for correct performance. This coaching package resulted in a large decrease in swimming stroke errors in a training pool, and generalization of improvements to the regular practice pool with all but one subject.

The studies described previously illustrate that motor behaviors can be successfully developed in sport environments through the use of procedures that incorporate combinations of instructions, modelling, physical guidance and positive practice. However, all of the studies cited above relied heavily upon coach/ experimenter managed contingencies to develop and maintain athletes' practice of acquired skills. Athletes in sports such as figure skating are often expected to practice with limited feedback from their coaches and few contingencies in the sport environment to promote desirable practice behaviors. A possible solution to this concern is to develop athlete-managed contingencies to improve and maintain performance.

Self-Management Techniques to Develop and Maintain Athletic Skills

Conceptual and theoretical issues in self-management. Kirschenbaum (1984) indicated that " most participants in sport who attempt to perform at a high level engage in goal-directed behaviors performed in the relative absence of immediate external constraints". This statement suggests the importance "self-control", or "self-regulation" plays in an athlete's preparation for competition. However, not all athletes have "self-control", or are able to "self-regulate". In fact, Cox (1989) identified lack of adherence by athletes to the practice of psychological procedures for competition preparation as a major problem facing sport

psychologists today.

Baer (1984) indicated that ideally, an individual with self-control would :

"1. acknowledge problems of their own as soon as these problems came into existence,

"2. translate these problems into sets of behaviors to be changed,

"3. find sets of natural reinforcement or punishment contingencies that should support those behavior changes, or, failing that, contrive some contingencies that could support those behavior changes,

"4. re-arrange their environments so that those contingencies now support those behavior changes,

(a) either directly and immediately, which is how contingencies work best,

(b) or, if direct and immediate environmental support seems impractical, then indirectly, thru explicit self-monitoring, self-evaluation, or self-instruction techniques, so that the desired behavior changes can produce some direct and immediate results,

"5. And self-controlling persons record the entire process, preferably quantitatively, graphically and daily" (p. 211).

Kirschenbaum (1984) defined the process of attempting to maximize performance in sport as a self-regulatory problem. He described a five stage model of self-regulation which involved problem identification, establishing a commitment to change, executing the components of self-regulation (e.g., self-monitoring, self-evaluation, and self-consequation), environmental management, and generalization. Kirschenbaum suggested various strategies by which athletes can maximize their self-regulated performance, including systematic and continual self-monitoring of performance, and attending to favorable aspects of performance. This model, however, can be viewed as a description of self-control at its ideal level of

meaning. As Baer (1984) has indicated, most often, "self-control" is more aptly described as self-management, as individuals have to be taught to self-monitor, self-evaluate, and self-consequate by a clinician/ researcher who also assists in identifying the behaviors to be changed and developing contingencies to support the change. Therefore, the term "self-management" rather than "self-regulation" or "self-control" will be utilized in reference to these strategies.

Martin and Hrycaiko (1983) suggested that one possible direction for future investigation by behavior analysts was the development of self-management techniques to benefit athletes. Kanfer (1970) defined self-management as the "maintenance of behavior in the absence of any immediate environmental support or feedback" (p.182). Self-management procedures involve an individual in implementing strategies which may enhance his or her behavior change. These procedures have been described as potentially being helpful in avoiding the generalization and maintenance problems typically associated with more trainer-centered approaches, because behavioral control is transferred from the trainer to the individual (Nelson, Lipinski, & Black, 1976). Self-management strategies may be applied as antecedents (in the form of situational inducement) or consequences of the targeted behavior (Browder & Shapiro, 1985). Generally, individuals may use any combination of self-observation, goal-setting, self-evaluation, self-recording, or self-reinforcement in applying consequences for their behavior. A commonly used term or procedure in self-management research is self-monitoring, which usually consists of two component procedures, self-observation and self-recording (Browder et.al., 1985). Goal setting is another strategy used in self-management packages. Goal-setting involves establishing a standard of performance, either by the experimenter alone, or by the experimenter in conjunction with the client, or by the client alone. Once a goal is established, performance is usually self-evaluated, or compared to the pre-set standard, and usually positively self-consequated or self-reinforced if the criterion is reached

(Hayes, Rosenfarb, Wulfert, Munt, Zorn & Zettle, 1985).

Different mechanisms have been postulated to account for the efficacy with which individual and combined components of self-management strategies help individuals promote and maintain behavior change. For example, Martin and Pear (1988) suggest that self-recording serves to strengthen the behavior being recorded by enhancing the distinctiveness of certain aspects of the behavior that are reinforcing for other reasons. Thus, self-recording functions as a discriminative stimulus. Hayes et.al (1985) suggest that a technique such as goal-setting works because it establishes a socially available standard against which an individual's performance can be evaluated, thereby altering social contingencies, and ultimately, the self-recorded behavior. These authors emphasize the importance of social contingencies engendered by publicly posted goals in producing desirable changes in behavior.

Self-reinforcement as a method of producing behavior change has been the center of great debate. Self-reinforcement has been defined by Bandura (1976) as the self-administration of freely available rewards contingent upon performance which meets self-adopted standards. Goldiamond (1976), Catania (1975, 1976) and Sohn and Lamal (1982) argue that the term "self-reinforcement" implies that it is functionally analagous to positive reinforcement as seen, for example, in the operant laboratory, where the experimenter determines when the subject will be reinforced for the behavior it is performing. These authors argue that in a self-reinforcement paradigm, subjects have the opportunity to short-circuit the contingency, or not emit the appropriate behavior, and still receive reinforcement. As a consequence, self-management packages have typically utilized external contingencies to prevent short-circuiting. Hayes et.al (1985) indicate that it has not yet been shown that a self-reinforcement procedure that is relatively devoid of external variables will work as well as external reinforcement, or indeed, will work at all " (p.201). These concerns aside, strategies referred to as self-reinforcement

have been widely used in attempts to add to the effectiveness of self-management packages.

Self-management strategies have been used with a variety of populations to deal with different skill deficits and behavioral excesses. For example, these strategies have been used to produce behavior change among mentally handicapped individuals (for reviews of this literature, see Albion, 1983; Browder & Shapiro, 1985); to reduce anxiety in normal adults (e.g., Deffenbacher & Suinn, 1980); in the treatment of sexual dysfunction (e.g., Morokoff & LoPiccolo, 1982); and with children in classroom settings (see reviews by Rosenbaum & Drabman, 1979; Workman & Hector, 1978). A limited number of studies have also examined self-management strategies with athletes in sports settings.

Self-management applications in sport settings. McKenzie and Rushall (1974) had swimmers publicly self-record training unit completion on program boards in an effort to increase work output during practices. This intervention produced an average work rate increase of 27.1%.

Keefe and Blumenthal (1980) reported using a combination of self-recording, stimulus control (i.e., specific warm-up exercises, locations, and times), a contract specifying exercise criterion for self-reinforcement, and gradually increasing goals to help three subjects establish a regular exercise regimen.

Kirschenbaum, Ordman, Tomarken, and Holtzbauer (1982) had subjects either positively self-monitor (i.e., rate components that they did well) or negatively self-monitor (rate components that they did poorly) their bowling skills. Subjects were matched into seven groups (1 control group, 2 instruction-only groups, 2 positive self-monitoring groups, and 2 negative self-monitoring groups). The authors found that positive self-monitoring significantly improved subjects'

bowling averages from baseline to post intervention assessment. They also found that within the groups using positive self-monitoring, post intervention bowling averages were greater for lower skill individuals than for individuals with a higher level of skill.

Hume, Martin, Gonzalez, Cracklen and Genthon (1985), successfully utilized a self-monitoring package consisting of a self-monitoring checklist, and coach feedback regarding performance to increase the frequency of young figure skaters' desirable practice behaviors. The target behavior was the frequency of jumps and spins that the skaters already knew how to perform.

Ziegler (1987) examined the effects of a self-directed stimulus cueing technique on the skill acquisition of beginning tennis players. A four-step verbal cueing program that required subjects to vocalize, for example, the word "hit" when they observed the ball contacting the racquet was utilized to produce an accelerated rate of stroke production. Stimulus self-cueing was found to improve backhand and forehand returns over 45% from baseline conditions.

Goal Setting to Develop and Maintain Athletic Skills

Studies such as those described suggest that self-management strategies can play an important part in maintaining performance of athletic skills or exercise behaviors. Traditionally, goal-setting has been viewed as an effective strategy for improving performance of athletes (e.g., Botterill, 1983), however, there has been limited empirical research undertaken to investigate the benefits of goal-setting to sport performance. While all the studies described previously utilized self-monitoring, only Keefe et.al (1980) used goal-setting as part of their self-management procedure. Studies in the area of sport or motor skill development that have utilized goal-setting exclusively as a performance enhancement strategy have generally reported that this strategy is more effective

than control strategies in improving performance.

Botterill (1977) found that subjects who set specific, hard goals on an endurance task performed significantly better than subjects who were told to do their best. Barnett and Stanicek (1979) found that a group of archers who set specific verbal and numerical goals achieved significantly higher scores than a control group not instructed to set goals. However, Weinberg, Bruya and Jackson (1985) found no difference in performance between groups given specific difficult goals versus " do your best" goals in performance of a strength and endurance task. Hall and Byrne (1986) suggested that the effects of competition between subjects in the control condition may have confounded the goal-setting manipulation in the latter study. In a review of the application of goal-setting to sports, Locke and Latham (1985) made several suggestions regarding the use of goal-setting based on the outcome of existing research:

"1. specific goals will regulate action more precisely than general goals,

"2. specific, difficult goals will lead to better performance than goals of "do your best" or no goals,

"3. goal-setting will be most effective, if not only effective, when there is feedback showing degree of progess in relation to the goal, and,

"4. commitment to the goal can be affected by asking the individual to accept the goal, showing support, and allowing participation in the setting of the goal, and training, and in selection of incentives and rewards" (pp.209-210).

Given these recommendations, Hall, Weinberg, and Jackson (1987)

examined the relationship between goal difficulty, goal specificity, and endurance performance using a physical activity as the dependent variable, and also attempted to determine the relationship between different types of information feedback, goals and performance. In this experiment, subjects were asked to perform a hand dynamometer endurance task. The subjects were randomly assigned to 3 conditions: do your best, improve by 40 units, or improve by 70 units. Subjects were also provided with either concurrent or terminal feedback. This research supported Locke et. al's suggestions that individuals with specific hard or challenging goals outperform individuals with do your best goals or no assigned goals. Contrary to expectation, there were no significant differences between the 40 units and 70 units conditions, i.e., as goal difficulty increased, a proportionate increase in performance was not observed. No significant difference was found between subjects receiving concurrent versus terminal feedback, though participants indicated that they preferred concurrent feedback.

Edwards (1988) also examined the relationship between setting performance standards and motor skill achievement in children. A standardized teaching strategy was used to teach groups of elementary school children a novel motor skill, namely a hockey flip shot. Once proper technique had been established, the teacher assigned individual standards (e.g, successful performance of two more trials than the average score of successful trials from the day before) to the children in the treatment group. The children with performance standards were found to achieve significantly higher performance scores on a novel floor hockey skill than children who were simply told to do their best. The treatment group was also found to engage in more motor appropriate behaviors than the control group, suggesting that individuals who received performance standards made better use of their time than those who did not have standards.

In a recent review of goal-setting in sport, Hall and Byrne (1988) observed that the studies demonstrating support for the effects of goal-setting on athletic performance were either laboratory studies, well-controlled field experiments, or investigations involving lengthy training on effective goal-setting. Moreover, these authors noted that not all of the recent empirical investigations of goal-setting in sport have supported Locke and Latham's recommendations. That is, while some studies such as those described previously have shown positive goal-setting effects with an experimental group over a control group, they usually fail to show significant differences between goal-setting groups (such as short-term or long-term goals). For example, Weinberg, Bruya, Longino and Jackson (1988) examined the effects of goal proximity and goal specificity on endurance performance of young children. They found no significant differences in performance of a two minute sit-up task between children with short-term or long-term goals. However, these authors noted that the groups with specific goals performed significantly better than the do-your-best group.

Despite these equivocal results, Hall and Byrne (1988) supported the use of goal-setting procedures to enhance athletic performance, stating that further research would help elucidate "how and why goal setting affects performance" (p.197). While the role of goal-setting as a component of a self-management package to enhance athletic performance has not yet been established, its apparent efficacy as a procedure to improve performance would support its inclusion in behavioral interventions.

A primary concern for athletes, once skills have been developed and are being maintained at practices, is the performance of these practiced skills in competitive situations. A third issue of significance to this research is the generalization of practice performance to competition.

Transfer of Practice Performance to Competition

Martin (1984) described 22 studies that utilized behavioral procedures to either develop athletic skills or to increase the frequency of practice/exercising behaviors. Only two of these studies (Komaki & Barnett,1977; Koop & Martin, 1983) assessed whether stimulus generalization (improvement in targeted behavior in non-training conditions) had occurred. Additionally, only two of these studies (Allyson & Allyon, 1980; Koop & Martin, 1983) assessed whether any response generalization (improvement in non-targeted behaviors as a result of intervention) occurred. Martin and Pear (1988) indicated that "to be effective, a therapeutic behavioral change must show stimulus generalization from the training situation to the natural environment, and it must also sometimes show response generalization to new behaviors" (p.172). Thus, an important aspect of this research will be to assess whether stimulus generalization , or transfer of practice performance to competition (or in this case, informal figures tests) has occurred, and whether response generalization has occurred in the practice setting.

Summary

Previous research suggests that a combination of positive feedback and self-management strategies should prove beneficial to improve the practice performance of athletes. While previous studies add to the growing body of literature supporting the effectiveness of behavioral procedures in improving athletic skills, major questions remain for future research to address. Most applications of behavioral strategies have involved extensive input by the coach/experimenter, and may not be applicable to a sport environment requiring considerable self-practice by young adults. Previous research has provided only limited data on the generalization of practice gains to competition, and has usually failed to examine response generalization of improvements to non-targeted skills as a result of treatment. This research addressed these concerns, and also

examined the efficacy of a training package that relied heavily on self-management strategies to increase the frequency of practice of existing skills. Moreover, this research extended the application of behavioral procedures to a novel area in applied sport psychology, namely, improvement in performance of figures by young figure skaters.

STATEMENT OF PROBLEM

In recent years, sport psychology consultations have become increasingly popular in athletic environments. The practical constraints imposed on the consultants in many of these environments pose intriguing practical problems for applied behavior analysis (Cox, 1989). One such problem was encountered by the author in the process of providing sport psychology service for the Manitoba provincial figure skating team (Srikameswaran, Note 1). Specifically, figure skaters at the provincial level practiced twelve to fifteen hours per week; of those hours, less than three were spent in one-to-one instruction, while the other nine to twelve hours were spent on self-practice. Generally, the coach would explain how to perform skating moves, and then the skaters were expected to improve on their own without feedback except at widely spaced intervals. This strategy is common to figure skating practices, and presents several difficulties. Not all of the skaters knew how to maintain or correct their own performance, nor did they all know how to consistently self-evaluate their performance. The skaters often experienced failure on figures test days, and were disappointed with their results at competition. Thus, several problems were identified by the skaters and the author, namely, lack of athlete-managed strategies to improve and maintain practice performance, lack of skills and/or consistency in self-monitoring and self-evaluation, and a lack of strategies to generalize successful practice performance to figures test or competition days.

The purpose of this research was to investigate behavioral strategies to

improve practice performance of figure skaters within the practical constraints of this sport environment. Thus, this research attempted to add to our understanding of the rapidly developing area of the applied behavior analysis of sport.

This study follows Azrin's (1977) outcome-oriented package approach by utilizing a behavioral package to improve figure skaters' performance of figures. It also followed the dimensions of applied behavior analysis emphasized by Baer, Wolf, and Risley (1968, 1987). Within the latter context, the single-subject research design that was used was a multiple-baseline design across behaviors within a subject, with replications across subjects. Dependent measures targeted for change were incorrectly performed components of compulsory figures by young figure skaters. The package consisted of skill selection (where the subject determined, within limits established by the coach and experimenter, the component skills to be mastered), a standardized coaching session providing corrective feedback from the coach (consisting of instructions, modelling, and physical guidance, i.e, techniques that were already used by the coach), subject self-monitoring and self-evaluation during practice, self-managed mastery criteria (or goals), and demonstration of mastery to the coach and experimenter.

Data were taken on non-targeted components of figures to assess whether response generalization occurred. Trial judging situations were used to assess whether performance gains seen at practice generalized to informal figures tests. Social validity measures were obtained from the skaters and the coach. Performance at formal figures test days was also described as an additional measure of social validity.

PROCEDURE

Subjects

Subjects were 4 figure skaters, aged 13 (S1, S2, and S3) and 15 (S4). All subjects had skated competitively for an average of three years. Three of the subjects (S1, S3, and S4) were in the process of preparing a set of figures for competition, while all four subjects were preparing a set of 12 figures for a figures test. The set of figures being prepared for the figures test were the target of this experiment. Subjects 1, 2, and 3 were preparing for their Fourth Figure test, while Subject 4 was preparing for his Fifth Figure test. Subjects 1, 2,3, and 4 had been working on this set of figures for 4, 5, 6 and 6 months respectively. Thus, each skater had an opportunity to practice both competition and test figures anywhere from 60 to 168 practices prior to participating in this experiment. As none of the skaters available for this experiment had made much progress during at least 4 months experience with their figures, these skaters were identified by their coach as exhibiting persistent errors in their performance of figures, and were described as potentially benefitting from a corrective feedback/self-evaluation package.

Informed consent was obtained from both the skaters and their parent/guardian before they participated in the study.

Setting

This study was conducted at the Kerrisdale Arena in Vancouver, B.C. S2 attended three practices per week, while Sl, S3, and S4 attended 7 practices per week. Skating practices were two hours in length, with the first hour designated as "patch" time (i.e, time to practice figures). Usually, between seven and 10

skaters attended each practice, under the direction of two coaches. At each practice, the coach randomly assigned a section of the rink (a patch) where the skaters could practice their figures.

Experimental Sessions

Session characteristics. Sessions lasted between 30 and 40 minutes in duration. Subjects 1, 3 and 4 were observed at approximately four practices per week over a five month period. Subject 2 was observed at two practices per week over the same time span. During the treatment phase a checklist (described below), prompt card, and a pencil were placed on a clipboard and mounted on the plexiglass wall closest to the skater's patch.

When the author was absent, the subjects practiced and received coaching on non-experimental figures. Practices where the author (and experimental conditions) would be present were pre-arranged by the author and individual subjects.

Personnel

Behavioral observations were taken by the author (a graduate student in clinical psychology), a female Master's student in counselling psychology, and a paid female undergraduate student who had experience in psychological research. The training of the observers occurred as follows. Firstly, the observers attended an orientation meeting during which the purpose and procedures of the research were explained. They were asked to read selected chapters from the Canadian Figure Skating Association's Figures Judging Manual prior to the next meeting. In the next session, the observers were formally introduced to the checklist and were given the Training manual that is described in Appendix A. The observers were

encouraged to ask questions, and were required to observe, over the next five practices, non-experimental skaters practice their figures. With the coach and non-experimental skater's permission, the author and the observers watched the coach give lessons, and had opportunities to see examples of all the components and categories. In the following three practice sessions, the author and observers practiced evaluating a co-operative, non-experimental skater while she laid out a figure. Inter-observer reliabilities were calculated (using procedures described in a later section) on these assessments. Any discrepancies in evaluation were discussed and clarified; if disagreement persisted, the coach was asked to clarify the question.

A figure skating judge who had five years experience judging and a skating coach (who was not otherwise involved in the project) who had several years experience in skating and in figures judging were recruited to conduct baseline and follow-up assessments. The judges also participated in an orientation session, where the purpose and the procedures of the research project were explained. They were then introduced to the checklist, and the training manual. The judges (and author) then had an opportunity to evaluate figures executed by a non-experimental skater. Once their inter-observer reliability was over 80% for two consecutive figures, the observers joined the judges on the ice and then evaluated the figures of the non-experimental skater. When the judges, author and observers inter-observer reliability was calculated to be over 80% for three consecutive figures, they were considered to be ready to utilize the checklist for baseline assessment.

The standardized coaching sessions were implemented by the skater's coach. The coach had over 9 years of experience in coaching figure skaters, and was herself an Olympic level competitive skater. She had coached the subjects for an average of three years each.

Dependent Variables

Percent correct performance of components of figures. A checklist were used to record subjects' performance of figures, and was subsequently used by subjects in the treatment phase. The checklist was developed with the aid of a figure skating judge with several years of skating experience, and two years of judging experience. This judge was otherwise uninvolved in the research. The Canadian Figure Skating Association's Figure Judging Manuals were also used to develop the checklist. A sample of the checklist is given in Table 1.

Insert Table 1 about here

The checklist defines incorrect and correct performance of figures based on the following categories: Form, Flow, Symmetry of Circles and Quality of Turns. Categories are comprised of sub-categories, each with several components that require evaluation. For example, the category "Symmetry of Circles" is comprised of 7 sub-categories,including the position of the long axes, measurements of the circles, position of turns, stepdowns, etc. Groups of sub-categories were the focus of evaluation and monitoring by the subjects.

Correct performance of components of a figure was determined by subtracting the number of incorrectly performed components from the total possible components within groups of sub-categories, thus obtaining the number of components performed correctly. This number was then divided by the total possible components within the category or sub-categories and multiplied by 100. For example, within the Category "Symmetry of Circles", the following sub-categories may have been targeted for treatment: stepdowns and shape of circles. This group of sub-categories contains 7 components. If a subject had performed 4

Table 1. Checklist used to evaluate subjects' performance of figures

Skater:_____ **Scoring Key:** Please denote occurrence of error by placing a checkmark in the "incorrect" column (✓)

Date:_____

CATEGORY 1 - FORM (INCORRECT)

1. **Hand positioning**				
- drooping or above waist				
- palms up				
- clenched fists				
- fingers wide apart				
2. **Changing position/edges/turns**				
- jerky movements of free foot				
- kicking foot forward or backward				
- moving free foot out and around skating foot				
3. **Position of head/chin**				
- chin tucked into chest				
- head tilted to side				
4. **Posture**				
- high shoulders				
- drooping back/spine				
- slouching				
- weight over heel of skating foot				

CATEGORY 1 - FORM (CORRECT)

1. **Hand positioning**				
- positioned below waist				
- parallel to ice				
- fingers together				
- fingers pointed away from body				
2. **Changing position/edges/turns**				
- continuous movement of free foot from back to front of body (or vice versa)				
- free foot is kept close to skating foot (so that they brush each other)				
3. **Position of head/chin**				
- chin should be level (head held level, eyes looking down)				
4) **Posture**				
- upright posture (i.e. upper body over skating foot, shoulders back)				

CATEGORY 2 - FLOW (INCORRECT)

1. **Entry into circle**				
- pulling free leg				
- slowing down toward end of circle				
2. **Speed**				
- going too fast				
- losing speed half way to three quarters of the way around the circle				
3. **Pushoff**				
- lunging				
- jumping onto edge				
4. **Turns and changes**				
- knee dips before turn				
- (LOOP) straight knee through turn				

CATEGORY 2 - FLOW (CORRECT)

1) **Entry into circle**				
- maintain consistent speed until ready for pushoff				
2) **Speed**				
- maintain consistent speed around circle				
3) **Pushoff**				
-transition of weight from foot to foot is smooth				
4) **Turns and changes**				
- knee lifts during turn				
- (LOOP) knee bent (intermediate position)				

CATEGORY 3 - SYMMETRY OF CIRCLES (INCORRECT)

1) ≥ 1 bladelength diff. b/t LONG axes of circles

2) - ≥ 1 bladelength difference in line-up at circles
- ≥ 1 bladelength difference in size (width)
- ≥ 1 bladelength difference in length of circles

3) - ≥ 1 bladelength diff. b/t position of turns on circle
- (LOOP) ≥ 1" diff. in position relative to long axis

4) **Stepdowns**
- incorrect edge
- not on a circle
- straight
- hooked out

5) **Pushoffs**
- ≥ 5" difference between pushoff and long axis
- ≥ 5" difference between pushoff and short axis

6) **Shape of circle**
- straight on top
- straight on sides
- bulged (i.e. wobbles on top/sides of circles)

7) **Flats (cleanness of edges)**
- quarter of circle
- 2 to 3 bladelengths
- 1 bladelength

(repeat occurrences of flats are more serious)

CATEGORY 3 - SYMMETRY OF CIRCLES (CORRECT)

1) Circles should be on the same long axis

2) - less than 1 bladelength diff. in lineup of circles
- less than 1 bladelength diff. in width of circles
- less than 1 bladelength diff. in length of circles

3) - Turns should be lined up **exactly** on circles
- (LOOP) Should be within 2" of long axis

4) **Stepdowns**
- should be lined up on circle (circles should be tangent
- correct edge

5) **Pushoffs**
- should be lined up on long axis
- should be lined up on short axis

6) **Shape of circle**
- should be rounded (well traced, round, no wobbles)

7) **Flats (Cleanness of edge)**
- ½" of flats acceptable (assuming no other occurences of flats in the layout)

CATEGORY 4 - TURNS (INCORRECT)

1) **Very serious errors**
- change in **or** out
- change in **and** out
- flats in **or** out
- flats in **and** out
- jumped (no top on turn)
- (LOOP) size of loop > 1 by 1½ bladelengths

2) **Serious errors**
- hooked or pulled turns
- forced turns (heavy edge)
- skids (at top of loops)
- scrapes

3) **Least serious error**
- spooned

CATEGORY 4 - TURNS (CORRECT)

1) All turns should be clean (i.e. without occurrence of any of the errors described in "Incorrect" column)

2) Size of LOOP = 1 by 1½ bladelengths

of these components incorrectly, a correct score of 3 would be obtained. Thus, percent correct performance would equal (3-7)x100, or 42.9%.

Assessment of Competitive Anxiety. Prior to baseline assessment, the subjects were asked to fill out Martens's (1977) Sport Competition Anxiety Checklist (SCAT -Form C). The SCAT is said to measure competitive trait anxiety, and reflects Martens's model of competitive stress, which suggests that the more important and uncertain the sporting outcome, the more one experiences competitive anxiety. This instrument has been demonstrated to have adequate levels of reliability and validity; the psychometric properties of the SCAT are described by Martens (1977). In this experiment, the SCAT was used to provide a structured format by which subjects could report on their feelings about competition prior and subsequent to their participation. A descriptive, rather than statistical analysis of the subjects' self-reports will be provided.

Each subject was approached individually, and both the author and the subject read through the instructions provided at the top of the questionnaire. The subject was asked if any further clarification was required, and then asked to fill out the questionnaire independently.

Immediately prior to the follow-up (or trial judging) session, the subject was once again asked to fill out the SCAT. The instructions for completion were reviewed, and the subject was asked to fill out the questionnaire.

Characteristics of Phases

Baseline Phase. Baseline assessments were conducted during "patch" or figures sessions. Two patch sessions were required to conduct one baseline

assessment of six figures. The figures to be assessed were selected by the coach, and were said to be representative of the figures being worked on by the individual subject. The sessions when assessment could occur were arranged in conjunction with the subject, judges, the author, and the observers.

At the beginning of an assessment session, the subject was asked to "warm-up" the figure in question on a practice patch. After the subject had had an opportunity to lay-out the figure on a practice patch twice, he/she was asked to lay-out the figure on a clean patch in the presence of the judges, the author and one observer. These individuals stood on the side of the patch in order to assess the figure using the checklist. Once the subject completed a lay-out of the figure, she was asked to warm-up the next figure, giving the observers an opportunity to evaluate the quality of the tracing on the ice.

The tracing (or lay-out) was evaluated independently by each of the observers, using strategies commonly used by judges (e.g., pacing out the length and width of the figure, examining turns for quality). The training manual illustrated in Appendix A provides descriptions and strategies for all the components. When all observers indicated completion of assessment, the subject was asked to lay-out the next figure. This process was repeated until all six figures were assessed over 2 consecutive patch sessions.

Due to practical constraints (i.e., unavailability of the volunteer judges due to competition and other commitments), subsequent baseline assessments were conducted by the author and an observer (the M.A. student in counselling psychology). As inter-observer reliabilities between the judges, and across all observers, were consistently above 80%, subsequent baseline assessments were undertaken by the aforementioned in order to avoid serious time delays. The subsequent baseline assessments were conducted in the same manner as the

first, that is, the subject was asked to warm-up the figure in question on a clean patch in the presence of the observers. While the observers examined the quality of the tracing, the subject prepared the next figure for judging.

Subsequent to baseline assessments, the author met with the coach and showed her the checklist assessing the subject's performance of the six figures. Components that were performed incorrectly over both assessments were highlighted; the coach then selected, on the basis of the following criteria, the components of the six figures that could potentially be targeted for treatment:

1) amenability of component to change (if the coach felt that the correct performance of the component would require developmental or "physical" changes, the component was not selected);
2) importance of correct performance of the component to evaluation at test or competition day (if the error would be weighted more heavily, it was more likely to be targeted for change); and,
3) stability of error during baseline assessments (errors were targeted that were relatively stable).

The subject was then approached with a list of components of figures that could be worked on, and asked to select, from the coach's selection, which he/she would like to work upon. Once the components were selected, a standardized coaching session was implemented during the subject's usual lesson time.

Treatment Phase: Standardized coaching. Standardized coaching is described as a treatment variable, however, coaching behaviors per se were not a focus of this research. Rather, feedback was standardized and incorporated all of the strategies commonly utilized by the coach during a lesson. Standardized coaching was given as follows:

1) The coach asked the subject to lay-out the targeted figure, and then examined the targeted components.
2) The coach provided her own verbal description of correct performance of the targeted components. For example, if the targeted component was a three-turn that had flats coming out of the turn, the coach would say "Your back three turns have flats coming out of them. In order to clean up those flats, you will have to keep your weight over the blade, and create a rocking motion - then, keep your hips checked and on the circle. If you do that, your turns will be clean."
3) The coach then modelled the undesirable behavior for the subject (in the above example, by tracing over the part of the circle where the turn had been executed incorrectly).
4) The coach then demonstrated correct performance of the component, and described what she was doing at the time (e.g., "weight over blade, rocking motion, hips checked and on the circle").
5) The coach then provided a specific verbal prompt(s) for the subject - e.g., "rocking motion, hips checked." The experimenter noted these prompts for the subject for use with the checklist
6) The subject was then asked to imitate the incorrect performance of the behavior, and then imitate the correct performance of the behavior on her tracing, while covertly repeating the prompts.
7) The subject was then asked by the coach if she understood the difference between incorrect and correct performance. If the subject said she did not understand the difference, Steps 2 - 6 were repeated, with additional instructions provided in Step 2, and if necessary, physical guidance at Step 6.
8) When the subject indicated understanding of correct performance, she was asked to lay-out the figure while repeating the self-prompts. The

figure was laid out such that it was not superimposed upon the original tracing (i.e., the subject "moved her centre over").

9) If the component was performed correctly, the coach provided immediate positive feedback ("good, that's right"),

10) If the component was performed incorrectly, the coach modelled correct performance, and the subject was required to imitate this performance.

11) The subject was required to lay-out the figure with the components performed correctly twice.

12) The subject was praised for correct performance by the coach.

The coach then left the subject after the standardized coaching session was administered.

Treatment phase: Self-evaluation package (SEP). This package was administered as follows:

1) After the standardized coaching session had occurred, the subject was taught the use of the self-evaluation package. The purpose of the checklist was described to the subject as follows:

"This is the checklist that the judges and I used to evaluate your performance of your figures. I want you to use it now to help you to improve your performance of (targeted components) of (targeted figure). On one side of the checklist are descriptions of incorrect performance. For example, if the long axis of your circles are off by a bladelength or more, that is considered incorrect. On the other side are descriptions of correct performance. For example, if all your turns are clean, that is considered to be correct. You'll notice that there are boxes on each side of the checklist. The boxes on the left hand side would be checkmarked to indicate incorrect performance, while the boxes on the right hand side would be checkmarked to indicate correct performance. So, if the long axis of your circles were off by a bladelength or more, we'd put a mark in this box (author modelled placing checkmark in box), and if your turns were clean we'd put a checkmark in this box (author modelled placing a checkmark in the box).

"Now, I've highlighted the components that you wanted to work on for this figure. We're working on (e.g) the quality of your turns. Can you describe for me, using the checklist, what would be considered incorrect performance of a turn? That's right, if your turns have flats, or changes, or are jumped they would be considered incorrect. What would be considered correct performance of the turns? That's right, if they were all clean. So if your turns weren't clean, and had changes in them, which box would you checkmark? That's right. And if they were clean, which box would you checkmark? That's right."

"At the bottom of the checklist is a prompt card, with a drawing of the figure,and the prompts that your coach gave you written beside them. That will help you remember what you learned in your lesson. What I'd like you to do in practice is to use what you have learned, and to evaluate how you perform your turns each time you lay them out."

2) The subject was then asked to lay-out the figure.

3) The subject and the author (and observer) then examined the targeted components and the subject was asked whether she thought that the component was performed correctly or incorrectly. (For example, whether all the turns were clean or not). If the subject's assessment corroborated with that of the author, then the subject was praised, and taken to the mounted checklist.

4) The subject was then asked to enter a checkmark in the appropriate column for the highlighted component(s). This process was repeated (i.e., the subject laid out the figure once again, and self-evaluated her performance of targeted components).

5) The subject was then told: "What I would like you to do, whenever you lay out this figure, is to examine (e.g., your turns) immediately, then enter a checkmark in the appropriate (incorrect or correct) column. Once you have performed all the targeted components correctly, on six

consecutive lay-outs, then you can show Coach what you've learned. In order to keep track of how many lay-outs you've done correctly, I'd like you to record the number of correct lay outs in the top right hand corner of the form, where it says '6'. If one of the lay outs doesn't work out, then you have to start again from the beginning, till you reach 6 consecutive lay-outs"

6) The subject was asked if she had any questions. Once questions were answered, the subject was asked to lay-out the figure twice and self-evaluate each time. If the subject and the author's evaluation were in agreement each time, the subject was considered competent in self-evaluation.

7) The subject was asked to lay-out the figure and self-evaluate twice at treatment practices. The subject was asked not to practice the targeted figure at any other practices apart from the treatment practices. Praise was provided for correct performance and implementation of the package was concluded.

The author kept the mounted checklist and presented it to the subject at treatment sessions.

After the subject reached criterion on the first set of components and had utilized the self-evaluation package successfully, a shortened version of the package was administered for subsequent targeted components, as follows:

1) The subject was shown the checklist with the highlighted components with the prompt card attached and was asked to describe the use of the checklist (i.e., define what equalled incorrect performance of a component, what would be considered correct performance of a

component, where checkmarks would be entered, etc.). The subject was reminded that 6 consecutive correct lay-outs were required prior to demonstration of mastery to the coach.

2) The subject was then asked to lay-out the figure twice. If the subject's self-evaluation agreed with the author's on both occasions, the subject was considered competent in self-evaluation.

Treatment phase: Experimental sessions. The mounted checklist with attached prompt card was employed at 4 out of 7 patch sessions for S1, S3, and S4, and at 2 out of 3 patch sessions for S2. The session began with the author mounting the checklist on the plexiglass closest to the subject's patch. The subject was greeted, and asked to inform the author when she was ready to lay-out. Thus, the author was cued so that the entire figure could be evaluated (while the subject only evaluated the targeted components). While the subject noted her evaluations on the checklist, the author (and an observer) made their evaluations. The subject then signalled or told the author that she was ready for a second lay-out, and the same process occured. If time permitted, the subject had the option of laying out the figure a third time. This was a decision that the skater made, and the author was cued if a third lay-out was going to occur. At the end of the lay-outs, the author checked the subject's self-evaluation against her own, as well as the subject's tally of total consecutive correct lay-outs. If disagreement occured twice on a particular component, the author's evaluation was considered correct, and with the subject's assistance, the appropriate changes were made to the checklist (e.g., total consecutive correct lay-outs were changed). Then the subject was given a booster session on the self-evaluation package. She was asked to lay-out the figure, and the targeted components were examined by both the experimenter and subject. The subject then recorded whether the component was performed correctly or incorrectly; if the assessments agreed, the subject was considered competent to continue in the use of the self-evaluation package.

The subject was then praised ("good work") or encouraged ("try again next time"), and the checklist withdrawn. If the disagreement was a simple mathematical error (i.e, an error in calculation of number of layouts successfully completed), the subject's attention was called to this, and the number changed. The subject was reminded of the recording procedure (a simple process of noting the number of correct lay-outs, and starting at zero if any of the lay-outs were performed incorrectly). If any time was left in the patch session, the subject was left to practice another, non-experimental figure.

Once the subject had achieved 6 consecutive correct layouts, she demonstrated mastery to her coach.

Treatment phase: Demonstration of mastery. During a regular lesson time, the subject told the coach that she was ready to lay out the targeted figure, and reminded the coach of the components that she had been working on. The coach then instructed the subject to layout the figure, and examined the execution of the components. If the coach was satisfied with the execution of the components, (ie., they were performed correctly, using the checklist criteria) then the subject was praised, and the mastery demonstration terminated. If the subject did not perform the components correctly, the subject was asked to lay-out the figure again. If the components were performed to the coach's satisfaction, then the subject was praised and the mastery demonstration was terminated. If the coach was dissatisifed, a booster session on the particular figure was implemented. This involved a reimplementation of all the steps described previously for the corrective feedback package.

In the latter case, the subject was then informed that the checklist would once again be employed to help improve and maintain performance of targeted figures. The subject was given the "short-form" of the self-evaluation

package, as described previously.

If a subject had attempted 12 lay-outs of a particular figure and had consistently failed to achieve 6 consecutive correct performances of the targeted components, a booster session, as described previously, was arranged (i.e, including both corrective feedback and the shortened self-evaluation packages). If the subject was still unable to reach criterion after 10 lay-out attempts, other components of another figure were targeted, so as to avoid frustration and to minimize the possibility that the checklist might become aversive for the subject.

The above process, including corrective feedback and the SEP, was utilized to give treatment to 3 to 5 sets of components of two or three independent figures.

Summary. A summary of the procedure used in this study is given below:

1) Baseline assessments were conducted on a set of six figures.
2) The coach selected, based on specific criteria, components of the figures that could be targeted for treatment.
3) Of these components of figures, the subject selected a group of components from one figure to receive treatment.
4) During a scheduled lesson time, the coach provided a standardized coaching session on the targeted components.
5) The author then provided training on the SEP.
6) The subject used the SEP during practice sessions until a mastery criterion of six consecutive correct lay-outs was reached.
7) Once criterion was reached, mastery was demonstrated to the coach. If

the mastery demonstration was successful, steps 3-6 were repeated until three figures received treatment.

8) If the subject was unable to achieve six consecutive correct lay-outs, a booster session of corrective feedback was arranged after the twelfth lay-out attempt.

Follow-up Phase. Immediately prior to the follow-up or trial-judging phase, the subject was asked to complete the SCAT once again.

One trial-judging was arranged for each subject. For three of the subjects, trial judging occurred a week and a half prior to their actual test dates. The fourth subject (S2) retired from skating, so trial judging was conducted immediately prior to her retirement.

The judges, author, and observer were involved in the assessment. Trial-judging was conducted at the Kerrisdale Arena, during a regular patch session (as no other ice time was available). The figures assessed included all the six figures initially evaluated in the baseline phase. In this manner, stimulus generalization or transfer of practice performance to a mock judging or competition situation was assessed. The trial-judging also provided another opportunity to assess response generalization, or the transfer of treatment gains to non-targeted components of figures.

The subject was provided with a warm-up period prior to the trial judging. Thus, each of six figures was warmed-up before lay-out was done in the judges' presence. While the subject warmed-up the next figure, the judges conducted assessment of the tracing of the previous figure. The subject's mothers were usually present at practices and tests, so the audience dimension could not be manipulated.

Formal written feedback was given to the subjects that summarized their performance of the figures and components. This feedback was provided so as to approximate the information skaters would receive after being tested. General encouragement and praise was also provided in this form. A sample of this form is provided in Appendix C.

Actual figures tests. The coach was present at all three skaters' formal figures test. The coach provided a verbal report of the results of the figures tests, and of her subjective impressions of the skaters' performances.

Assessment of response generalization. During baseline, treatment and follow-up phases, the subjects' performance of all the components (or categories) of a targeted figure was evaluated. For example, the components of Category 3 of Figure A was targeted for intervention for S1. Data were also obtained on S1's performance on the components of Categories 1, 2 and 4; S1's percent correct performance of these non-targeted components was averaged across experimental phases in order to determine if response generalization had occurred. Though data were obtained on subjects' performance of figures other than those selected for treatment, these data were not examined for response generalization as it was not possible to control for the effects of practice or feedback with those figures.

Additional Variables Controlled Through the Experiment

"Practice" assessment sessions. In order to ensure reliability of assessment between the judges and observers over time, 4 "practice" assessment sessions were conducted throughout the course of the experiment. A senior skater who was not participating in the research was asked to lay-out figures for the judges and observers. Three figures were arbitrarily selected each time for

lay-out. Then, the assessment process as described previously was undertaken. Inter-observer reliabilities were calculated across judges and observers to ensure consistency in the use of the checklist.

Time spent practicing targeted figures. The subjects were asked to practice targeted figures only during experimental sessions, and not during patch sessions where experimental conditions were not in effect. Similarly, the coach was asked not to provide extra lessons on the targeted figures while treatment conditions were in effect. Generally, subjects and the coach reported complying with this request during treatment. However, all subjects reported practicing targeted figures an average of three hours during the week and a half prior to the follow-up (or trial-judging) phase, when mastery had been achieved on all targeted components, and experimental conditions were no longer in effect.

General prompts. General prompts were given to begin an experimental session. During the baseline phase, subjects were generally instructed as follows: "We'd like to begin by looking at your (figure). Please warm up the figure on your patch". After a few minutes had passed, and the subject had been given an opportunity to warm up the figure, the author said, " We're ready to assess (figure). Let's go to the lay-out patch". Once at the lay-out patch, the author said "Go ahead," and assessment began.

Prior to the training phase, the author approached the subject to determine which figure she would like to work on. She was shown a written list of potential figures and the components that would be targeted for change. The subject would indicate verbally which figure she had selected; she was not asked to provide any reasons for her selection. The author thanked the subject, and informed her that she would receive a standardized coaching session on the

components she had selected at her next lesson.

At the beginning of the experimental phase, the author would indicate " The checklist is up for you to use. Let me know when you're ready to do a lay-out". The subject was asked to indicate when she was ready to do a lay-out so that the author (and observer) could evaluate the entire figure. If the subject appeared to be extending her warm up time, or otherwise dawdling, she was prompted to stay on-task: "Please get ready to do a lay-out; you're running out of (practice) time," or was told "Let's get back to work!" At the end of the experimental sessions, the subject was either congratulated for accurate self-monitoring, self-evaluation, and progress toward achieving the mastery criterion, or encouraged for her continued attempts (e.g, "Good work, only 2 more correct lay-outs to go", or "You worked hard - try again next time!").

Frequency of the interactions described above were monitored intermittently by the author and the observer. "Pleasantries" such as greetings, etc by the skater or experimenter were not noted. Attention was paid to questions asked by the subject (e.g., occasionally, the skater would ask the author whether she thought she was doing better overall, or ask whether she " really had to start from scratch just because a lay-out was incorrect"). Very general answers were given to these questions, e.g, "It seems like you've been working hard; or the subject would be asked "what do you think?" and vague agreement would be given to the skater's opinion. The subject was praised and/or encouraged at each treatment session.

Experimental Design

A multiple baseline across components design with a follow-up (trial judging) phase, and replication across subjects was used (for a description of this

design, see Martin & Pear, 1988). The percent correct performance of figures for each subject was monitored across baseline and treatment conditions. Presentation of treatment was staggered across components and across subjects, such that treatment was initiated with components of one figure at a time, and such that initiation of treatment with one subject did not coincide with initiation of treatment with another subject.

Social Validation:

All four subjects were asked to fill out a social validation questionnaire to determine their views on the experimental procedures. The coach was also asked to respond to a questionnaire, in order to determine whether she viewed the gains the subjects had made to be useful. A sample of each of these questionnaires is provided in Appendix C. One of the judges was asked by the experimenter to comment upon the adequacy and usefulness of the checklist, as well as the usefulness of trial judging. These questions were open-ended, and the judge was encouraged to be candid about her impressions.

Corollary Information

Corollary information was obtained from the coach regarding the following areas:

1) The usual amount of time it takes skaters to acquire competence on the figures assessed.
2) The subjects' performance on the actual figures judging day.

Reliability Assessments

The author and one or both of the observers periodically recorded

concurrently in order to assess interobserver reliability (IOR). Observations were carried out so that neither observer could determine what the other had recorded. IORs were calculated on several variables, as described below.

Performance of components of figures. During the baseline phase, "practice" assessment, and follow-up phases, the author, observer and the two judges independently evaluated whether all the components of the figures were performed correctly or incorrectly. During the treatment and follow-up phases the author and the observer independently evaluated whether all the components of the figure were performed correctly or incorrectly. However, to calculate IORs, the total number of agreements on the targeted components performed incorrectly was divided by the total number of agreements (regarding performance of targeted components) plus disagreements times 100. Thus, IORs were calculated to reflect percent agreement on performance of targeted components, rather than on performance of the entire figure.

Response generalization data. IORs on the performance of non-targeted components of figures were calculated separately. To calculate these IORs, the total number of agreements on the non-targeted components performed incorrectly was divided by the total number of agreements (regarding performance of non-targeted components) plus disagreements times 100.

Procedural reliabilities. During the experimental conditions, the coach's implementation of standardized coaching, the experimenter's implementation of the self-evaluation package, and the subject's accuracy of self-monitoring and self-evaluating were recorded. The forms used to evaluate the coach and author's implementation of their respective session or package are given in Appendix D. The subject's accuracy of self-monitoring and self-evaluating was determined by comparing the subject's evaluation and recording of performance of the targeted

components to the experimenter's evaluation and recording. Accuracy of self-monitoring and self-evaluation was determined by comparing the subject's evaluation to the experimenter's evaluation. Thus accuracy was determined by dividing the number of agreements on the components performed incorrectly by the total number of agreements plus disagreements, and multiplying by 100.

RESULTS

Baseline assessments were conducted on six figures for each of the four subjects. Incorrectly performed components of two to three of these figures were targeted for change for each subject. 100% correct performance represents correct performance of all the components within a group of sub-categories. The standardized coaching (SC) phase represents percent correct performance during training on target components with the coach, while the self-evaluation package (SEP) phase represents percent correct performance as the subject attempted to reach mastery criterion.

The first subject's (S1) performance is shown in Figure 1.

Insert Figure 1 about here

As Figure 1 illustrates, the combination of standardized coaching and the self-evaluation package effectively improved this subject's performance of five categories of components of three figures. For each of Figures A, B, and C, one, two, and two categories of components respectively were targeted for treatment, based on baseline evaluations, and upon the subject's own selection of errors to be corrected. S1 required an average of eight lay-outs per category of components to achieve the mastery criterion of 6 consecutive correct lay-outs of that category. Follow-up was scheduled for session 33, approximately a week and a half subsequent to mastery demonstration for Figure C. Unfortunately, this subject sustained an injury that required her to be off the ice for two weeks. S1 gradually resumed skating over a subsequent two week period. S1's performance at follow-

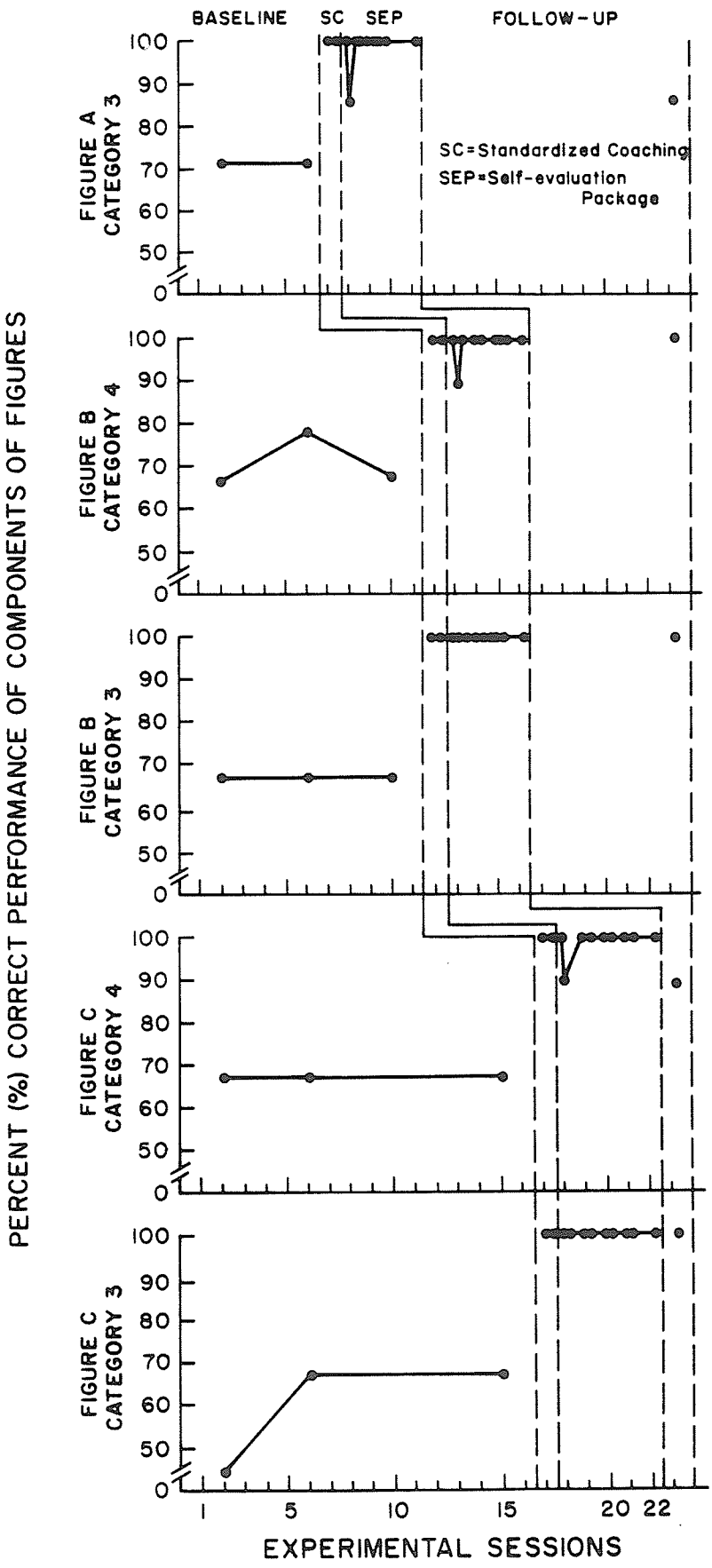

Figure 1. Percent correct performance of five categories of components of three figures for Subject 1, across experimental phases.

up may reflect this fact. Performance gains were maintained on both component categories of Figure B, and on Category 2 of Figure C. Gains were partially maintained on Figure A, and on Category 4 of Figure C. Performance on these categories remained well above baseline levels. This subject passed her Fourth Figure test one and a half weeks after follow-up.

The second subject's (S2) performance is shown in Figure 2.

Insert Figure 2 about here

As Figure 2 illustrates, the combination of standardized coaching and the self-evaluation package produced some improvements in this subject's performance of the components of 2 figures. However, this subject was unable to consistently achieve 100% correct performance of the targeted components. For each of Figures A and B, one and two categories of components respectively were targeted for treatment. Seven lay-outs were attempted with Figure A, and a booster session provided at S2's request. The booster session was also ineffective at helping this subject achieve 100% correct performance of Figure A. Implementation of the package on Categories 1 and 2 of Figure B yielded much the same results. Overall, S2 attempted an average of 18 lay-outs of each of the figures, without reaching criterion. Progress, as such, was demonstrated to the coach despite the lack of achievement of mastery criterion so that S2 could receive some feedback and encouragement. Follow-up assessment revealed some maintenance of gains, particulary with Figure A and Category 4 of Figure B. This subject chose to retire from skating and therefore did not take the Fourth Figure test.

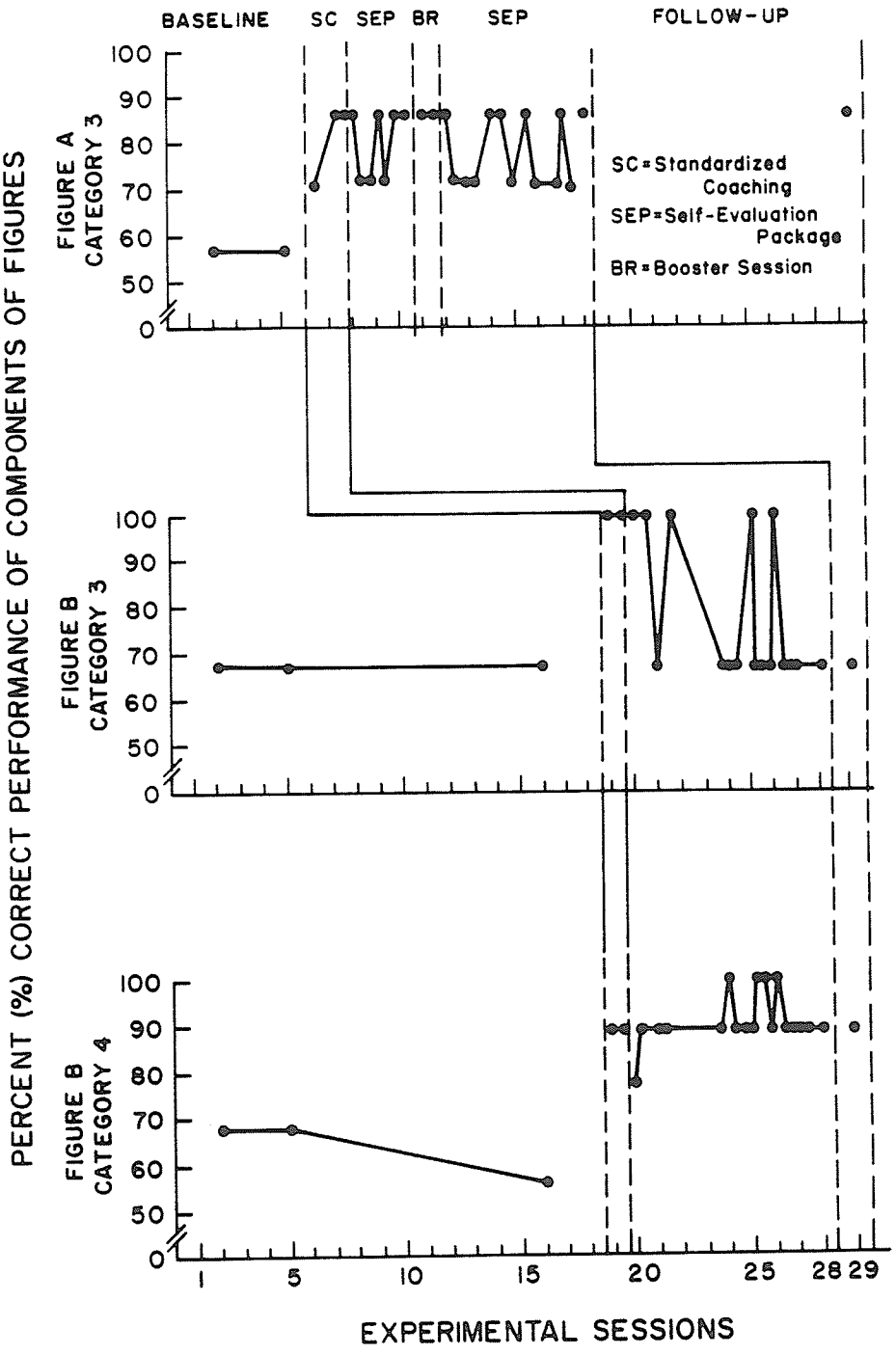

Figure 2. Percent correct performance of three categories of components of two figures for Subject 2, across experimental phases.

The third subject's (S3) performance is shown in Figure 3.

Insert Figure 3 about here

As Figure 3 illustrates, the combination of standardized coaching and the self-evaluation package was effective in improving this subject's performance of three figures. For each of Figures A, B, and C, one, two and one categories of components respectively were targeted for treatment. This subject required an average of 12 lay-outs per category to achieve the mastery criterion of 6 consecutive correct lay-outs. Follow-up assessment occurred a week after mastery of Category 3 of Figure C was demonstrated to the coach. Treatment gains were maintained on 3 of the 4 Categories targeted for intervention. Treatment gains were not maintained for Category 1 of Figure B. However, performance of this category did not fall below baseline levels. This subject passed her Fourth Figures test one week after follow-up was conducted.

The fourth subject's (S4) performance is shown in Figure 4.

Insert Figure 4 about here

As Figure 4 illustrates, the combination of standardized coaching and the self-evaluation package was effective in improving this subject's performance of three categories of two figures. For each of Figures A and B, one and two categories of components respectively were targeted for treatment. This subject required an average of seven lay-outs per category to achieve the mastery criterion

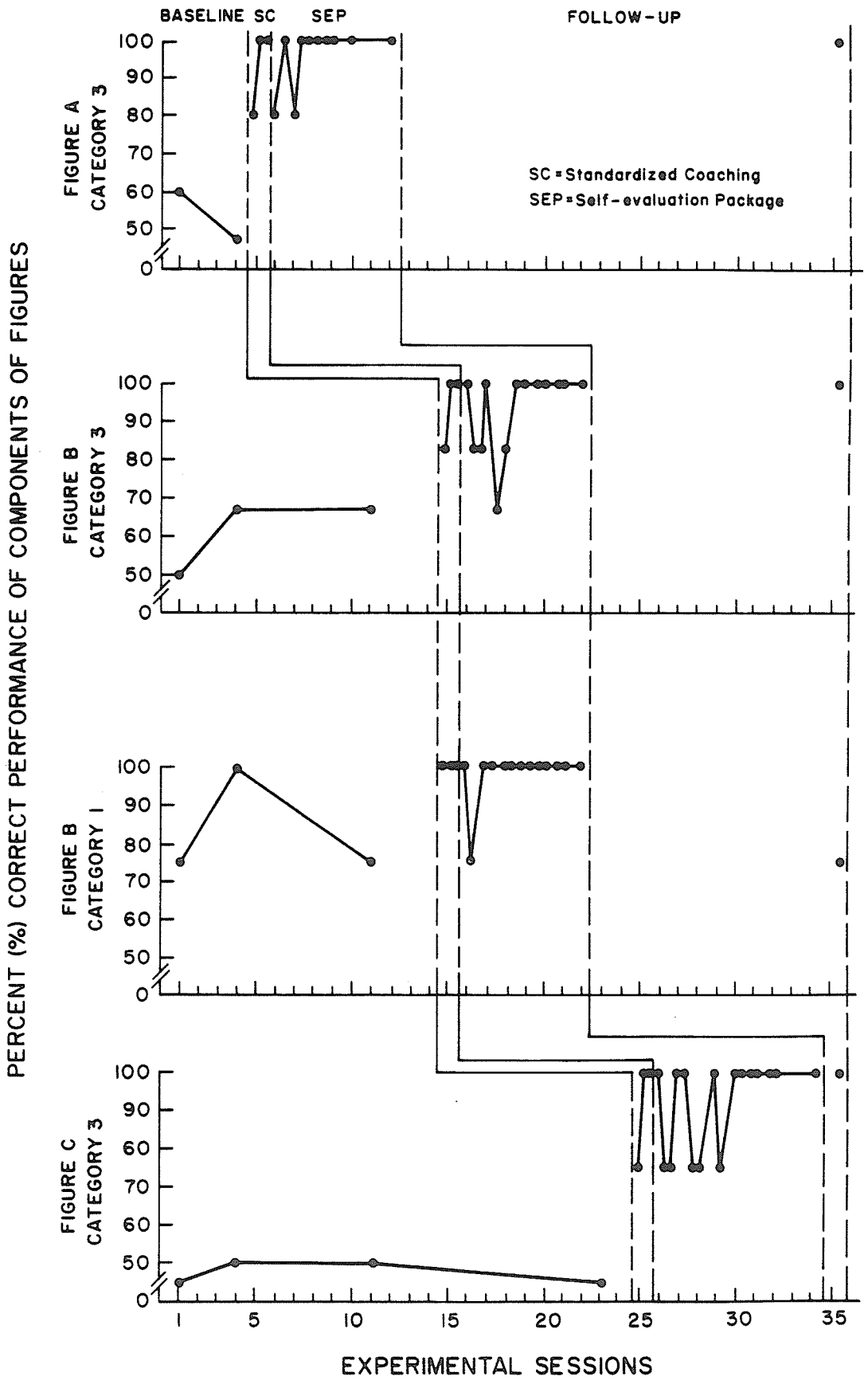

Figure 3. Percent correct performance of four categories of components of three figures for Subject 3, across experimental phases.

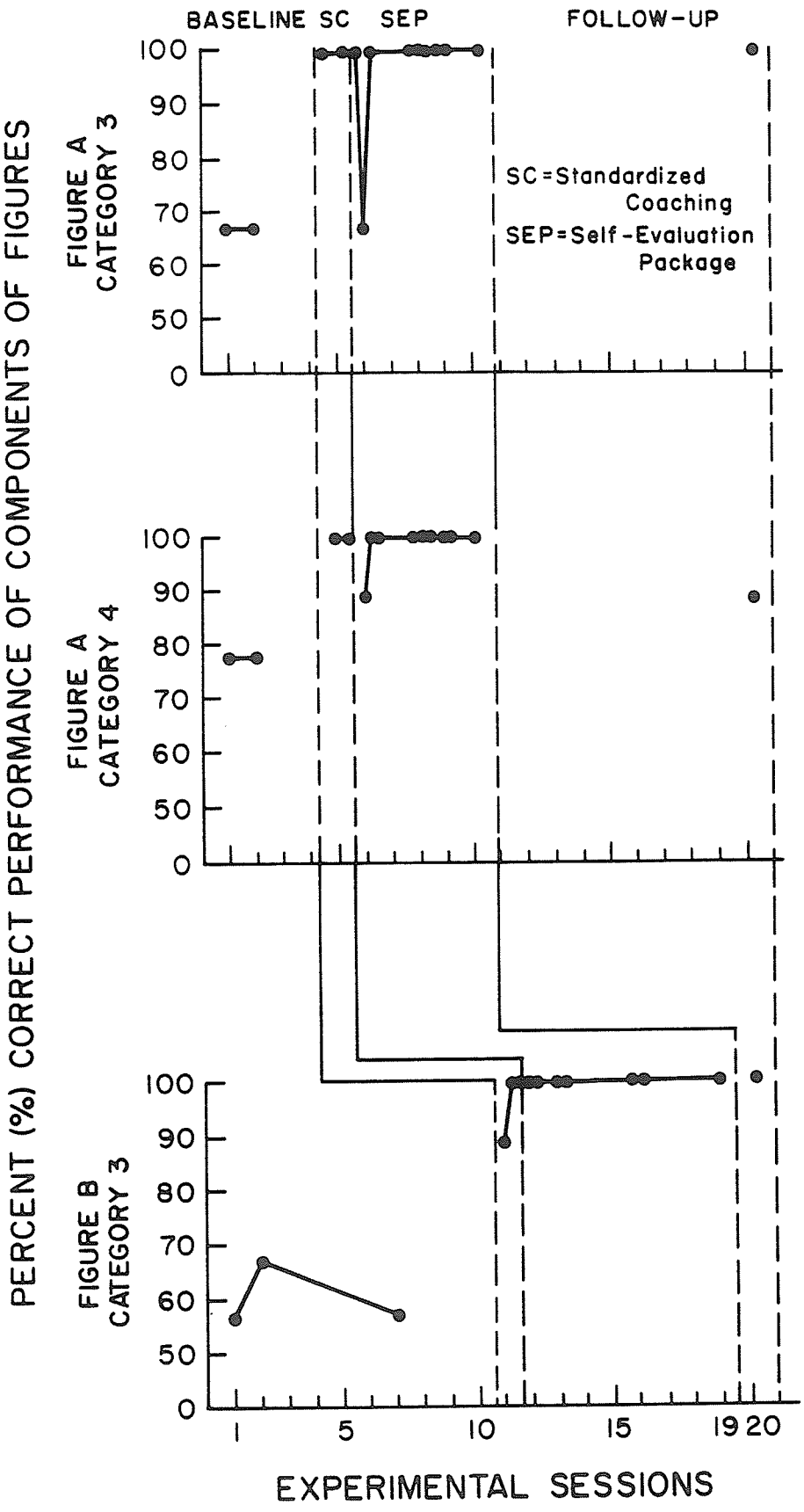

Figure 4. Percent correct performance of three categories of components of two figures for Subject 4, across experimental phases.

of 6 consecutive correct lay-outs. Follow-up assessment occurred one and a half weeks after mastery of Figure B was successfully demonstrated to the coach. S4 maintained treatment gains on Category 3 of Figure A, and on Category 3 of Figure B. Follow-up performance on Category 4 of Figure A decreased below treatment levels, but remained above baseline levels. This subject passed his Fifth Figures test one week after follow-up.

In summary, a combination of standardized coaching and the self-evaluation package was effective in producing 100% correct performance of targeted component categories in three out of four subjects. This combination was also effective in improving the performance of the fourth subject (S2), though not to the levels observed in the other subjects.

Response generalization

During baseline, treatment, and follow-up phases, subjects' performance of all the components of targeted figures was evaluated. Data from these observations were averaged, and a total percent correct performance of these components was obtained per figure for each subject. Because performance of targeted components was expected to improve following intervention, these averages were calculated only on non-targeted components. As Figure 5 illustrates, the standardized coaching and SEP facilitated correct performance of non-targeted components of figures.

Insert Figure 5 about here

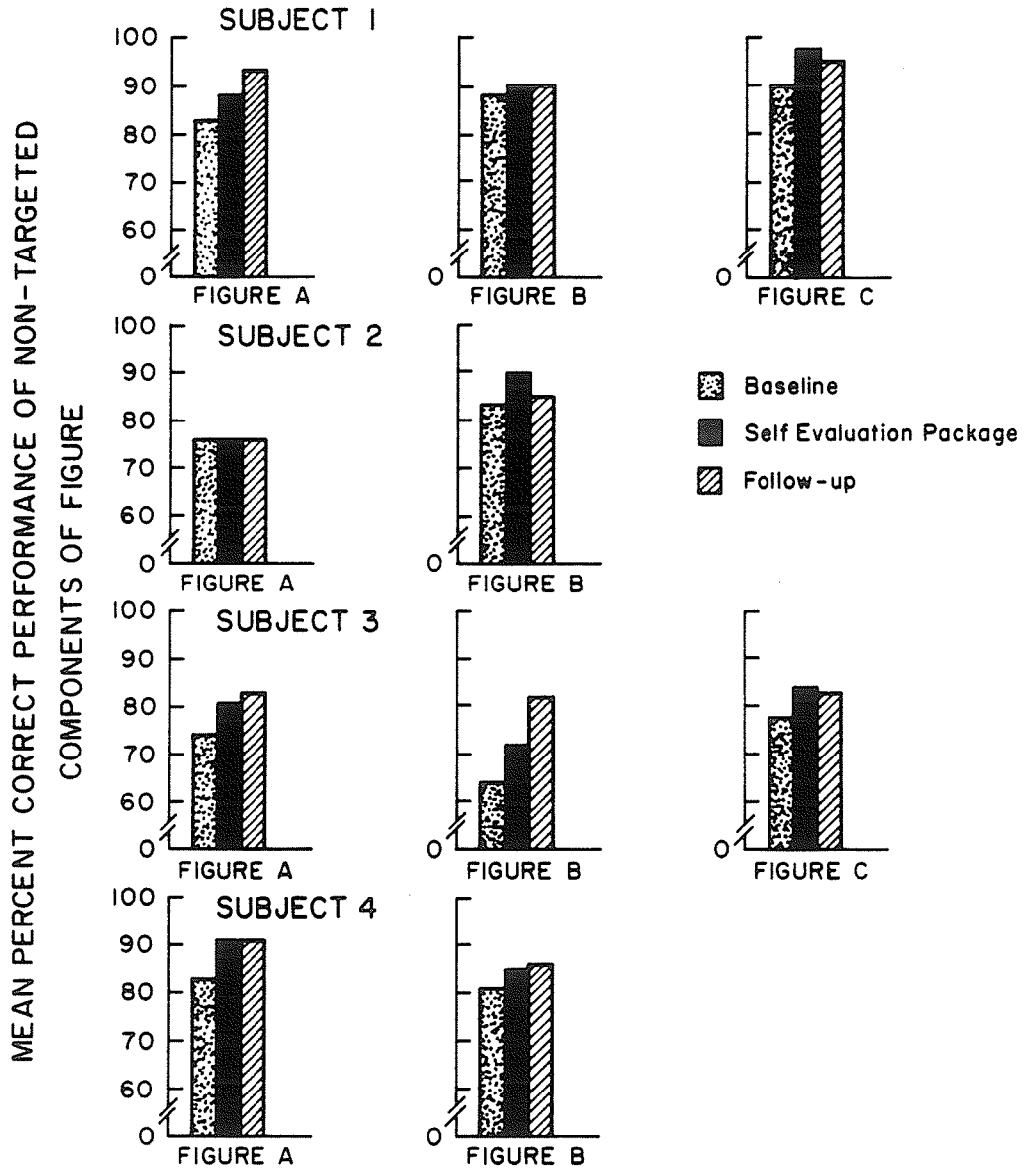

Figure 5. Mean percent correct performance of non-targeted components of figures for four subjects, across experimental phases.

Performance of non-targeted components during treatment and follow-up were consistently above baseline levels, with one exception (S2, Figure A) where performance remained at baseline level. However, performance improvements on non-targeted components was not nearly as great as on targeted components.

Accuracy of self-monitoring/self-evaluation

The mean accuracy of S1 over 24 lay-outs, or during the self-evalution package phase, was 100%. S2's mean accuracy over 35 lay-outs was 87%. S3's mean accuracy over 36 lay-outs was 89%, and S4's accuracy over 14 lay-outs was 100%.

Frequency of interactions

During the baseline phase, an average of four interactions per session occurred with each subject. These interactions fell under the category of general prompts (e.g., instructions to begin laying-out a figure). During the SEP phase, the number and category of interactions per experimental session with each subject was kept relatively constant. An average of four interactions under the categories of general prompts and positive feedback occurred at each of the experimental sessions with each subject.

Social Validation

All four subjects indicated that they thought it was important for them to know how to evaluate their figures. Two of the four subjects, S1 and S4, indicated that they knew how to evaluate their performance of figures prior to participation in this research project. Three of the four subjects, S1, S2 and S3

stated that they evaluated their performance of figures "sometimes" (i.e., 2-3 times per week), while S4 described evaluating his figures "often" (i.e, every practice). All four subjects described the coach's feedback as very useful. Two of the subjects, S3 and S4, described laying-out their figures and monitoring their progress on the checklist to be "very useful." Subjects 1 and 2 described this process as "somewhat useful." All four subjects described the trial judging session as "very useful." Three of the four subjects, excluding S2, stated that participating in this project had helped them to improve their performance of figures. S2 found participating to be "somewhat useful." Three of the four subjects (S2,S3 and S4) gave equal importance (i.e, first rank) to coach feedback, laying-out the figure and using the checklist, and trial judging. S1 rated coach feedback and trial judging first, or most useful, and the checklist second. Three of the four subjects (S2, S3, and S4) said they would use the checklist on their own to evaluate their performance of figures, while S1 indicated that she would "perhaps" use the checklist for this purpose. Two of the subjects (S1 and S3) commented that they found the use of the checklist to be time consuming.

The coach described satisfaction with the outcome of this project (i.e, three of the four subjects passed their figures' tests). The coach described feedback, or the standardized coaching session as very easy to administer, as it followed her usual lesson strategy. She indicated that she liked the self-evaluation package, though she, like some of the subjects, viewed it as time consuming. She indicated that she would more likely encourage the skaters to use a modified version of the package. The coach also found the trial judging session to be very useful, as she felt it contributed a great deal to preparing the subjects for their test day. The coach was also asked to provide corollary information regarding the amount of time it usually takes skaters to master their figures. The coach indicated that skaters can take an average of 8 months to successfully master the figures in the Fourth or Fifth figures test. The coach did not feel that participation

in this project had hastened the subjects' acquisition of the figures. However, the coach commented favorably upon the consistency of performance of the targeted figures in three of the four subjects. The coach also noted a great difference in performance on test day with the three subjects. She described these subjects as relaxed and confident, and was "pleasantly surprised" to see one of the subjects (S1) smiling while doing her figures test.

One of the judges was asked to comment upon the adequacy of the checklist, and its usefulness, as well as the usefulness of trial judging, in preparing skaters for figures tests. The judge commended the checklist as a basic way by which skaters could learn to evaluate their figures. The judge indicated that many skaters, including subjects in this research, have profited greatly from trial judging. She noted that judges can be asked by the skaters or the coach to conduct a trial judging session, but that in practice, this happens infrequently.

Reliability assessments

Performance of components of figures. Inter-observer reliabilities were obtained at all baseline, standardized coaching sessions and follow-up sessions for all four subjects. During the self-evaluation package phase, inter-observer reliabilities were obtained as follows: 14 out of 24 lay-outs for S1; 20 out of 35 lay-outs for S2; 22 out of 36 lay-outs for S3 and 8 out of 14 lay-outs for S4. Table 2 describes the average agreement across observers on the performance of non-targeted components of figures, per phase for each subject.

Insert Table 2 about here

Table 2

Average Inter-Observer Reliabilities (IOR) for Targeted Components Across Phases

Subject	BL	SEP	Follow--up
1	90 range = (83.3 - 100)	89.9 (89 - 100)	97.8 (89 - 100)
2	88.3 range = (83.3 - 100)	90.9 (93.3 - 100)	95.3 (86 - 100)
3	92.3 range = (80 - 100)	91.4 (80 - 100)	92.7 (83.3 - 100)
4	92.2 range = (83.3 - 100)	94.1 (83.3 - 100)	94.4 (83.3 - 100)

BL = Baseline
SEP = Self-Evaluation Package

Response generalization data. At all sessions where interobserver reliabilities were conducted, the entire figure including targeted and non-targeted components was assessed. Table 3 describes the average agreement across observers on the performance of non-targeted components of figures, per phase for each subject.

Insert Table 3 about here

"Practice assessments". A total of 12 figures performed by a senior skater not participating in this research were evaluated by the experimenter, observer and the judges over 4 sessions in order to ensure consistency in the use of the scoring key of the checklist. Mean agreement obtained across observers for all of the components of each of the figures was 90%, 92%, 100%, 90%, 86%, 84%, 100%, 84%, 90%, 88%, 84%,and 92% respectively.

Procedural reliability assessments: Agreement across components and subjects on the coach's provision of corrective feedback was 100%, averaged over a total of 10 implementations. Agreement across components and subjects on the experimenter's administration of the full version of the self-evaluation package was 95.3% (range= 92-100%), averaged over a total of four implementations. Agreement across components and subjects on the experimenter's administration of the shorterned version of the self-evaluation package was 100%. One booster session was administered, and agreement on coach feedback and the experimenter's administration of the shortened version of the self-evaluation package were both 100%.

Table 3

Average Inter-Observer Reliabilities (IOR) for non-targeted Components Across Phases

Subject	BL	SEP	Follow--up
1	95.5 range = (89.7- 100)	89.6 (85 - 100)	89.9 (85 - 100)
2	89.8 range = (80 - 100)	91.1 (85 - 100)	97.5 (95 - 100)
3	83.9 range = (80 - 100)	90.8 (83.5 - 100)	92 (90 - 93)
4	93.3 range = (85 - 100)	88.6 (85 - 100)	96.5 (93 - 100)

BL = Baseline
SEP = Self-Evaluation Package

Assessment of competitive anxiety

Martens's (1977) SCAT (Form C) is an inventory that provided a structured format by which subjects could be asked to describe their feelings at, and about competition. The subjects were asked to fill out the questionnaire prior to baseline conditions, and prior to the follow-up phase. The subjects' self-report can be summarized as follows. In the baseline assessment, S1 reported worrying "often" about making mistakes and not performing well. S1 reported feeling relaxed , or nervous and uptight "sometimes" before competing. At the follow-up phase, the same subject reported worrying only "sometimes" about not performing well, and felt that she "hardly ever" got uptight before she competed. Endorsement of other items remained unchanged from baseline to follow-up conditions.

In the baseline assessment, S2 reported worrying "often" about not performing well, feeling uneasy and nervous before competition, worrying about making mistakes, getting a funny feeling in her stomach prior to competing, and getting uptight before competition. At the follow-up phase, the same subject reported that she "sometimes" got a funny feeling in her stomach prior to competing. Endorsement of other items remained unchanged.

In the baseline assessment, S3 reported feeling relaxed or nervous "sometimes" before a competition. This subject indicated that she "hardly ever" got uptight before a competition, and reported that she "often" felt calm before a competition. Endorsement of these items did not change from baseline to follow-up phase.

In the baseline assessment, S4 reported that he "often" worried about

competing. He described that he "sometimes" felt calm before competition, though he worried about making mistakes. At the follow-up phase, the same subject reported that he "sometimes" felt nervous, and got a funny feeling in his stomach prior to competing. Endorsement of other items remained unchanged.

DISCUSSION

The results of this study suggest that a combination of a standardized coaching session, a self-evaluation package can be effective in improving young figure skaters' performance of figures. The standardized coaching and SEP assisted three out of four subjects in firmly establishing skills that they had been practicing on their own, with inconsistent success, for an average of four months. These three subjects required an average of 24 lay-outs to master 12 categories of components of 8 different figures. Performance gains for 8 of the 12 categories of targeted components were maintained in the follow-up, or trial-judging phase, suggesting that stimulus generalization had occurred. Performance of non-targeted components of figures generally exceeded baseline levels for all skaters, suggesting that response generalization had also occurred.

One subject, S2, was not able to achieve mastery criterion on any of the sets of targeted components. This subject attempted 35 lay-outs of 3 sets of components, but was only infrequently able to perform these components without errors. However, some improvements in performance were noted; S2's performance often exceeded baseline levels. Small performance gains were noticed at follow-up. There may be several reasons for this subject's difficulty. This subject may have lacked some of the motor coordination to perform the figure appropriately; this may have been due more to the subject's limited involvement in skating compared to the other subjects. That is, the other subjects may have had more opportunity to learn and rehearse the motor skills involved in executing figures, as they attended more practices, and these skills likely enabled them to master the targeted components with less difficulty. This subject had expressed

great interest in participating in the study and was therefore included but she had also indicated that her commitment to skating was waning. As mentioned previously, this subject retired subsequent to the completion of the study in order to focus her efforts upon her academic work.

Three of the four subjects indicated that they thought that participating in this project had helped them improve their performance of figures. While all four subjects found the standardized coaching session and trial judging to be very useful, only two of these subjects reported the self-evaluation package to be similarly useful in improving performance of figures. Three of the four subjects indicated that they would use the SEP on their own to evaluate their performance. Another subject indicated that she found the SEP to be too time-consuming. Generally, the coach reiterated the majority of the skaters' opinions, and was very satisfied that three of the skaters had passed their figures' tests. However, she also noted that the SEP may be too time consuming for everyday use at practices. This aspect of the package was discussed; it was explained to the coach and the skater that the rigorous requirements of research likely prolonged this activity, and that the use of the checklist would probably be much less demanding under ordinary practice conditions. Under ordinary practice conditions, the coach could utilize the checklist to evaluate skaters' figures during lesson times. The checklist could either be used to evaluate the entire figure, or to evaluate selected categories or targeted components. After providing corrective feedback to the skater, the coach could then assign "homework" (i.e., encourage self-evaluation by use of the checklist and provide a mastery criterion for the skater), check the "homework" (i.e, periodically verify whether the skater had used the checklist: encourage demonstration of mastery), and schedule, based on demonstration of mastery of figures, opportunities for skaters to be evaluated in a trial-judging situation. The figure skating judge commented positively on the checklist and on the trial-judging procedure in preparing the skaters for their figures' tests. The

judge also noted that in common practice,trial-judging situations are organized infrequently, though judges are often more than willing to assist skaters in their competition and test preparation.

Several reasons may account for the effectiveness of the procedures used in this study. Firstly, the practice of self-evaluating and self-monitoring after each lay-out, along with an established mastery criterion likely exerted some stimulus control over the skaters' performance of figures. An established mastery criterion functions as a goal, and as research has suggested, goals are more likely to be met when they are specific, rather than "do your best" reminders, or no goals at all. Furthermore, goal-setting plus feedback has been shown to be more effective than goal-setting alone or feedback alone in improving performance. In this study, subjects had both a goal (or mastery criterion), feedback in the form of self-evaluation, and mastery demonstration, all of which may have facilitated improvements in performance. Secondly, subjects were involved in self-monitoring, and received positive feedback from the coach during mastery demonstration. They also had an opportunity to view their progress relative to their baseline performance (i.e, their performance of targeted components became more consistent); these events probably functioned as conditioned reinforcers for improved performance. Thirdly, the checklist with its list of components, and the attached picture of the figure being practiced may have served to prompt the skater regarding the requirements for correct performance after each lay-out. Fourthly, the follow-up or trial-judging phase both served as an opportunity to assess stimulus generalization, and also provided subjects with a "dress rehearsal" for their test day. The coach indicated that she was "pleasantly surprised" by the subjects' performances on the test day, as they appeared relaxed and confident when executing their figures. The coach indicated that the subjects in the past expressed nervousness and anxiety on test days. Thus, the trial-judging session may have given subjects an opportunity to experience and habituate to stimuli

usually seen only on a test day (e.g, judges with clipboards, etc). In fact, the SEP, which required the presence of the experimenter and observer at practices may have served a similar function.

Baer, Wolf,and Risley (1968;1987) noted that "the stimulus controls for behavior-analytic conduct in the world of application were the seven key words...applied, behavioral, analytic, technological, conceptual, effective and capable of appropriately generalized outcomes" (p.314, 1987). The term "applied" is said to be determined by "the interest which society shows in the problems being studied" (p.92, 1968). The "behavioral" attributes of a study are determined primarily by its emphasis on reliable quantification; the "analytic" attribute is determined by the experimenter's demonstration of control over the behavior under study. In order for a study to be described as "technological", the techniques that make up a particular behavioral application must be completely identified and described. The term "conceptual" refers to the relevance of procedures to principle, or to a comprehensive theory about behavior. In order for a study to be described as "effective", the impact of the procedures must be powerful enough to be socially important. Finally, a study must demonstrate that the behavior change has generality, i.e., it proves durable over time, across environments, and across behaviors. This study fits the dimensions of applied behavior analysis described by Baer et.al in several ways. Sport skills and sport performance have increasingly become a focus of interest in society (Martin, 1984). This study successfully utilized a treatment package consisting of established behavioral procedures to improve performance of figure skaters. Improvements in performance were noted across categories of components, and replicated across subjects. Interobserver and procedural reliabilities were conducted to ensure reliable quantification. Social validity data were obtained to determine if the behavior changes were socially significant. Finally, response generalization and stimulus

generalization data were gathered, and generality of behavior change across environments and behaviors was demonstrated.

This study used a combination of several procedures, including self-management strategies, to help improve athletic behaviors. Albion (1983) commented on the need for component analyses of self-control procedures. A necessary next step in determining the efficacy of self-control (or self-management) procedures to improve athletic behaviors would be to examine the efficacy of individual components such as the standardized coaching session, self-monitoring, and self-evaluation, and trial judging in improving performance of figures. It would also be intriguing to determine if this combination of procedures, or one of these procedures alone would be effective in helping an athlete acquire a skill.

Another area of importance that was tentatively explored in this study was the athlete's experience of competitive anxiety. Results from this study imply that athletes' competitive performance can be enhanced by frequent exposure to stimuli that are present in the competitive situation. Further research is necessary to establish the relationship between subject self-report of competitive anxiety, exposure to competition-like stimuli, and performance.

In summary, this study contributed to the growing body of research in the applied behavior analysis of sport in several ways. This study successfully extended the application of behavioral procedures to a novel area in applied sport psychology, namely, improvement in performance of figures by young figure skaters. This study also examined the efficacy of a training package that relied heavily on self-management to increase the frequency of practice of existing skills. While previous research has provided limited data on stimulus generalization or response generalization, this research addressed both concerns.

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APPENDIX A: Training Manual For Use By Observers And Judges

Training Manual

- Observers: Please read enclosed manuals on Figures Judging and the read description of use of the checklist.

Category: FORM

1. **Hand positioning:** Hands should be positioned below the waist or at waist level during the execution of the figure. Palms should be held parallel to the ice, with the fingers together and pointed away from the body. During the execution of turns and during pushoffs, you will notice transitions in the positioning of the arms (due to turning action and pushoff action). On these occasions, hands may be above the waist (1st component) - this will **not** be considered incorrect.
2. **Changing position/edges/turns:** As the skater is a) turning, b) changing edges at centre or c) changing position after she has pushed off, her free foot should move continuously to its appropriate position - e.g. "tucked" close to her skating foot. Her free foot should not be more than a blade length away from her skating foot.
3. **Position of head/chin:** The skater's head should be held level, with her eyes looking downward. On figures such as the loop and the backward inside and outside edged figures, having the chin at the shoulder is acceptable (otherwise, she won't be able to tell where she's going). However, as the skater is moving in a forward direction, her chin should be level and her head held straight and not tilted to the side. Thus, a chin tucked into the chest is considered incorrect.
4. **Posture:** A common problem seen particularly during turns (at the entry) are high shoulders. This component would be marked incorrect if a skater traced her figure with her shoulders at the level of the middle of her neck or higher. Drooping back/spine refers to the skater who leans back over the heel of her skate (often seen when the skater returns to centre). Slouching refers to the error where the skater leans over the ball of her skate, and is hunched over while executing her figure. The skater's upper body should be squarely distributed over the skating foot, and her shoulders should be back and "below" her neck.

Category: FLOW

1. **Entry into circle:** As the skater enters the circle, she **should not** be tugging or pulling with her free leg to assist her in reaching the centre where she will change edges. This error may occur in conjunction with the problem of loss of flow, that is the skater has not paced herself appropriately and therefore slows down toward the end of the circle (as

she's coming into centre). The skater should maintain consistent speed as she executes the figure, so that she's not struggling to complete it.

2. **Speed:** As mentioned previously, the skater should maintain consistent speed throughout the execution of the figure. A skater may not pace herself well after the pushoff, and you may notice that she's going very quickly around the circle, so much so that it appears she does not have good control of her edges or of her body position. Alternatively, she may have a weak pushoff and therefore she may lose speed as soon as half way to three quarters of the way around the circle (as opposed to the end of the circle, when she's coming into centre). These behaviors are considered to be errors.

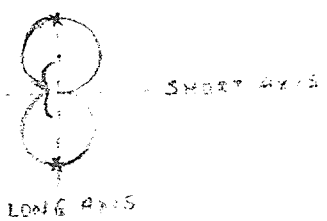
3. **Pushoff:** At centre, the skater pushes off onto the circle. The action of pushing off is very important, as it determines the amount of speed or "strength" the skater will have to complete the tracing. One problem encountered is lunging. this is defined as the action of pushing off onto the circle such that most of the body weight is over the balls of the foot -- the whole upper body looks as if it's getting onto the circle before the skating foot is! On the backward pushoffs, the skater looks as if she is placing most of her body weight on the heel of the foot; again, her upper body enters the circle before the skating foot does -- this is an error. The error of jumping onto an edge appears much as it sounds -- the skater has not effected a smooth transition of edge, or change of foot and "jumps" onto the edge of her blade.

4. **Turns and changes:** The proper action of the knee during a turn is as follows -- prior to the turn, the knee is slightly bent. As the skater executes the turn, the knee lifts and then goes back to its slightly bent position. A common error is that a skater will anticipate the turn and straighten the knee before the turn, and then dip it during the turn.

LOOP: The loop is done with the knee in an exaggerated bend, with the body weight and centre of gravity lower than it is for the other figures. The bend position in the loop is called the intermediate bent position. Therefore, a common error seen is that the skater will come out of the loop position (straighten up) in anticipation of the turn. Thus the knee should remain bent in the intermediate position (45 degree angle) throughout the figure.

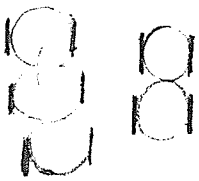
Category: SYMMETRY OF CIRCLES

NOTE that for all figures, WITH THE EXCEPTION OF LOOPS, the tracing should be executed such that there is LESS THAN OR EQUAL TO 1 bladelength (length of your boot or shoe) difference. AS LOOPS ARE SMALLER FIGURES, the tracing should be executed such that there is LESS THAN OR EQUAL TO one-half a bladelength difference.



1. **Long axes of circles:** refers to the vertical axis of all two (or three of the circles). First of all, establish where the centre is -- this is the point where the skater started. You will

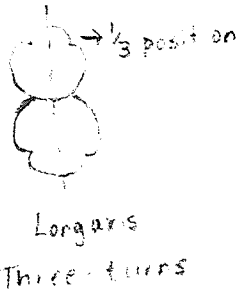
see a small flat ("railroad tracks") leading into a straight line where the circle begins. The space between where the skater has rested her free foot and the small flat is where the long axis lies. Lay a mitt or a pencil at the long axis. If the figure is three lobed, go to the next centre and establish the long axis. and lay a mitt or pencil there. Then travel to the tops of the circles, and establish the centre (top most point) of the circles, and lay a pencil or mitt there. You can then evaluate by visual inspection, the difference between the long axes, and thus determine whether the skater successfully maintained the long axis when she laid out the figure. The long axes of all the circles, including the centres, must be equal to or less than a bladelength in difference.



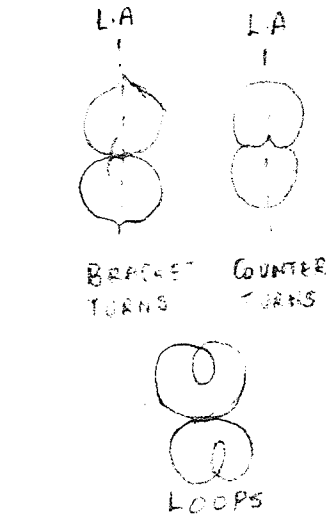
2. Lineup of circles: This refers to whether the lobes of the figure line up on the side (vertically). Place a mitt or pencil on both sides of each circle, at the roundest part of the circle. By visual inspection, determine if there is less than or equal to a bladelength's difference between lineup on respective sides. Both sides of the circle have to be lined up for this component to be considered correct.

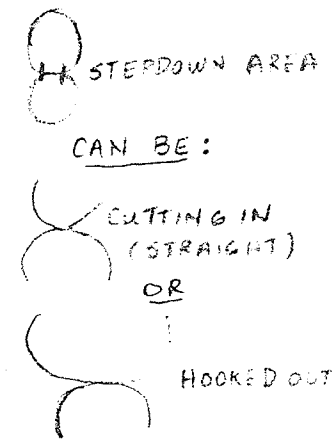
3. Width of circles: This refers to the width (horizontal measurement) of the circles. From one side of the roundest part of the circle, pace out the width of the circle to the other side. You may count the number of footsteps across, but ensure that you measure both circles the same way. Again, there should be less than or equal to one bladelength difference in width of the circle.

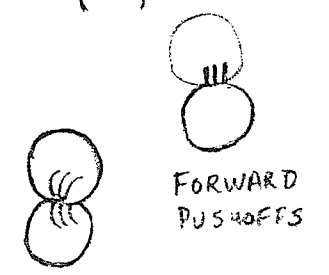
4. Length of circles: From the topmost point of the circle, pace out the length of the circle till you reach the centre. From the centre, pace out the length of the circle till you reach the topmost point of the next circle. (You should be travelling along the long axis).



5. Position of turns relative to the long axis: There are several kinds of turns. Each circle will have two sets of "three" turns; 1 set of bracket turns, or one set of loops. Counter turns occur at the centre (rather than at the top or





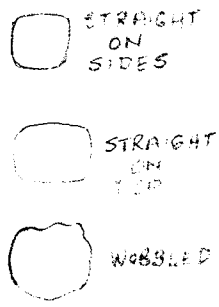


side of the circle). The "three" turns should divide the circle into thirds, and should thus be placed within one bladelength of the one-third position on the circle. The bracket turns and loops, as well as the counters, should be placed on the long axis (within one bladelength; EXCEPT FOR LOOPS = 2 INCHES, AS MEASURED BY THE LENGTH OF THE HEEL OF YOUR BOOT). First of all, establish the topmost point of the circle and/or the long axis. Measure the difference in position between each set of turns relative to the long axis. All turns have to be correctly placed to warrant a "correct" checkmark.

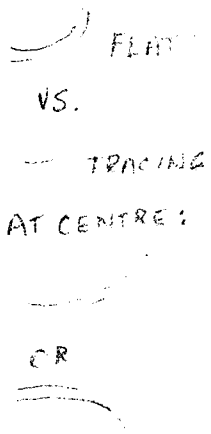
6. **Stepdowns:** The stepdown refers to where the skater placed the skating foot on the circle. Ideally, the skater should begin her tracing with the skating foot on the circle, using the correct edge. Check the stepdown to ensure the skater has changed edges at centre, before the stepdown, rather than at the stepdown itself. Check to ensure that the stepdown is on the circle, rather than cutting it in (straight), or hooked out. If the stepdown does not fit the previous descriptions, but is not on the circle, mark it incorrect. Essentially, the circles should be tangent, and should have a round shape.

7. **Pushoffs:** Pushoffs refer to the action of the skating foot at centre that gives the skater the momentum or flow to do the tracing. This action results in a pattern on the ice that is to be evaluated. Ideally, the pushoffs should be lined up or traced at centre, and they should be positioned less than or equal to 5 inches from the long axis, and less than or equal to 5 inches from the short axis. Determine where the long axis and short axis occur, and then evaluate the position of the pushoffs relative to the long axis. Problems potentially included scattered pushoffs -- all the pushoffs should be within the same distance from the long and short axes.

8. **Shape of circle:** The circles should be round, well traced (i.e. each of the three tracings should overlap closely, ideally to the point of being indistinguishable). Often, skaters



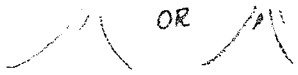
have difficulty establishing or maintaining the shape of the circles; they may be straight at the top of the circles (i.e. straight across when they should be rounded), or straight on the sides (the figure will look cut in), or bulged (or wobbled). Bulges and wobbles refer to "wavy" patterns on the ice where it appears that the skater has not been able to maintain good, consistent control of her skating foot and has not been able to trace out a circle properly. These are all considered errors, and should be marked as such.



9. Flats: The skater is supposed to trace the figure on one edge (except at centre, where she changes edges). Thus, there should only be a single line tracing on the ice. The skater may have difficulty maintaining an edge, and place the entire skateblade on the ice, resulting in a "railroad track", or double line pattern on the ice. The only time when a flat is appropriate is at centre, when the skater places the entire skateblade on the ice in order to change edges. Occurrences of flats elsewhere on the figure is considered an error. Examine the entire figure for occurrences of flats. They are more likely to occur coming into or out of turns and as the skater approaches centre. If you noticed a loss of flow in the execution of the figure, there is a higher probability that flats have occurred. Half an inch of flats (not including the "flat" at centre) is considered acceptable. This will account for any occurrences of "water flats" -- often if there is water on the ice, the skater's blade may pick up the water and a double line pattern is left on the tracing -- this is not an error.

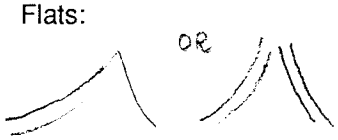
<u>Category:</u> TURNS

Changes:

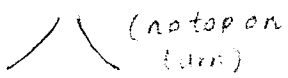


Common errors in turns include changes, flats, jumped turns, hooked or pulled turns, forced turns, scrapes, and spooned turns. Examine each set of turns for these errors. Occasionally, turns are "traced", i.e. the turns are done overlapping one another, and it is difficult to distinguish between them. In those cases, evaluate the turns that are

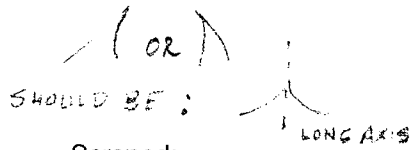
Flats:



Jumped:



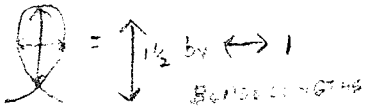
Hooked:



Scraped:

Spooned:

Looped:



Skids:

distinct. Changes refer to changes of edge that show up on the ice during the turn, leaving a very small flat at the top of the turn, at its point of entry and/or its point of exit. Ideally, the skateblade should "turn" from edge to edge, leaving a single line pattern on the ice. Flats refer to the "railroad" pattern on the ice. Flats are longer, and you may see them at the entry of the turn, and/or the exit of the turn. A jumped turn is a turn with no top on it -- all you will see is a single line entering the turn and a single line leaving the turn, with no turn *per se* traced on the ice. LOOP: the loop is an oval shaped turn -- it should measure one and one half by one bladelengths. Loops half a bladelength larger or smaller than this are considered errors.

Once the long axis or one-third position on the circle is established, place a pencil on the turns to establish the axis. A hooked or pulled turn will appear off axis at its crown -- this is considered an error. A forced turn is the result of a heavy edge, and thus the turn will appear quite scraped both in entry and exit. In contrast, a scrape will usually appear on either entry or exit from the turn. LOOPS: a common problem at the top of the loops are skids -- the loop will appear heavily scraped at the top. This is considered an error.

The least serious error is a spooned turn. At the top of the turn, you may see an oval or spooned shaped marking; this is a spooned turn.

APPENDIX B: Sample Written Feedback Given to Subjects after Trial-Judging (follow-up) Phase

Figures evaluated: Back outside double threes, Back inside double threes, Forward outside change double threes, Left inside bracket, Left outside bracket, Back outside loop.

Judges comments:

- Overall, your form and flow on all figures evaluated was good. Your hand positioning was consistent, posture was good, and speed or flow while doing the figure was good.

- The BO double threes, BI double threes, and the serpentine figure were done well. Watch the positioning of the turns relative to the long axis; while the majority were placed appropriately, one set was often a bladelength (or less) off axis. Also watch the shape of your circle: we noted "wobbles" or bulges on the circles. Overall, the turns on these figures were well executed, apart from occasional small flats.

- The LI Bracket was O.K. in terms of form and flow. However, we noticed differences in the width and length of the circles (i.e., greater than a bladelength off axis. Circle shape was also a concern; the circle was straight on the sides and had wobbles or bulges. Some of the turns were changed.

- The LO Bracket was O.K. in terms of form and flow. The lineup of the circles was off, and there was more than a bladelength difference in the length of the circles. Watch the pushoff; we noted that the pushoff was off both the long and short axis (make sure you close the circle!) Bulges or wobbles were also a problem. Some of the turns themselves were changed, or jumped, or pulled. Scrapes were also noted.

- The BO loop was O.K. in terms of form and flow. The lineup of the circles was a bit off, as was the length of the circles. Wobbles were noted coming into centre. One of the loops was too small, and one set were tilted (a bit) off axis.

Overall, you did a nice job! We suggest that you work on your brackets over the next while -- we realize that conditions on the ice yesterday were not the best, so some of the problems may just have been due to that. You have a nice "presentation" style. We think you have a good chance of passing your test. **Good Luck!**

APPENDIX C: Social Validation Questionnaire Administered to Subjects

Social Validation Questionnaire

1) Do you think that it is important for you to know how to evaluate your figures:

Yes___ No___

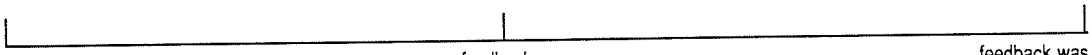
2) Before you participated in this project, did you know how to evaluate your performance of figures:

Yes___ No___

3) Before you participated in this project, did you evaluate your performance of figures:

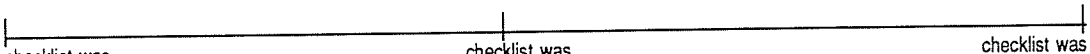
Often (every practice) | Sometimes (2-3 times per week) | Rarely (once a week or less)

4) At practices, you work to improve your performance of figures. Did you find the coach's lessons (or feedback) useful?



feedback was **very useful** | feedback was **somewhat useful** | feedback was **not at all useful**

5) Did you find laying out your figures and monitoring your progress on the checklist to be useful?



checklist was **very useful** | checklist was **somewhat useful** | checklist was **not at all useful**

6) Did you find the trial judging session to be useful?

trial judging was **very useful** | trial judging was **somewhat useful** | trial judging was **not at all useful**

7) Do you think that participating in this project helped you to improve your performance of figures?

very useful | **somewhat useful** | **not at all useful**

8) Which was or were the most useful parts of the project? Number your choices from 1 to 4, "1" indicating the most useful, and "4" indicating the least useful:

Coach's feedback ___
Laying out figure and using the checklist ___
Trial judging ___
Other (please describe)_____

9) Would you use the checklist **on your own** to evaluate your performance of figures?

Yes ____ Perhaps ____ Definitely Not ____

10) What changes, if any, would you make to the checklist system if you were to use it?

_____

_____

_____

Thank you very much for participating in the project! If you have any questions, please call me at 228-1844.

Suja

APPENDIX C: Social Validation Question Administered to Coach

Coach - Social Validation Questionnaire

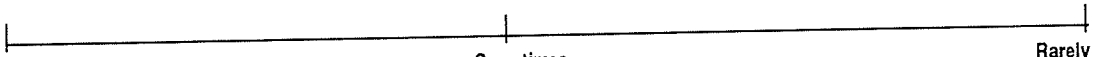
1) Do you think that is is important for your skaters to know how to evaluate their figures:

Yes ___ No ___

2) Before they participated in the project, did you feel satisfied with your skaters' ability and frequency of self-evaluation?

Yes ___ No ___

3) Before they participated in this project, how often on average do you think your skaters evaluated their performance of figures?



Often (every practice) — **Sometimes** 2-3 times/week — **Rarely** (once a week or less)

4) Three of the four skaters participating in this project passed their figures test. Please indicate which procedures you felt were most important to this achievement. Number your choices from 1 to 4, "1" indicating most useful, and "4" indicating least useful.

Coach feedback ___
Skater laying-out figure and using the checklist ___
Trial judging ___
Other _____

5) Would you encourage the skaters to use the checklist on their own to evaluate their figures?

Yes ___ No ___

6) If not, would you encourage them to use a modified version of the checklist (that would involve a further breakdown of components, or a different scoring system)?

Yes ___ No ___

7) Usually, how long would it take each skater to master the figures in their respective figures tests?

S1 ___ S2 ___

S3 ___ S4 ___

8) Comments:

APPENDIX D: Procedural Reliability Checklist to Assess Coach's Implementation of Corrective Feedback

Procedural Reliability Checklist (Coach)

			Repeat	
	Yes	No	Yes	No
1) Coach requests skater to lay-out targeted figure				
2) Coach examines targeted components				
3) Coach provides verbal description of correct performance of targeted components				
4) Coach models incorrect performance of components				
5) Coach models correct performance of components, and provides description of what she is doing (e.g. "keep hips square to the circle, etc.")				
6) Coach provides a specific verbal prompt (e.g. "hips checked")				
7) Skater asked to imitate incorrect performance of components				
8) Skater is asked to perform components correctly, while covertly repeating verbal prompt				
9) Skater asked by coach if she understands difference between correct and incorrect performance				

If skater says NO, steps 2 through 9 will be repeated. Check procedure again.

If YES:

	Yes	No
10) Skater asked by coach to lay-out figure while repeating self-prompts		
11) Coach provides immediate positive feedback (e.g. "yes, that's right, good") for **correct** performance. **GO TO 13.**		
12) **IF PERFORMANCE IS INCORRECT:** Coach models correct performance; skater is asked to imitate this performance in a lay-out		
13) Skater is asked to lay-out figure again		
14) Coach praises skater for correct performance of component		

APPENDIX D: Procedural Reliability Checklist to Assess Experimenter's Implementation of SEP

Procedural Reliability Checklist (SXPTR)

	Yes	No
1) Purpose of checklist described: - same checklist as used by judges initially to evaluate performance - now, will be used to help improve performance of (components) of (figure)		
- description of incorrect performance, plus location on checklist		
- criteria for correct performance of components described (e.g., "all turns must be clean, with no flats or scrapes")		
- criteria for incorrect performance described		
- purpose of boxes (to self-monitor) described		
- experimenter models how checkmark would be placed in box if performance was incorrect		
- experimenter models how checkmark would be placed in box if performance was correct		
- experimenter asks skater where she would place a checkmark if performance was correct		
- if skater answers **correctly**, experimenter praises skater		
- If skater answers **incorrectly**, experimenter informs skater, and describes criteria for correct performance, and models self-monitoring again		
- experimenter asks skater where she would place a checkmark if performance was incorrect		
- if skater answers **correctly**, experimenter praises skater		
- if skater answers **incorrectly** experimenter informs skater, describes criteria for incorrect performance, and models self-monitoring again		

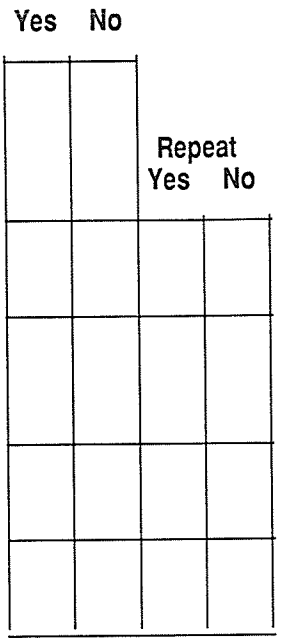
2) Experimenter shows skater drawing of figure with verbal prompts written in at appropriate place on figure. Skater is encouraged to use these prompts.

3) Experimenter asks skater to lay-out figure

4) Experimenter ask skater to evaluate components (experimenter does so independently)

5) If experimenter and skater agree, experimenter praises skater

6) Experimenter asks skater to enter checkmark in appropriate box for the target component



7) STEPS 3-6 REPEATED. If skater performs <u>appropriately,</u> GO TO #9.

8) If experimenter and skater's evaluation disagree, steps 3-6 repeated again with added explanation if necessary

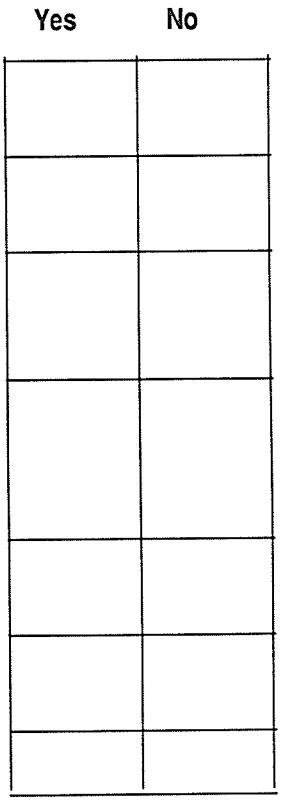
9) Experimenter informs skater of mastery criterion (6/6 consecutive correct lay-outs), and necessity to demonstrate mastery to coach

10) Experimenter shows skater where to record number of consecutive correct lay-outs on checklist, and that skater will have to start again from beginning if one of the lay-outs is unsuccessful

11) Skater asked to lay-out figure twice and self-evaluate and self-monitor each time

12) If skater and experimenter assessment corroborate, skater is praised

13) If assessments do not corroborate, steps 3-6 repeated



APPENDIX D: Procedural Reliability Checklist to Assess Experimenter's Implementation of Shortened Version of SEP

Procedural Relability (Shortened Version, Experimenter)

	Yes	No
1) Experimenter shows skater checklist with prompt sheet attached. Skater asked to describe how she would use checklist		
2) If experimenter satisfied with skater's response, skater is praised		
3) If experimenter not satisfied, skater is prompted about use of the checklist		
4) Skater is reminded of mastery criterion, and asked to lay-out figure twice		
5) If skater's self-evaluation corroborates with experimenter, skater is considered competent to self-evaluate, and is praised		
6) If skater's self-evaluation disagrees with experimenter, disagreement discussed, skater prompted, and asked to lay-out figure and self evaluate		
7) Skater is praised for successful self-evaluation and self-monitoring		