The Effects of Direct and Response-Exchange Contingencies of Reinforcement on the Social and Physical Activity of the Disengaged Elderly

by

Laurel Lee J. Mayo

A thesis
presented to the University of Manitoba
in partial fulfillment of the
requirements for the degree of
Master of Arts
in
Psychology

Winnipeg, Manitoba, 1983

THE EFFECTS OF DIRECT AND RESPONSE-EXCHANGE CONTINGENCIES OF REINFORCEMENT ON THE SOCIAL AND PHYSICAL ACTIVITY OF THE DISENGAGED ELDERLY

BY

LAUREL LEE J. MAYO

A thesis submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

MASTER OF ARTS

ACKNOWLEDGEMENTS

I would like to express my appreciation to:

My advisor, Dr. Steven Holborn, for his meticulous editing and positive feedback concerning this manuscript. In particular, I would like to thank him for his encouragement and friendship which sustained me through "thick and thin".

My committe members, Dr. John Whitely and Dr. David John, for their valuable suggestions and for their attendance at the "9:00 a.m." oral.

Dr. Joseph Pear, who is primarily responsible (along with Dr. Holborn) for my being a radical behaviorist (albeit still a neophyte) - a label I am remarkably glad to bear.

My friends -especially Alan, Linda, Wanda, Vivian and Rayleen- who contributed to the completion of this thesis in various ways, but mainly by being there when I needed them.

My brother Chris for proof reading this when he could have been out having a good time, and the rest of my family (especially my mom) for telling everyone how wonderful I am.

My son, Bruce, because he makes me laugh and cry, because he gives me a shoulder to lean on when I'm down, because he makes me take time to "smell the flowers" and because he has never once complained about having a student as a mother.

Tache Nursing Centre for their enthusiastic support and interest in my work.

To Donald for whom there are no words

ABSTRACT

The present study investigated the feasibility of using behavioral procedures within a progressive walking exercise program to effect changes in the exercise level and the amount of social interaction of six disengaged elderly residents of a nursing home. An ABCB reversal design was used where, after baseline, reinforcement for exercising was alternated with reinforcement for speaking to other individuals. Reinforcement was either administered directly to a resident for her own behavior (direct reinforcement) or the residents were paired into dyads and received reinforcement for their partner's behavior (response-exchange reinforcement). When reinforcement (either direct or response-exchange) was contingent on exercising, the residents increased the number of laps they walked on an indoor track. Little social interaction was observed until the residents could obtain reinforcement for speaking to others, either through direct or response-exchange reinforcement. No generalization of activity levels or socializing was observed, except for that found immediately after the exercise sessions. It was concluded that explicit programming of physical activity, social interaction and generalization must be undertaken with elderly residents who are disengaged.

THE TABLE OF CONTENTS

ACKNOWLEDGEMENTS ii

ABSTRACT iv

page

THE EFFECTS OF DIRECT AND RESPONSE-EXCHANGE CONTINGENCIES OF REINFORCEMENT ON THE SOCIAL AND PHYSICAL ACTIVITY OF THE DISENGAGED ELDERLY 1

Exercise and the Elderly 2
Operant Conditioning Procedures and Exercise . . . 3
Generalization 7
Peers as Common Stimuli 8
Social Interaction as a Natural Maintaining Reinforcer 9
Social Interaction and the Disengaged Elderly 10
Exercise and Social Interaction 12
Response-exchange Contingency of Reinforcement 14
Summary and Purpose of the Present Research . . . 17

METHOD 20

Subjects 20
Setting. 21
Procedure 21
General Procedure 21
Exercise Program 23
Reinforcer Survey 24
Research Design and Data Analysis 25
Dependent and Independent Variables 25
Data Collection 28
Interobserver Reliability 29
Design 30

RESULTS 33

Exercise Behavior 33
Response-Exchange Reinforcement Condition 34
Direct Reinforcement Condition 39

Direct and Response-Exchange Reinforcement Condition 44
Social Interaction 49
Response-Exchange Reinforcement Condition 49
Direct Reinforcement Condition 53
Direct and Response-exchange Reinforcement Condition 57
Generalization Measures 62
Weekly Probes in the Occupational Therapy Room 62
Social Interaction After the Exercise Session 63
Social Interaction On the Ward 71
Activity Level 75

DISCUSSION 76

Exercise 76
Social Interaction 77
The Verbal Community 77
Response-Exchange Contingencies of Reinforcement 80
Generalization 82

REFERENCES 85

Appendix page

A. MEDICAL CONDITIONS THAT PROHIBIT EXERCISE 91

B. TOTAL PERCENTAGE OF RESIDENT-RESIDENT SOCIAL INTERACTION AND PERCENTAGE DIRECTED TOWARDS EACH RESIDENT DURING EXERCISE SESSIONS 93

C. PERCENTAGE OF INTERVALS SUBJECTS ENGAGED IN SOCIAL INTERACTION DURING WEEKLY PROBES IN THE OCCUPATIONAL THERAPY ROOM 94

D. MEAN PERCENTAGE OF SOCIAL INTERACTION SUBJECTS ENGAGED IN WEEKLY ON THE WARD 95

E. MEAN WEEKLY ACTOMETER UNITS 96

THE EFFECTS OF DIRECT AND RESPONSE-EXCHANGE CONTINGENCIES OF REINFORCEMENT ON THE SOCIAL AND PHYSICAL ACTIVITY OF THE DISENGAGED ELDERLY

Research concerning the therapeutic benefits of exercise is of particular importance to the many individuals in geriatric institutions who are inactive and withdrawn from other residents and staff (McClannahan & Risley, 1974; 1975). The literature indicates that, typically, over half of the elderly in nursing homes exhibit this pattern of behavior (Baltes & Lascomb, 1975; McClannahan & Risley, 1974; 1975). Although, in the past, this inactivity has been thought to be a function of the physical aging process (Cumming & Henry, 1961), statistics released by the Nursing Home Association indicate that only aproximately 20% of these individuals have physiological problems that require confinement to their own rooms, and which would prevent them from participating in various activities. Therefore, other residents who show similar patterns of disengagement from their environment must be doing so for psychological rather than physical reasons.

For these individuals, such behavior can have serious consequences (Kraus & Rabb, 1961; Shephard, 1978; deVries, 1975; 1980). A growing body of evidence shows that continued inactivity can accelerate the normal physical deteriora-

tion associated with aging (Karaus & Rabb, 1961; deVries, 1975). Such systems as the cariovascular system and the musculatory system are adversely affected by protracted periods of disengagement. In addition, osteosis, as well as bowel and bladder disorders are exacerbated by long periods of inactivity (Adams & deVries, 1973; Comstock, Mayers & Folson, 1969; Frekany & Leslie, 1975; Shephard, 1978; Rodahl, 1967; Sawin, 1975; Bonner, 1969).

Exercise and the Elderly

Participation in relatively vigorous exercise programs has been shown to create beneficial changes in the degenerative processes of the elderly (deVries, 1970; 1980; 1975; 1971a; 1971b; Barry, Daly, Pruet, Steinetz, Page, Birkhead & Rodahl, 1966; Adams & deVries, 1973). For example, deVries (1970) measured the effects of 6, 9, and 42 weeks of a training program (jogging/walking) on retired men with an average age of 60.5 years and found that the men in the program showed improvement across several different measures including physical work capacity, blood pressure and percentage of body fat. In another study (Adams & deVries, 1973) it was found that elderly females also showed improvement in physical fitness after engaging in an exercise program for 12 weeks. The extent of their cardiovascular improvement was similar to that found with the men. Although most programs with the elderly have used a jogging/walking

exercise regimen, similar results have been found when the exercise was walking (Stamford, Hambacher & Fallica, 1974; Cooper, 1970) cycling, jogging (Buccola & Stone, 1975), or swimming (Cooper, 1970).

Operant Conditioning Procedures and Exercise

Most exercise programs assume that delayed consequences such as improved health, flexibility, etc., are sufficient to develop and maintain a person's participation in the exercise program. However, exercise, although associated with these reinforcing consequences on a long-term basis, often generates punishing consequences on a more immediate basis. The functional deterioration of the disengaged elderly limits the types of activities in which they can successfully engage without experiencing aversive, physical consequences such as severe breathlessness, anginal pain and muscular-skeletal injuries (Kavanagh, 1973). As a result, the elderly are less likely to participate in any vigorous activity, such as exercise, even though exercise activities are still potentially rewarding to them (Lewinshohn & MacPhillay, 1974). It may be more difficult to have the elderly develop good exercise habits because these individuals must begin at a slower pace and may require longer periods to reach a desired level of fitness, since they are initially in very poor physical condition. As well, it may be that the duration and intensity of exercise required to improve fitness

may produce adverse side effects such as soreness and fatigue (Dishman, 1978; Epstein & Wing, 1980).

A possible solution to the problem of the disengaged elderlys' lack of participation in vigorous activity is suggested by psychological studies of operant conditioning which show that behavior is usually controlled by immediate rather than delayed consequences (Skinner, 1969; Schwartz, 1978; Rachlin, 1976). Thus, in order to counteract the aversiveness of vigorous activity, and compensate for the delayed positive consequences of improved health, the disengaged elderly could be provided with powerful reinforcers immediately after any exercise or vigorous activity.

Studies with younger and middle-aged adults corroborate the belief that operant techniques facilitate the acquisition of exercise behavior (e.g., Stalonus, Johnston & Christ, 1978; Wysocki, Hall, Iwata & Riordan, 1979; Epstein, Wing & Thompson, 1980). Keefe and Bluenthal (1980), for example, found that once reinforcement was made contingent on exercising, the men in their program gradually increased their activity level to match the rising exercise criterion level. In a similar vein, Epstein and his colleques (1980) compared the exercise behavior of university students who either received no reinforcement, continuous reinforcement, or the opportunity to win reinforcement. They found that the students exercised more often when they received or had the chance of receiving reinforcement, then when there were

no contingencies on exercising. These studies suggest that, at least initially, extrinsic reinforcement is necessary to maximize an individual's participation in an exercise program.

In an examination of the literature, only one study was found that suggested operant conditioning procedures would be effective in increasing compliance to an exercise regimen with institutionalized elderly patients. Libb and Clements (1969) used a token reinforcment procedure to increase the rate of four geriatric patient's exercise behavior on a stationary bicycle. Tokens, which could later be exchanged for back-up reinforcers, were automatically delivered to the patients after they had completed a certain number of wheel revolutions on the bicycle. A comparison of the subjects baseline performance with their performance during treatment indicated that three of the subjects increased their rate of wheel pedalling. The authors explained that the fourth subject, whose performance did not change, began pedalling at such a high rate that there was little room for improvement when treatment was introduced.

Additional reports involving non-exercise programs have shown that operant procedures are effective in increasing ambulatory skills of the institutionalized elderly (see Patterson and Jackson, 1980 for a review). For example, McDonald and Butler (1974) provide a clear demonstration of the functional relationship between increased walking behavior

of two geriatric residents and a procedure which involved social reinforcment and prompting. During treatment, a 92-year-old male and an 85-year-old female, who had not walked for serveral months, were prompted to walk to the dining hall, a distance of 40 feet. The experimenter provided praise and social interaction (social reinforcement) for walking. A dramatic hange in walking behavior was demonstrated when prompts and reinforcement were in effect. Thus, operant procedures are effective in increasing the gross motor activity of the elderly living in institutions. However, deVries (1980) reports that, for the sedentary elderly, it is necessary to walk at a vigorous pace in order to produce a training effect. He points out that an exercise regimen is required since, as the level of fitness improves, the training criterion must increase in order to maintain the training effect of the exercise. Gradually increasing the distance walked as fitness improves is one of the safest and least strenuous forms of exercise. In fact, researchers have proscribed progressive walking exercise progams for the elderly where the more traditional exercise forms are contraindicated (Cooper, 1970; Shephard, 1978).

Whether such procedures will be effective with the disengaged institutionalized elderly is a question that still has to be addressed, since Libb and Clement's subjects were not described as disengaged. Researchers have suggested that disengagement from participation in institutional life may

be a result of an influential group of people who reinforce the withdrawn residents for behaviors that are incompatable with gross motor activity (Hoyer, Mishara, & Riehel, 1975; Mueller & Atlas, 1972; Hoyer, Kafer, Simpson & Hoyer, 1974). Lester and Baltes (1978) have observed that the members of the institutional community who hold the most powerful reinforcers are likely to be the staff. These individuals are likely to distribute these reinforcers contingent on passive, dependent types of behavior. Thus behaviors typically associated with gross motor activity may not be exhibited by the elderly because other responses have been acquired in the institutional setting which are incompatible with such activity. However, by creating a situation where reinforcement is contingent on exercise behavior their level of gross motor activity should be enhanced.

Generalization

Effectiveness in changing the target behavior is only one of the concerns that must be examined when evaluating the applied value of a therapeutic procedure. Another concern is whether the targeted behavior is maintained when the procedure is withdrawn. For the withdrawn, inactive elderly, an exercise program would be of lessor value if the activity level returns to baseline values once extrinsic reinforcement is withdrawn. Although maintenance of the behavior, once the training program has been withdrawn, is important

to any therapeutic procedure, the process of removing the operant contingencies is akin to an extinction procedure. As a consequence, rather than being maintained, we would expect the subject to cease exercising once reinforcement is withdrawn, especially as the maintaining staff contingencies for passive behavior are likely to still be in effect. Stokes and Baer (1977) in a review of 120 studies, categorized nine procedures, used to promote generalizaation. Two of these procedures, Programming Common Stimuli and Introducing to Natural Maintaining Contingencies, provide a possible solution to the problem of what will maintain the behavior once reinforcement has been withdrawn.

Peers as Common Stimuli. In this procedure, it has been found that generalization of the targeted behavior will occur to other settings if there are sufficient stimulus components common to both the training and generalization setting. Two ways in which this has been accomplished have been first, to include peers in the training and generalization sessions (Johnston & Johnston, 1972) and second, to make the training settings more closely resemble the physical characteristics of the generalization setting (Rincover & Koegel, 1975). The use of peers when programming for common stimuli lends itself to an institutional settings. Individuals are confined to a relatively small area, increasing the probability that they will come into contact with each other outside of training sessions. Thus, members of

this community, if included in training sessions, can act as discriminative stimuli, signaling to the resident that reinforcement is available for the targeted behavior. It should be noted, however, that in order for this procedure to be effective in enhancing generalization to other settings, the members of the community (the common stimuli) must actually deliver reinforcers for appropriate behaviors.

Social Interaction as a Natural Maintaining Reinforcer. Stokes and Baer (1977) have suggested that a training program can be designed so that reinforcment contingencies existing in the natural environment can take over and maintain the target behavior once the training contingencies are withdrawn. They state that maintenance can be assured, if there exists in the natural environment a community of individuals who would automatically provide reinforcement for the targeted behavior. The social contingencies inherent in interactions with these individuals, would be sufficient to maintain the behavior. As was mentioned, this verbal community can also provide discriminative stimuli for the target behavior. Equally important is the fact that by including members of this verbal community in the training sessions (i.e., programming for common stimuli), a resident is more likely to engage in the behavior on the ward in the presence of the very individuals who are most likely to reinforce that behavior.

According to Baer and Wolf (1970) socially reinforcing interaction with peers is generated if, in proximity to this community, the individual can be trained to emit behaviors that normally would receive reinforcing consequences from this group. Such a procedure assumes, however, that the institutionalized elderly still possess a repertoire of reinforcing skills common to typical natural communities. It also assumes that the activity targeted for training is one that is likely to be reinforced by the resident's verbal community. However, the validity of these assumptions needs to be examined.

Social Interaction and the Disengaged Elderly. Skinner (1969) suggests that an individual's verbal and social behavior is primarily shaped and maintained by the reinforcement that his/her verbal community provides for such behvior. On entering an institution, an individual leaves this verbal community behind. If no replacements are found within the insitutionalized community, many of the social and verbal behaviors of the institutionalized person under-go extinction (Hoyer, Mishara, & Riehel, 1975; Mueller & Atlas, 1973; Hoyer, Kafer, Simpson & Hoyer, 1974). These researchers have suggested that this situation is not irreversible, however. They state that rearranging the local environment so that disengaged patients are placed in a situation where they come into contact with other residents should lead to increaded participation in the activities they are attending

and, as a side effect, greater interaction between residents.

Limited support can be found in the literature for the argument that encouraging attendance or participation at physical activites, either through reinforcement or restructuring of the environment, will lead to increased interaction among residents. For example, Blackman, Howe and Pinkston (1976) found that when reinforcers (refreshments) were contingent on coming to a lounge area, the number of people attending and interacting in this area increased. Quattrockituben and Jason (1980) reported that a similar environmental manipulation (access to refreshments in a lounge area) resulted in more elderly residents coming to the lounge (an average of 10.5 residents as compared to 4.3 residents during baseline). They also noted that the number of elderly interacting with each other increased as attendance increased (.25 residents during baseline versus 3.5 residents interacting during periods when refreshments were available). In another study, McClannahan and Risley (1974) found that the number of elderly coming to a specific area and interacting could be increased by providing prompts (announcements of the activity) and reinforcement (money) contingent on coming to the dining room and taking part in a brief conversation with the experimenter. Taken as a whole these studies indicate that as more elderly residents attend or participate in an activity, the number of residents so-

cializing with other residents increases as well, even though they are not specifically reinforced for doing so.

Although it can be argued that having disengaged elderly participate in activities that require proximity to other residents will, as a side effect, lead to increases in responsiveness to others, it should be noted that these studies do not provide evidence on which any firm conclusions can be based. These and other similar studies do not identify whether the residents who attend the activities are withdrawn or not. Increases in social interactions may be a function of a greater number of socially skilled residents attending a reinforcing activity. Nor do they mention whether it is the same residents attending these activities each day. This is of interest since researchers (e.g., Burnside, 1971; McClannhan & Risely, 1974) have reported that withdrawn residents do not interact with others even though they have the opportunity to do so.

Exercise and Social Interaction. Typically, the above studies have involved the reinforcment of activities that, in the past, have been associated with socializing. Thus, the occurrence of these behaviors is likely to lead to some social reinforcement (interaction) with another resident. There is some question, however, whether an activity such as exercising is one which would generate such social behavior. Generally, studies investigating psychological side effects of exercise have used indirect measures such as Cattells's

16Pf, the Wechler Adult Intelligence Scale, Personality tests, or individually developed tests. Few have noted, except anecdotally (Stamford, Hambacher & Fallica, 1974; de-Lerma Salter & Salter, 1975; Birjandi & Scalfani, 1973) whether social interaction also changed when the elderly attended the exercise program. Stamford et. al. (1974) suggest that engaging in exercise behaviors with other individuals may indeed faciliate social interaction. When examining the effects of an exercise program on the physiological and psychological state of men in a geriatric insitution, they stated:

> Additional evidence reflecting change is derived from subjective information obtained through informal observation. Experimental group patients attended daily exercise sessions in randomized groups of three, thus permitting patient to patient, as well as patient to researcher, interaction. Initially, essentially no social interaction was observed among patients or between patiens and researcher. As the study progressed, however, subtle, but noticeable, spontaneous conversations occurred, and the expression of common courtesies, greetings and farewells, was prevalent. Emphasis on such seemingly trifle data gains importance when considering the fact that care was taken to expose both the experimental and control patients to similar social stimulation and that control patients did not demonstrate the aforementioned characteristics (Stamford et. al., 1974, p40).

Similarly, in an exercise program with university students, Wysocki et. al. (1979) reported that "many instances of cheers, black-slapping, and other positive social interactions were observed following improved performance by subjects." The students could earn back items of personal val-

ue that they had deposited with the experimenter at the beginning of the study. They earned these items in two ways: (a)by exercising, and (b)by providing the researchers with data indicating their partner was exercising. As in the previous study, Wysocki and his colleques suggested that the social interaction was a side benefit of having the students exercise in a group.

Thus these studies provide tenative indications that exercise may be an activity that sets the occasion for socially reinforcing interaction from peers. If this is the case such social reinforcement could be effective in maintaining the target behavior (i.e., exercising). However, more systematic observation and quantitative monitoring of social interaction must be undertaken to establish this as fact before exercise generated social interaction can be relied on as a natural contingency for maintenance of therapeutic gain. It is interesting to note that, in an examination of the factors that contributed the most to having 585 adults attend and participate in sports activities, Greendorfer (1977) found that peers were the major influence. They influenced participation because of their prestige and power to distribute rewards and punishment.

Response-exchange Contingency of Reinforcement. In the Wysocki et. al. (1979) study, since individuals also earned back items for handing in data on other subject's exercise behavior, they were in effect, receiving reinforcement for

other people's behavior. This reinforcement contingency is similar to the response-exchange contingency (also called "backscratch contingency") that has been shown to facilitate social interaction and communication socially withdrawn individuals in institutions for the mentally retarded (Powers & Powers, 1979; Williams, Martin, Hardy & Lamber, 1975; Williams, Martin & Abrami, 1974; Cuff & Martin, 1974; Cuff & Martin, 1975). In a response-exchange contingency of reinforcement, two individuals receive reinforcement not for their own behaviors, but for each other's. For example, in an exercise program, subject A would receive reinforcement if subject B completed the prescribed exercise behavior, and subject B would be able to obtain reinforcement only if subject A engaged in the required behavior. Although never used in an exercise program or with institutionalized elderly, response-exchange contingencies have been used with institutionalized mentally retarded individuals in a variety of activities, such as table setting (Williams et. al., 1975), picture name training (Cuff et. al., 1974), and lever pressing (Power & Powers, 1971; Williams et. al., 1974; Cuff et. al., 1975). These subjects showed an increase in the target behavior as well as consistently showing (as a side effect) an increase in positive social interaction.

Williams et. al. (1974) suggest that, under such a contingency, the individual will attempt to control his or her partner's behavior through social interaction. Therefore,

the social interaction that Wysocki and his associates report may have been due to this reinforcement contingency. However, reinforcement was simultaneuously obtained for their own as well as for another subject's behavior. Therefore, it is impossible to determine whether the response-exchange type of contingency contributed to the subjects increased social interaction or whether it was the result, as they and Stamford et. al. (1979) suggest, of subjects exercising in close proximity.

As was mentioned earlier, there is some question as to whether the disengaged elderly will automatically provide natural reinforcement for a target beahvior. If they will, some rearrangement of the "natural" reinforcment community may be all that is necessary in order to make residents more salient to each other, especially as reinforcers. Williams et. al. (1974) have implied that a response-exchange contingency of reinforcement be considered in such situations, since they maintain that when an individual's reinforcement is dependent on a partner's behavior, that individual will attend more to that person than when they can obtain reinforcement independently. Thus, a situation is created where they will attempt to control each other's behavior through social reinforcement, in order to maximize the opportunity of receiving reinforcement themselves.

Summary and Purpose of the Present Research

Researchers are concerned with the inactivity that characterizes the elderly living in institutions (e.g., McClannahan & Risley, 1974). These people, described as disengaged, have withdrawn from participation in everyday life. It has been argued that inducing the elderly to participate in exercise activities would ameliorate the problems associated with inactivity (deVries, 1980). Studies, such as those carried out by Epstein, Wing and Thompson (1980) and Keefe and Blumentahl (1980), have demonstrated the appropriateness of using operant conditioning principles and techniques in the analysis, control, and/or modification of exercise behavior in younger and clinical populations. Only one study was found that was directed at the institutionalized elderly, and the subjects in that study were not identified as disengaged. Thus, the factors associated with the disengaged, institutionalized elderly's acquisition and adherence to an exercise regimen require investigation.

Maintenance of the behavior once the training contingencies have been withdrawn is of interest in any therapeutic program. Stokes and Baer (1977) suggest that maintenance can be programmed for by creating a situation where natural contingencies will take over when the training program is terminated. One way to do this, according to Baer and Wolf (1970) is to select a behavior for training that will elicit socially reinforcing interactions with peers who can also

act as discriminative stimuli for target behaviors in both the training and natural setting.

The literature (e.g., Stamford et. al., 1974) provides tenative, anecdotal evidence that exercising in proximity to others, is an activity that sets the occasion for reinforcement from one's natural community. However, systematic and quantifiable estimates of social interaction have not been obtained throughout an exercise program. Thus, a second area of concern is whether exercise is an activity that will elicit social reinforcement from disengaged peers.

There is some question in the literature as to whether disengaged elderly attend to their peers, since they do not interact with each other, even though they have the opportunity to do so. Studies with mentally retarded populations have suggested that a response-exchange contingency makes peers salient to each other and, as a side effect, elicits social interaction. Thus, a third area of concern is whether a response-exchange reinforcement contingency will be effective in creating a situation in which disengaged residents attempt to control each other's exercise behavior through social interaction.

The present research reinforced disengaged institutionalized elderly for exercising using either a direct reinforcement or a response-exchange reinforcement contingency. Social interaction was monitored throughout the program to determine the extent to which exercise sets the occasion for

peer generated social reinforcement. Thus, three questions were addressed, a) to what extent can operant procedures be used to increase activity levels of disengaged elderly in institutional settings, b) to what extent does exercising generate social reinforcement from peers when the peers are disengaged elderly, and c) to what extent does a response-exchange contingency generate, as a side effect, social interaction between disengaged elderly residents.

A possible collateral effect of this program could be an increase in social interaction and activity level outside of the exercise setting. In fact an increase in resident-resident social interaction in the natural environment is probably a necessary requirement for generalization and maintenance of exercising behavior. It seemed especially relevant, therefore, to document whether the present research was successful in facilitating social interaction outside of the training setting (i.e., on the ward).

METHOD

Subjects

Six elderly female residents (mean age 67 yrs.) from Tache nursing centre in Winnipeg, Manitoba, Canada, were selected from a group referred by the Physiotherapy Department as socially withdrawn, inactive residents. Patients were approached and asked to volunteer for research involving a progressive walking exercise program using modern psychological techniques. Prior to the program, all subjects received a physical examination and approval of their physician to participate in the study (see Appendix A for disqualifying factors). None of the subjects had participated in the nursing centre's physiotherapy walking class or had experience in a response-exchange contingency of reinforcement. The diagnosis on which they were admitted to the nursing centre ranged from Korsakoff's disease (Nan), chronic schizophrenia (Fran and Jessie), organic personality syndrome due to brain trauma (Lucy), and Alzheimer's disease (Rita).

Setting.

The observations where made in three different settings, the gym, the ward, and on two different occasions in the Occupational Therapy room. Observations were made on the ward in order to get a measure of their behavior in their natural environment (i.e., the setting were day to day contingencies were in effect). Additional observations, made once a week in the morning in the Occupational Therapy room, were undertaken in order to measure the resident's behavior in a setting where staff contingencies for passive behavior were not in effect. Measures of social interaction were also made immediately after the exercise program, again in the Occupational Therapy room. These measures provided an opportunity to examine any immediate or short term effects the exercise program might have outside of the training setting. Contingencies were in effect for behavior in the gym, a 23 m long X 11 m wide room located on the first floor of the centre. A 31 m oval tract was set up in the gym using rubber pylons and a rope.

Procedure

General Procedure. The exercise sessions began at 5:45 p.m. in the gym, Monday through Friday. Subjects were instructed that they could walk around the track for as long as they liked. During conditions where reinforcement was contingent on exercising, they were told the number of laps

they had to walk in order to earn tokens. The session was terminated after 13 min had elapsed. At the end of this time period the subjects were given 15 paper tokens if the required number of laps had been completed. Five "bonus" tokens were available if one or more additional laps had been walked past the experimenter specified criterion. These tokens could be exchanged for back-up reinforcers twice a week after the exercise session.

When reinforcement was contingent on talking to others, the subjects were told that the session had been divided into 4 sec intervals. They would receive a token for each interval they (or, in the case of a response-exchange diad, their partner) were observed talking to someone. Since the subjects could earn a great deal more tokens in this phase than they could in the previous phase, the cost of the back-up reinforcers was adjusted so that their tokens had approximately the same "buying power".

In the morning (8:45 a.m.) the subjects were observed for 20 min in one of two locations. On Tuesdays observations took place in the Occupational Therapy room where the residents had coffee. On the other four days the subjects were observed on the ward.

In order to measure the daily activity level of the residents, an actometer was strapped on either the subject's wrist or foot just before the observations of social interaction on the ward began. An actometer is a modified self-

winding wristwatch which records motion in a plain parallel to the face of the watch (Cunningham & Barkley, 1979). One subject refused to wear the actometer, while another would only wear it on her wrist.

Halfway through the first experimental condition it was observed that, while interactions during the exercise sessions were mainly directed towards those in authority (experimenters, observers or staff), interactions immediately following the sessions usually involved other residents. In order to obtain a measure of the extent of interaction between residents without the confounding effect of the authority figure's presence, beginning at the 27th session, the subjects went to the Ocupational Therapy room after the exercise session for a 10 min coffee break. All other individuals were excluded from this session and behavior was recorded via a Sony reel-to-reel video machine.

Exercise Program. In general, the exercise program was to have consisted of a progressive walking program based on Cooper's aerobic walking program for individuals over 65 years of age (1972; 1974). The initial level at which a resident was to begin at was determined during baseline, where the subject was told to walk as many laps as she wanted to, within the initial time period for the first exercise level (13 min). Shortly after the exercise program began, it became apparent that none of the residents were capable of walking the distance (1/2 mile) required for Cooper's

first level. Therefore the target of the exercise program became to progressively increase the distance the residents walked in a 13 min period, the time period proscribed for Cooper's initial exercise level. Immediately after each walking session, an observer counted the resident's heart rate using a stethoscope. Heart rate values determined whether the resident progressed to a more strenuous level. Five days at a particular level with a heart rate in the lower end of the 40-60% exercise heart rate range signalled that the person should engage in a higher level of exercise. The exercise heart rate was found by taking the maximum heart rate (220 minus age) and subtracting the individual's resting heart rate. The magnitude of the increase was based on the previous three sessions. The new level was, typically, 1 lap (31 m) more than the average number of laps walked during the previous three sessions. If the previous three sessions, however, included one session with an abnormally high lap rate, and if the subject gave evidence that such an increase might increase the probability of them falling, the criterion was based on the last five sessions.

Reinforcer Survey. Prior to intervention, the reinforcement Survey Schedule (Cautela, 1977) was administered individually to each subject. Items used as back-up reinforcers were selected from the events or items a subject rated highly. At a subsequent meeting, the items were rank ordered in terms of each subject's preference. Those items a subject

rated high, were assigned a greater token cost than items ranked by the subject as having a lower value. For example, ice cream (a highly preferred item) cost almost double the tokens of the less preferred movie magazine.

Research Design and Data Analysis

Dependent and Independent Variables. Dependent variables were exercise behavior, social interaction, and activity level. Exercise behavior was defined as the number of laps completed in the gym during an exercise session. Social interaction was measured using those categories employed by Blackman et al. (1976) to measure social interaction of elderly residents in a nursing home, which were as follows:

1. Positive social interaction: any of the following behaviors directed toward another person:
    a) speaking (subject must be within 3.05 m of the person she is talking to, head must be oriented toward the person, and the subject must be making an audible verbalization (excluding any of those found in the negative social interaction classification).
    b) listening (subject must be within 3.05 m of another person, head must be oriented toward the other person, and the other person must be making an audible verbalization).
    c) touching another resident.

d) handing an object to another resident.

2. Negative social interaction: any of the following behaviors directed by the subject towards another person:
   a) verbalization directed towards another person less then 3.05 m away. This would include name-calling, threats, telling another person to leave, scolding another person about their behavior.
   b) physically abusing another person.
   c) throwing objects at a person within 3.05 m
3. Isolated behaviors: any of the following behaviors:
   a) sitting without talking or listening to another person.
   b) looking straight ahead and remaining silent.
   c) talking not directed to any person or verbalizing while more then 3.05 m away from another person.

The subjects activity level was monitored on the ward using actometers (Cunningham & Barkley, 1979). Since actometers are modified self-winding wristwatchs which record motion in a plain parallel to the face of the watch, activity level was recorded as units of activity accumulated on the actometer.

One independent variable was the type of activity for which reinforcement was available, either a physical activity (exercise) or a social activity (talking to others). The second independent variable was the type of contingency un-

der which reinforcement was given. Reinforcement for participation in these activities was administed under either direct or response-exchange reinforcement contingencies. Two subjects, Maggie and Jessie, received reinforcement for their own behavior (direct reinforcement). Two other subjects, Fan and Nan, were paired into a diad and received reinforcement for their partner's behavior (response-exchange reinforcement). When Nan emited the targeted behavior, Fran received reinforcement and when Fran engaged in the appropriate behavior, Nan received reinforcement. Two additional subjects, Lucy and Rita, received first direct and then response-exchange reinforcement during the first experimental condition (reinforcement available for a physical activity). Originally all subjects were to be exposed to both contingencies but in counterbalanced order. When it became apparent that neither contingency had an effect on social interaction, it was decided to switch the contingent reinforcement to social behavior in order to determine if the residents lack of social interaction was due to a skills deficit or due to staff contingencies for passive behavior. However, before changing the target behavior to talking, it was decided to change Lucy and Rita from direct reinforcement to response-exchange reinforcement for exercising. This was done for two reasons. First, it was decided to determine if the lack of expected social interaction in the response-exchange diad was due to having introduced this

contingency without first having exposed the residents to direct reinforcement. In most of the studies investigating the response-exchange contingency, direct reinforcement always preceded the response-exchange contingency. Secondly, since the subjects' exercise behavior increased regardless of whether they were under the response-exchange or direct reinforcement contingency, it seemed apparent that a comparison of the two contingencies using the same subject was needed in order to find out if the two contingencies were equally effective in controlling exercise behavior.

Data Collection. Observations of social interaction were initially recorded using a 10 sec observe/5 sec record time-sampling procedure (see Martin & Pear, 1978, pages 294-295 for a description). At first the six subjects met in two groups of three each, but on the 32nd session due to time limits imposed by other groups booking the gym, the subjects were combined into one group. As a result the original 10 sec observe/5 sec record was changed to a 4 sec observe/2 sec record, so that it was possible to obtain the same number of observations on each subject. The data were then changed to percentage measures (i.e, the percentage of intervals the subject engaged in social interaction during the 13 min exercise session). Percentage measures were used in order to facilitate comparisons between the two time periods, i.e., before and after the 32nd session. When observation of one person was completed, the observer moved on

to the following person. If the person was not there, the observer recorded her as absent and waited for the next observation period to record the next person. The order in which the subjects were observed was counterbalanced across days. When observations were taken on the ward, the time period between observations between increased substantially, so that only four observations were obtained on each individual. This was due to the fact that subjects were not all located on the same floor, and were not always found in the same place. Thus, the observer would have to travel from floor to floor and locate the individual before taking an observation. As well as recording the type of social interaction, the observer also recorded with whom the interaction took place, e.g., a staff member, a resident not in the program or another subject. Actometer readings were recorded at the end of an 8 hr period, which began at 8:30 in the morning. Exercise behavior (laps) were recorded on a manual counter each time a subject passed a specified point on the track (i.e., the pylon where the subject first entered the track).

Interobserver Reliability. In order to insure consistency in observations, prior to the experiment the observers were trained in the use of the behavior codes for social interaction, using residents in the lounge of the Nursing Home as target subjects. Training continued until the interobserver reliability score was over 80% in three consecutive

observation periods (the criterion used for any retraining that was necessary during the program). Interobserver reliability scores for social interaction were calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. During the study, unannounced interobserver reliability checks were conducted once a week.

Design. Initially a reversal design consisting of baseline (A), direct reinforcment of exercise behavior (B), and response-exchange reinforcement of exercise behavior (B') was to be used, where the experimental conditions are systematically altered in order to compare the effects of the two reinforcement contingencies. Presentation of the experimental conditions (B and B') were counterbalanced across subjects to control for order effects. Thus, in the beginning for four subjects the design was to be an A-B-B'-B and for the other two subjects the design was to be an A-B'-B-B'. No return to A (baseline) was planned, since the major thrust of the research was to compare the two contingencies. Social interaction did not appear to increase substantially over baseline level when the subjects were receiving direct or response-exchange reinforcement for exercising in phase 2. On the other hand both contingencies seemed to be equally effective in controlling exercise behavor. Therefore for two subjects, Lucy and Rita, the design was changed to an A-B-C-B, for two other subjects, Fran and

Nan, it was changed to an A-B'-C'-B', where C was direct reinforcement for talking to others and C' was response-exchange reinforcement for talking to others. The two additional subjects, Lucy and Rita, who switched from direct reinforcement of exercising to response-exchange reinforcement of exercising, continued under the response-exchange reinforcement contingency so that their design was an A-B-B'-C'-B'. Since exercise and social interaction did not change from the B phase when the first B' phase was introduced, the two contingencies were considered interchangeable and no return to the B phase was undertaken.

Phase 1. During baseline (A) all subjects were told that they could walk as many laps as they liked within a 13 min. period.

Phase 2. On the first day after the baseline phase in the Occupational Therapy room, the subjects were informed that they would receive either direct reinforcement or response-exchange reinforcement for exercising (B or B'). Maggie, Jessie, Lucy and Rita, the four subjects under the direct reinforcement contingency (B), were told that they would receive reinforcement, if they completed a specified number of laps. Fan and Nan, the other two residents in the response-exchange condition (B'), were grouped into a diad. They were told that they could obtain reinforcement, if their partner walked the specified number of laps. Before each exercise session, the experimenter reminded the resi-

dents of the number of times they had to walk around the track. Halfway through this phase Lucy and Rita, who were receiving direct reinforcement, were grouped into a diad also, and were only able to obtain reinforcement if their partner exercised.

Phase 3. During the next phase (C or C') the experimental conditions were reversed so that instead of receiving reinforcement for their own exercise behavior or for their partner's exercise behavior, subjects were told they would receive reinforcement for talking to someone (C) or in the case of diad partners, if their partner talked to someone (C').

Phase 4. During this final phase (B or B') the experimental conditions returned to direct or response-exchange reinforcement for exercising.

RESULTS

Interobserver agreements on social interaction in the Occupational Therapy Room and during the Exercise Sessions, averaged 90.62% across 21 observation sessions, with a range of 73% to 100%. More specifically, interobserver reliability during the exercise sessions was 86.85%, and in the Occupational Therapy room was 94.40%. Two reliability checks were beneath the required 80% agreement (73% and 74%). Retraining of the observers took place until the interobserver reliability scores were, once again, over 80%.

Exercise Behavior

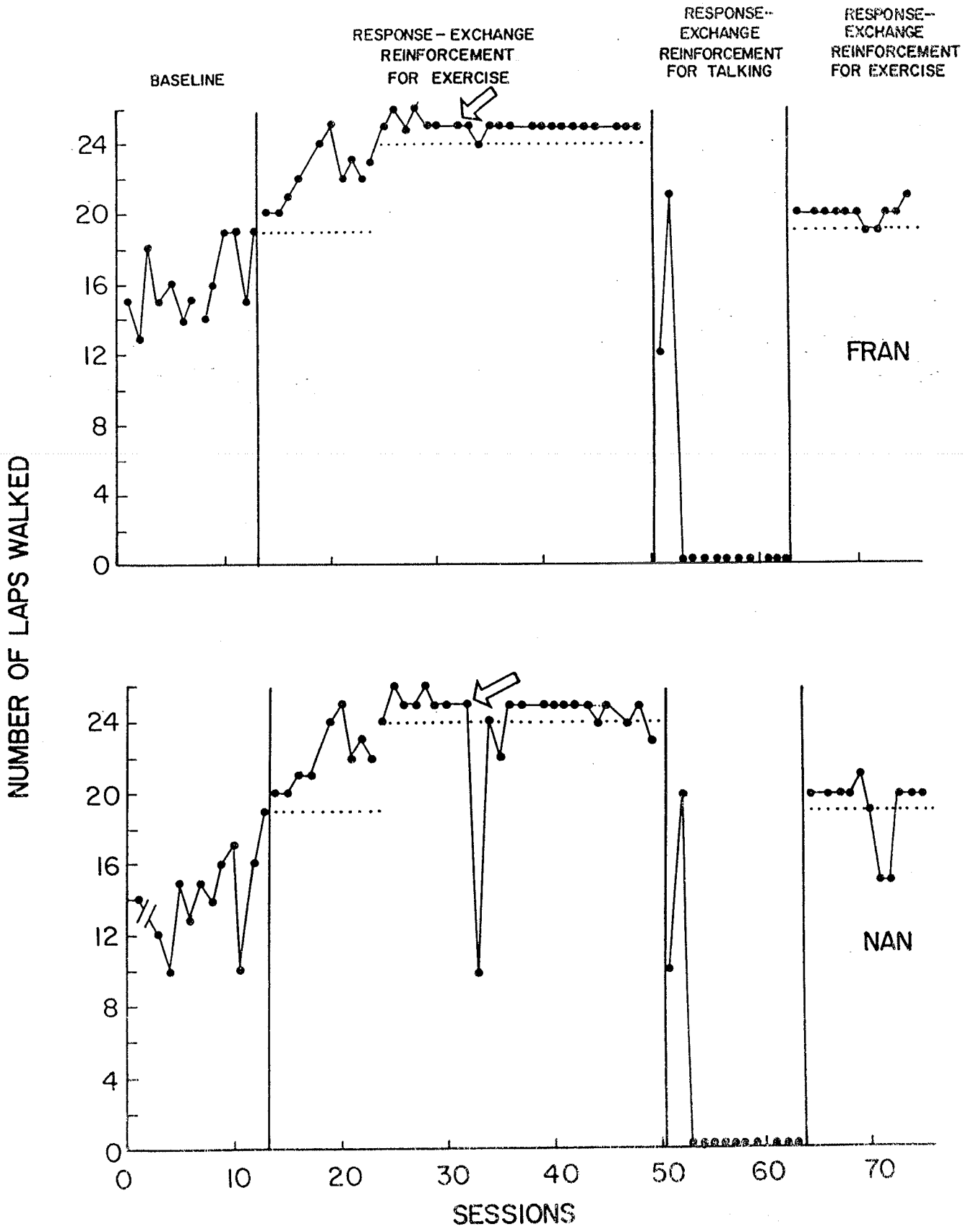
The data on the residents' exercise behavior shows the specific effects that reinforcing participation in a physical or social activity has on elderly residents' exercise behavior. The data plotted across exercise sessions are the number of laps a subject walked during the 13 min daily exercise period. The dotted line indicates the minimum number of laps a subject had to walk in order to receive (or for her partner to receive) reinforcement. It can be seen that whenever direct or response-exchange reinforcement was contingent on walking a specified number of laps, the subjects usually met or surpassed this level. However, when rein-

forcement (direct or response-exchange) was administered for talking to others, the number of laps the subjects walked soon dropped to zero or almost zero. When reinforcement was reintroduced for exercising, the subjects immediately walked at or beyond the experimenter specified criterion.

Response-Exchange Reinforcement Condition. Fran (Figure 1) walked an average of 16 laps per session during baseline. Following a decreasing trend, the number of laps she walked stabilized around 19 laps. After response-exchange reinforcement for walking was introduced, Fran immediately surpassed the initial criterion (19 laps) set by the experimenter by 1 lap. Her exercise behavior, after some variability, stabilized at an average of 22.11 laps per session. This was an average increase of 6.11 laps over the mean number of laps she walked during baseline. At the 23rd exercise session, the criterion level was raised to 24 laps. Excluding the 23rd session, Fran once again immediately met and surpassed this new criterion. Responding quickly stabilized at an average of 24.96 laps per session. This is a mean increase of 2.85 laps from that found when the initial criterion was in effect. When response-exchange reinforcement was withdrawn for exercising and introduced for talking, Fran discontinued walking completely after two sessions, an average decrease of 22.21 laps per session.

Figure Caption

Figure 1. Number of laps walked by Fran and Nan (Response-Exchange Reinforcement) during the 13 min exercise sessions. (The dotted line indicates the number of laps required for reinforcement. The arrow indicates the session the two groups were combined.)


BASELINE
RESPONSE – EXCHANGE REINFORCEMENT FOR EXERCISE
RESPONSE-EXCHANGE REINFORCEMENT FOR TALKING
RESPONSE-EXCHANGE REINFORCEMENT FOR EXERCISE
FRAN
NAN
NUMBER OF LAPS WALKED
SESSIONS
0
4
8
12
16
20
24
0
10
20
30
40
50
60
70

This situation continued until response-exchange reinforcement was once again in effect for exercising, whereupon she began walking an average of 19.91 laps per session, slightly above the criterion set by the experimenter (19 laps). This resulted in an average increase of 17.16 laps from that found in the sessions of the previous experimental condition when talking was reinforced.

Nan's exercise behavior (Figure 1) is remarkably similar to Fran's, her partner in the response-exchange diad. Nan walked an average of 14.25 laps per session during baseline. A downward trend in the data is followed by an upward drift that unlike Fran's data, does not stabilize. Normally when an upward trend is noted, phases are not shifted until responding has stabilized because any subsequent increase in behavior can not unequovically be attributed to the experimental conditions. However, in this case, several factors entered into the decision to shift phases at this point. First, it was felt that changing criteria (Kazdin, 1982) within the experimental condition would provide additional support for attributing changes in exercise behavior to the experimental procedure. Secondly, the main experimental comparison was to take place between the B'-C'-B' portion of the experimental design. Thus, while any change in behavior from the A-B' phases was of interest, it was not as important as the latter phase changes. Thirdly, Fran and Nan were diad partners and experimental conditions could not be

introduced for one without being introduced for the other as well, and so despite the upward trend during baseline, the first experimental condition was introduced.

When response-exchange reinforcement was introduced for walking the data, after some variability, stabilized at a mean of 22 laps per session. This is an average increase of 7.75 laps over that found in baseline. At the 23rd session, when the specified number of laps to be walked was reset to 24, Nan immediately increased the number of laps she walked to match this criterion. Averaging 24 laps per session (excluding session 33, where she stopped walking early when her stocking fell down), Nan walked an average of 1 lap further than the mean of the previous time period when the lower criterion was in effect. When response-exchange reinforcement was made contingent on talking rather than exercising, Nan soon ceased walking entirely. With a mean of 2.5 laps per session, the average distance she walked decreased by 20.5 laps from the previous condition when reinforcement was contingent on her partner walking. Upon reintroduction of response-exchange reinforcement for exercising, Nan immediately increased the distance she walked, surpassing the experimenter specified criterion (19 laps) by 1 lap. After an initial stable period, the number of laps she walked temporarily dropped to 15 laps, returning after two sessions to a stable 20 laps per session. It is interesting to note that during this drop, Fran reduced the number of laps she walked

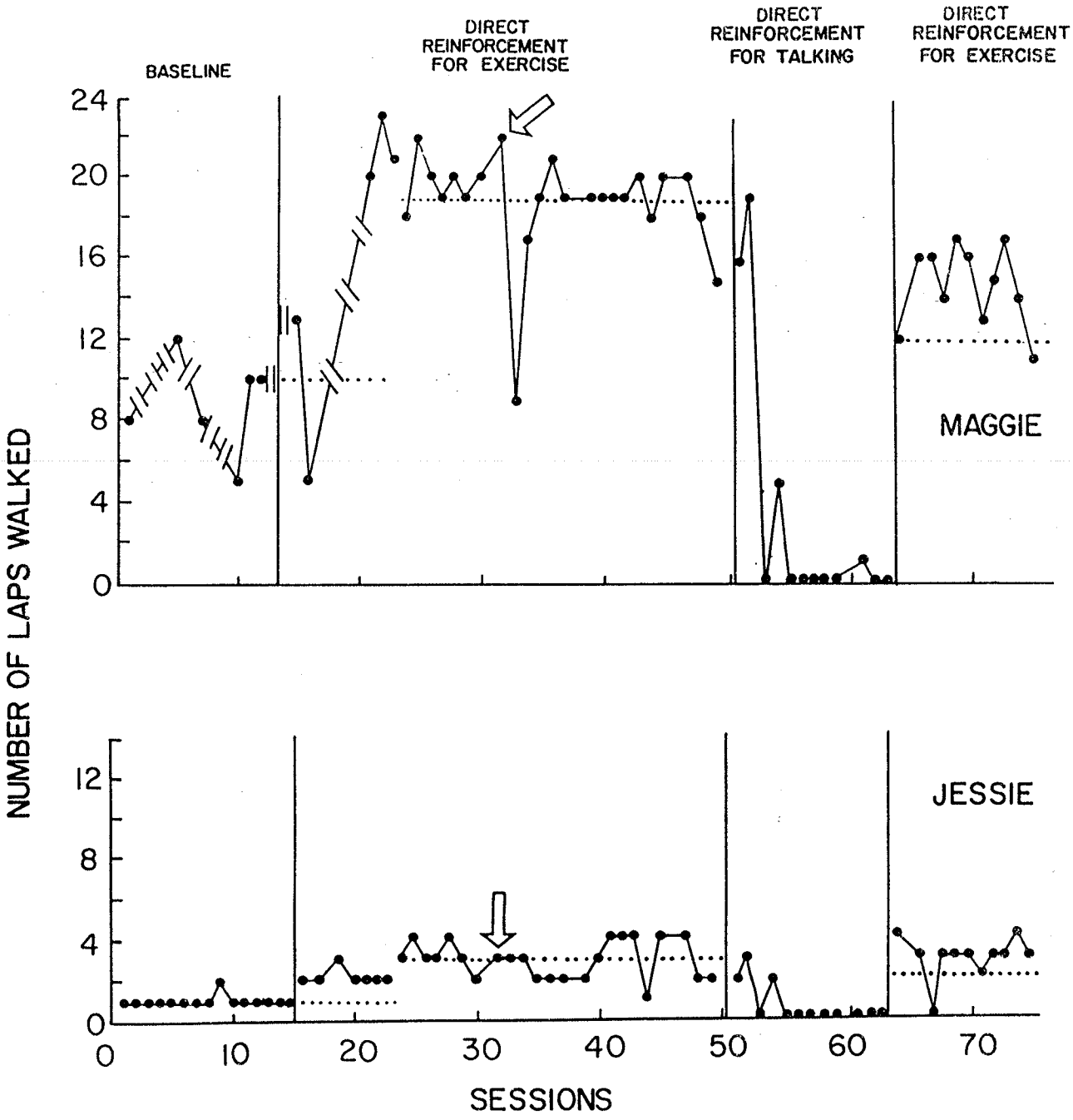
to the minimum number required, thus preventing Nan from receiving any bonus tokens. With a mean distance of 19.09 laps per session, she displayed an average increase from the previous experimental condition of 16.59 laps.

Direct Reinforcement Condition. While in baseline, Maggie's participation in the exercise program was extremely spasmodic (Figure 2). On 7 of the 13 baseline sessions she refused to attend the exercise program. During the sessions she did attend, she walked an average of 8.83 laps per session. A downward trend is followed by an upward shift to a stable 10 laps over the next two sessions. Again it should be mentioned that it is desirable to have more than two stable data points before shifting conditions, but Maggie's lack of attendence at the next session can also be taken as a measure of the strength of her exercise behavior. Maggie initially had difficulty in meeting the exercise criterion (10 laps) when direct reinforcement for walking was introduced. On four of the first seven experimental sessions she refused to come to the gym and failed to meet the exercise criterion on one of the two other sessions. Thus, she had little opportunity to come into contact with the reinforcement contingencies. Before the 21st session, Maggie was allowed to sample a back-up reinforcer. Afterwards she never refused to attend again. As well, the distance she walked increased substantially. While the first criterion was in effect, she walked an average distance of 16.40 laps, a 7.57

increase over that found in baseline. After the 23rd session, the criterion was raised to 19 laps. At almost every session, Maggie matched or surpassed the exerimenter specified criterion. On the occasions (sessions 33, 34, 44, 48, 49) when she failed to meet criterion, either her speed was so slow that the time ran out before she was able to complete the required number of laps, or she followed another resident off the track. The average distance Maggie walked was 18.74 laps, an increase of 2.34 laps over the time period when the lower criterion was in effect. When reinforcement was made contingent on Maggie talking instead of walking, the distance she walked dropped dramatically after the first two sessions, to a mean of 3.58 laps. This was an average of 15.16 laps less then when her walking was reinforced. On eight of the remaining 10 sessions she didn't walk at all. Although there is a 2 point declining trend just before shifting to this condition, the magnitude of the drop and the relatively few overlapping data points (2 data points) lends support to the experimental procedures effecting this change. Upon making reinforcement contingent once more on walking, Maggie again increased the distance she walked, surpassing the experimenter specified criterion of 12 laps.

Figure Caption

Figure 2. Number of laps walked by Maggie and Jessie (Direct Reinforcement) during the 13 min exercise sessions. (The dotted line indicates the number of laps required for reinforcement. The arrow indicates the session the two groups were combined.)


BASELINE
DIRECT REINFORCEMENT FOR EXERCISE
DIRECT REINFORCEMENT FOR TALKING
DIRECT REINFORCEMENT FOR EXERCISE
MAGGIE
JESSIE
NUMBER OF LAPS WALKED
SESSIONS
0
4
8
12
16
20
24
10
30
40
50
60
70

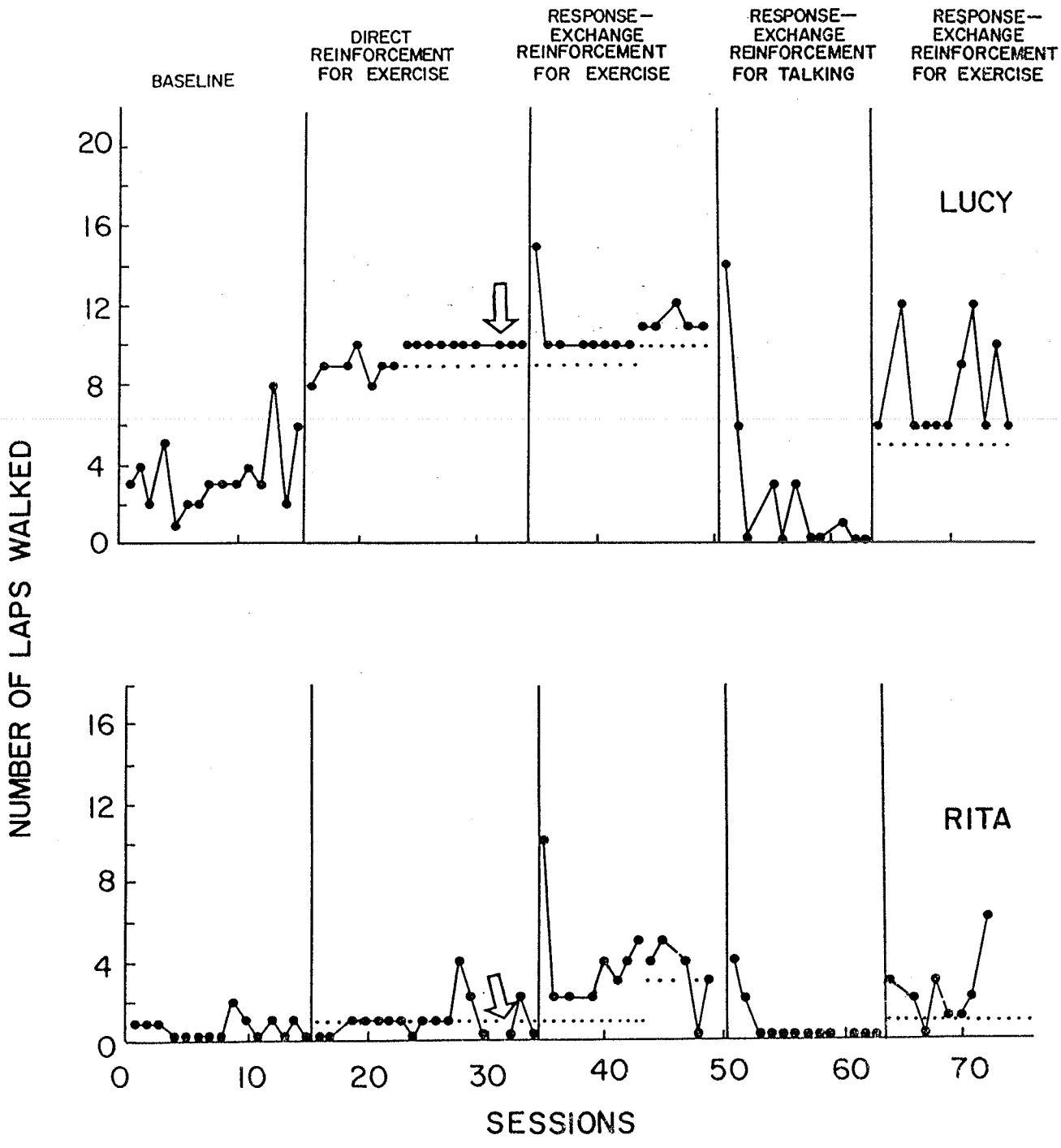
During this time period she averaged 14.64 laps per session, an increase of 11.06 laps from the previous experimental condition.

During baseline, Jessie's exercise behavior occurred at a very low but stable rate, at an average of 1.07 laps per session. When direct reinforcement was introduced for walking, Jessie increased the distance she walked to match the criterion set by the experimenter (1 lap). With a mean of 2.14 laps per session she walked 1.07 laps more than she did during bseline. When the criterion was raised again, she initially had no difficulty in meeting it. Subsequent to the sixth session at this new level, however, her exercise behavior became slightly unstable so that on 8 out of the remaining 28 sessions she stopped 1 lap short of criterion (3 laps). On three of these occasions she complained of being dizzy and expressed a fear of falling. With a mean of 2.91 laps, she averaged .84 laps per session more then when the lower criterion was in effect. When reinforcement was withdrawn for exercising and introduced for speaking to others, the number of laps she walked soon dropped to zero, with only three overlapping data points with the previous condition. When reinforcement for walking was once again in effect, she immediately began walking again, failing to meet or surpass the experimenter specified criterion of 2 laps on only one occasion. Averaging 2.82 laps per session, her data show an increase of 2.24 laps per session over that found when talking was being reinforced.

Direct and Response-Exchange Reinforcement Condition. While in baseline, Lucy's exercise behavior started off at a relatively low rate which was followed by a slightly positive slope (Figure 3). The average distance she walked was 3.4 laps. When reinforcement was made contingent on her walking a minimum of 8 laps, she immediately met and surpassed this criterion, averaging 8.86 laps per session. This was an increase of 5.46 laps over that found when she was in baseline. When the criterion was raised to 9 laps (on the 24th session) the number of laps she walked stabalized at 10, a 1.14 lap increase over the previous time period. On the 35th session, response-exchange reinforcement for walking was introduced. Little difference is noted in her exercise behavior from the previous condition. She averaged 10.63 laps per session. The increase of .63 laps is entirely due to the extra laps she walked on the 35th session. When the criterion was raised to 10 laps on the 44th session, Lucy immediately increased the distance she walked to an average of 11.2 laps per sesion, an increase of 1.2 laps over that found under the 9 lap criterion. When response-exchange reinforcement was withdrawn for walking and introduced for speaking to others, Lucy showed a drop in exercise behavior to an average of 2.42 laps per session. Although there is one overlapping data point, this represents an average of 8.78 laps less then when reinforcement was contingent on her partner walking.

Figure Caption

Figure 3. Number of laps walked by Lucy and Rita (Direct and Response-Exchange Reinforcement) during the 13 min exercise sessions. (The dotted line indicates the number of laps required for reinforcement. The arrow indicates the session the two groups were combined.)


BASELINE
DIRECT REINFORCEMENT FOR EXERCISE
RESPONSE–EXCHANGE REINFORCEMENT FOR EXERCISE
RESPONSE–EXCHANGE REINFORCEMENT FOR TALKING
RESPONSE–EXCHANGE REINFORCEMENT FOR EXERCISE
LUCY
RITA
NUMBER OF LAPS WALKED
SESSIONS
0
4
8
12
16
20
0
10
20
30
40
50
60
70

When response-exchange reinforcement was reintroduced for exercising, Lucy immediately increased the distance she walked, surpassing the experimenter specified criterion of 6 laps. With a mean of 7.72 laps per session, this is an average increase of 5.3 laps over that found when reinforcement was contingent on her partner talking.

Rita's exercise behavior occurred at a very low and stable rate during baseline, an average of .53 laps per session. On a number of occasions she would start to walk down the track, then turn around and walk back to the starting point. On sessions 7 and 8 she started to walk across the ropes that outlined the track, whereupon the experimenter guided her back to the track. When direct reinforcement for exercising was introduced, Rita, again displayed evidence of some difficulty in walking the track. Typically she would walk into the ropes and stand there unless given physical guidance, i.e., an experimenter would direct her to the middle of the track. After the 22nd session, Rita ceased to walk across the ropes, although she continued on occasion to stand in the middle of the track or to walk back to the starting point. During this time period she averaged .94 laps per session, a minimal increase of .41 laps from that found in baseline. A substantial difference was found in the distance she walked when response-exchange reinforcement was introduced for walking. Although the experimenter specified criterion was 1 lap, Rita walked an average of 4 laps

per session, an increase of 3.06 laps from that found when reinforcement was contingent on her own exercise behavior. An upward trend is noted just before the criterion changed to 3 laps, partially due to her partner guiding Rita around the track on a few occassions. Averaging 3.2 laps per session, Rita was able to match this subsequent increase in criterion except for 1 session. When response-exchange reinforcement for exercising was withdrawn and replaced with reinforcement contingent on her partner speaking to others, her exercise behavior, after two sessions, decreased to and maintained at zero. With an average of .5 laps per session, this was a decrease of 2.7 laps from the previous experimental condition. When reinforcement was once again contingent on her partner exercising, Rita immediately increased the distance she walked, averaging 1.64 laps per session, slightly above the experimenter specified criterion of 1 lap. This was an average of 1.14 laps more then when reinforcement was contingent on her partner talking to others. It should be noted that once during baseline (9th session), once during direct reinforcement for exercising (28th session) and five times during response-exchange reinforcement for exercising (35th, 36th, 45th, 72nd and 75th sessions) her diad partner guided Rita around the track, a situation that is partly responsible for the upward trends seen in Rita's data.

Social Interaction

Figures 4 to 6 illustrate what happens to the level of elderly female resident's social interaction in exercise sessions when reinforcement is contingent on participation in either a physical or social activity. The data plotted across exercise sessions are the percentage of intervals a subject was observed engaged in positive social interaction with another resident. Almost no negative social interaction occurred. As a consequence only the positive social interaction is reported. The dotted line indicates the mean amount of a subject's social interaction during each experimental condition. Appendix B presents data as to whom the social interaction was directed. In general, although slight or no increases over baseline levels of social interaction with other residents were found when exercising was being reinforced, relatively large increases in soical interaction occurred when the residents were reinforced for speaking to others (either through direct or response-exchange reinforcement). Most of this interaction was directed towards Lucy (see Appendix B) while any remaining interaction was directed towards their partners (in the case of diad members) or equally distributed throughout the group. When reinforcement was once again contingent on walking, social interaction returned to baseline levels.

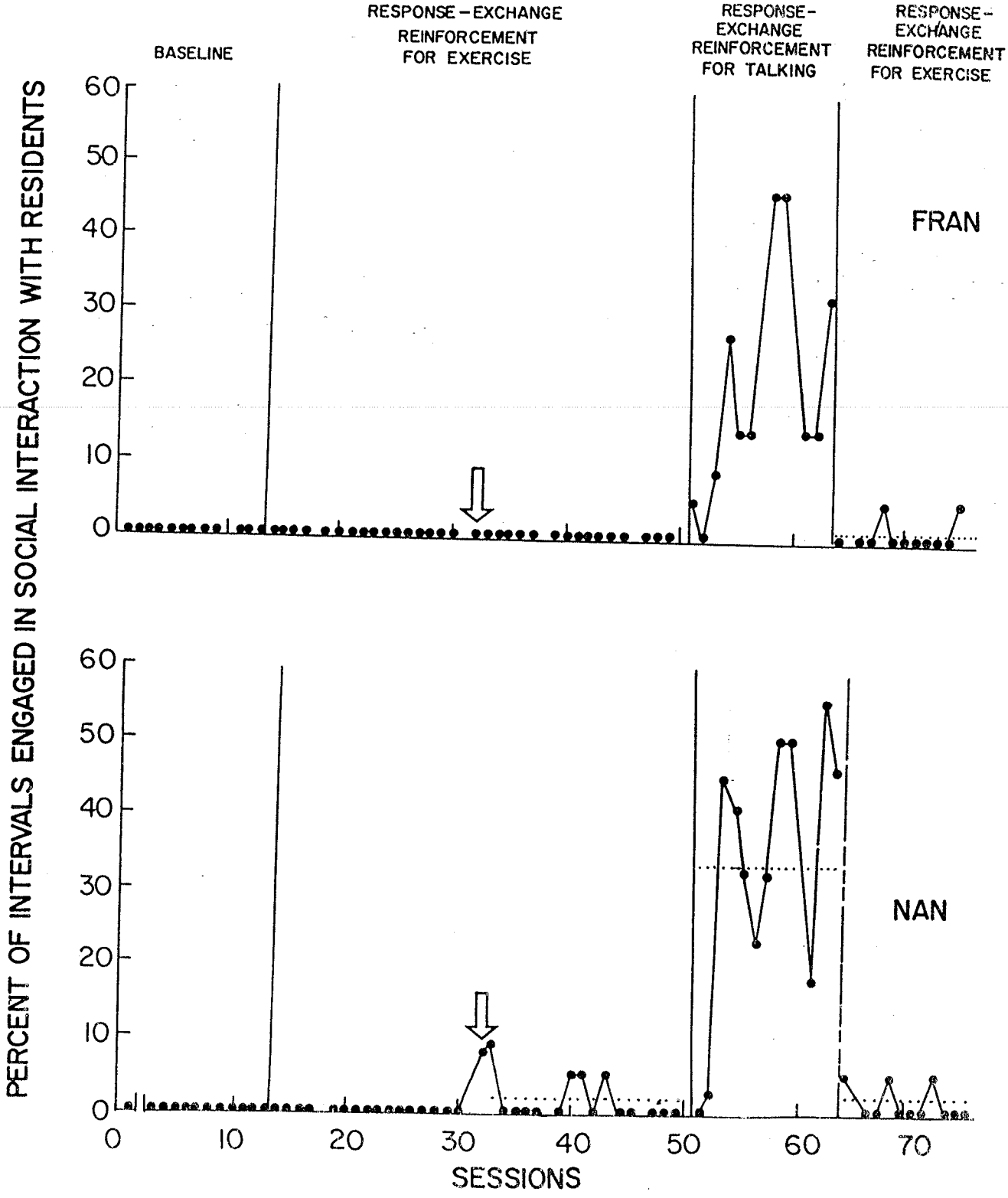
Response-Exchange Reinforcement Condition. Figure 4 shows the social interaction Fran and Nan engaged in with

other residents. An examination of Fran's social interaction with other residents indicates that there was no social interaction with other residents during baseline. This situation did not change when response-exchange reinforcement for exercising commenced. When response-exchange reinforcement was withdrawn for exercising and introduced for talking to others, the percent of intervals Fran was observed socially interacting with other residents increased substantially. Occurring an average of 20.63 percent of the intervals during exercise sessions, this represents an increase of 20.33 percent from the previous condition. When response-exchange reinforcement for exercising was reintroduced, the number of intervals Fran spent socializing returned to a similar level as that found in the original condition in which response-exchange reinforcement was contingent on exercising (an average of .82 percent of the intervals).

Nan did not interact with any of the other residents during baseline. Her data indicate relatively little change (.45 percent of the intervals) when she was placed under the response-exchange contingency for exercising. After the two groups were combined, a minimal increase in the intervals she was observed interacting with other residents was noted, with a mean of 1.52 percent of the intervals being spent in social interaction with another resident.

Figure Caption

Figure 4. Percentage of intervals that Fran and Nan (Response-Exchange Reinforcement) engaged in social interaction with another resident during the 13 min exercise sessions. (The dotted line indicates the average percentage of social interaction for each experimental condition. The arrow indicates the session the two groups were combined.)


BASELINE
RESPONSE – EXCHANGE REINFORCEMENT FOR EXERCISE
RESPONSE – EXCHANGE REINFORCEMENT FOR TALKING
RESPONSE – EXCHANGE REINFORCEMENT FOR EXERCISE
FRAN
NAN
PERCENT OF INTERVALS ENGAGED IN SOCIAL INTERACTION WITH RESIDENTS
SESSIONS
0
10
20
30
40
50
60
70

After reinforcement became available for her partner talking rather than walking, the intervals Nan was observed interacting with other residents increased dramatically to a mean of 33.04 percent of the intervals. This is a mean change of 31.53 percent from that found in the previous experimental condition. When reinforcement was once again contingent on her partner exercising, the intervals in which social interaction occurred immediately dropped to an average of 1.27 percent. This was a mean decrease of 31.77 percent from that found when response-exchange reinforcement was in effect for talking.

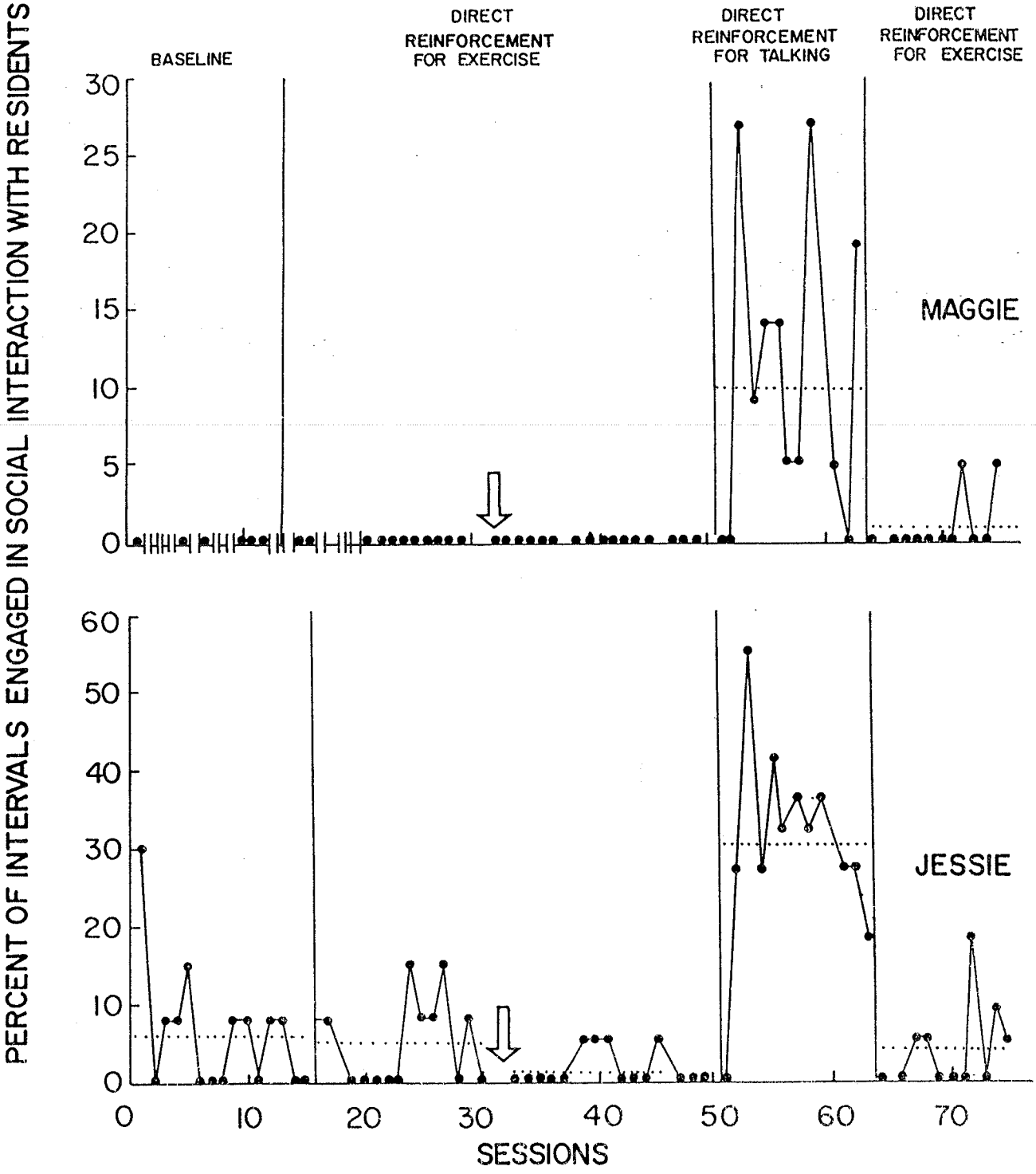
Direct Reinforcement Condition. Figure 5 shows the social interaction of Maggie and Jessie with the other residents during the exercise sessions. As can be seen from Maggie's social interaction with other residents, she was not socially active with the residents during baseline, nor during the first part of the experimental condition where reinforcement was contingent on her exercise behavior. When the groups were combined, this situation continued. When reinforcement was made contingent on talking rather than exercising, the percentage of intervals she spent interacting with other residents rose to an average of 10.25 percent, an increase of 9.95 percent. Although a great deal of session to session variability is observed, there are only two overlapping data points with the following phase. This effect was reversed when the contingency was switched from talking

back to the reinforcement of exercising. With an average of .82 percent of the intervals being spent in social interaction, this represents a mean decrease of 9.43 percent.

During baseline, Jessie's social interaction with other residents occurred in an average of 6.1 percent of the intervals in the exercise sessions. Little difference is seen when direct reinforcement is introduced for exercising, where she socially interacted in an average of 4.94 percent of the intervals (a decrease of 1.16 percent). Following the combination of the two groups, Jessie's social interaction declined to an average of 1.2 percent of the intervals, with Jessie refraining from any social interaction with other residents in a majority of the exercise sessions. When reinforcement was withdrawn for exercising and introduced for speaking to others, the percentage of intervals she was observed interacting with other residents rose dramatically to an average of 29.83 percent, with only one overlapping data point with the previous condition (an increase of 28.63 percent). A decreasing trend is noticed in the data after the 60th session. Shifting to the next condition on this downward trend was undertaken mainly due to time limitations imposed upon the study. However, the magnitude of the difference between the two means provides support that the experimental contingencies effected the change. When reinforcement for exercising was once again in effect, she immediately decreased her social interaction, engaging in interaction an average of 3.69 percent of the intervals.

Figure Caption

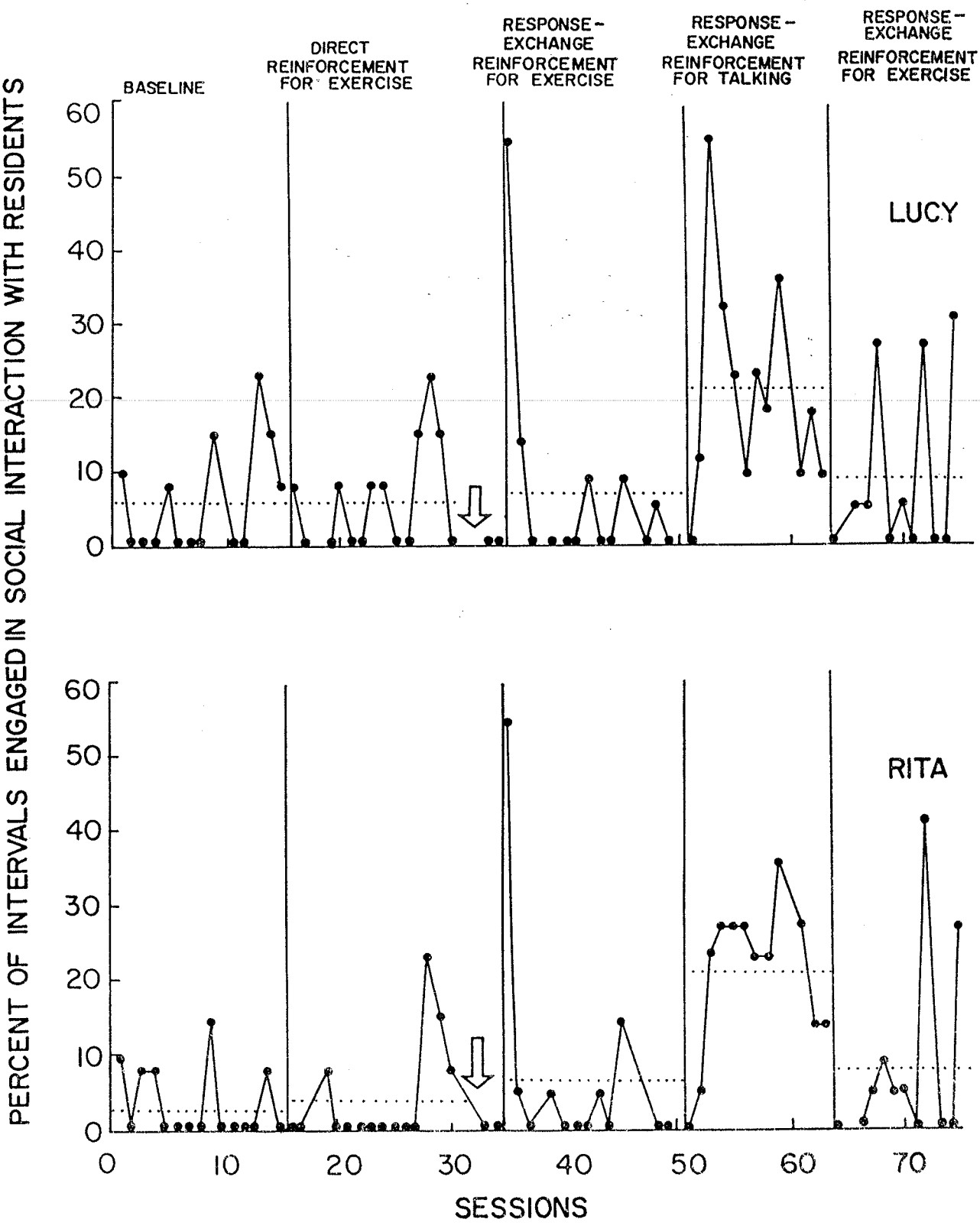
Figure 5. Percentage of intervals that Maggie and Jessie (Direct Reinforcement) engaged in social interaction with another resident during the 13 min exercise sessions. (The dotted line indicates the average percentage of social interaction for each experimental condition. The arrow indicates the session the two groups were combined.)


BASELINE
DIRECT REINFORCEMENT FOR EXERCISE
DIRECT REINFORCEMENT FOR TALKING
DIRECT REINFORCEMENT FOR EXERCISE
MAGGIE
JESSIE
PERCENT OF INTERVALS ENGAGED IN SOCIAL INTERACTION WITH RESIDENTS
SESSIONS
0
5
10
15
20
25
30
40
50
60
70

Direct and Response-exchange Reinforcement Condition. Figure 6 shows Lucy's and Rita's social interaction with other residents. During baseline, Lucy spent an average of 5.75 percent of the intervals socializing. Her data indicate very little change when reinforcement was introduced for exercising. Social interaction occurred an average of 6.03 percent of the intervals, a negligible increase of .25 percent. After the groups were combined, for the two sessions left during this phase, Lucy did not interact with any of the residents during the exercise sessions. This situation did not change, other then for the first session, when response-exchange reinforcement replaced the direct reinforcement for exercising. During the initial session, her partner initially remained standing in the middle of the track while Lucy continually lapped her. After passing her several times, Lucy locked arms with Rita and guided her around the track for several laps. Since this type of contact was considered part of social interaction, it was this factor which produced the elevated data point during this session. Lucy engaged in social interaction with other residents in an average of 6.99 percent of the intervals. Social interaction increased when response-exchange reinforcement for exercising was switched to response-exchange reinforcement for talking. Although there are some overlapping data points, social interaction occurred in an average of 20.49 percent of the intervals during the exercise

Figure Caption

Figure 6. Percentage of intervals that Lucy and Rita (Direct and Response-Exchange Reinforcement) engaged in social interaction with another resident during the 13 min exercise sessions. (The dotted line indicates the average percentage of social interaction for each experimental condition. The arrow indicates the session the two groups were combined.)


BASELINE
DIRECT REINFORCEMENT FOR EXERCISE
RESPONSE-EXCHANGE REINFORCEMENT FOR EXERCISE
RESPONSE-EXCHANGE REINFORCEMENT FOR TALKING
RESPONSE-EXCHANGE REINFORCEMENT FOR EXERCISE
LUCY
RITA
PERCENT OF INTERVALS ENGAGED IN SOCIAL INTERACTION WITH RESIDENTS
SESSIONS
0
10
20
30
40
50
60
70

sessions. This represents a 13.5 percent increase over the previous experimental condition. When response-exchange reinforcement was reintroduced for exercising, the intervals Lucy spent socializing returned to a level only slightly higher then that found in the initial condition where reinforcement was contingent on her partner exercising. During this last phase, she interacted socially with other residents in an average of 9.03 percent of the intervals. With only three overlapping data points with the previous phase, this represents a 11.46 percent decrease in the average intervals spent socializing during an exercise session.

Figure 6 also shows the amount of social interaction between Rita and other residents. During baseline relatively little time was spent socializing with other residents (an average of 3.23 percent of the intervals) in the exercise sessions. Her social interaction did not change when direct reinforcement was made contingent on exercising. A sharp increase in the data during the 28th session, rapidly declines in subsequent sessions, stabilizing at 0% after the two groups were combined, a situation comparable to that found in a majority of the exercise sessions during this phase. This general decline may be due to the fact that when the groups were combined, the larger number of residents made the sessions more closely resemble the environment on the ward (i.e., the presence of a large number of residents) where contingencies for passive behavior were in

effect. The increase during the 28th session was the result of Lucy guiding Rita around the track. Rita was observed interacting with the residents in an average of 3.84 percent of the intervals, a minimal increase of .61 percent over that found in baseline. Like her partner's (Lucy's) data, Rita's social interaction changed minimally when response-exchange reinforcement for exercising replaced direct reinforcement for exercising, except for a dramatic and temporary increase in her social interaction during the initial session of this phase, when Lucy again guided her around the track. As was mentioned in the section concerning Rita's exercise behavior, Lucy guided Rita around the track a number of times, in baseline as well as the experimental phases. It is likely that the physical guidance given Rita by the experimenters to disentangle Rita from the track's ropes acted as a model for Lucy. While response exchange reinforcement was contingent on exercising, she interacted with other residents in an average of 6.64 percent of the intervals. When response-exchange reinforcement was made contingent on talking to others, the average percentage of intervals she was observed socially interacting with other residents rose to 20.46 percent. With only two overlapping data points, this represents an average increase of 13.82 percent. Upon the reintroduction of response-exchange reinforcement for exercising, Rita immediately limited her social interaction with other residents, averaging interaction

in 8.24 percent of the intervals. Although there are two overlapping data points, this reflects a 12.22 percent decrease in her social interaction. The two high points are due to her partner's guidance around the track.

Generalization Measures

The measures of generalization of social interaction are expressed in percentage of intervals engaged in social interaction with other residents. Appendix C provides the data collected during the weekly 20 min probe in the Occupational Therapy room. Figures 7 to 9 present the social interaction data taken during a 10 min coffee break in the Ocupational Therapy room immediately after the the exercise sessions. The dotted lines provide an indication of the mean responses made during an observation period. Appendix D provides the samples of the subjects social interaction taken on the ward, four days a week.

Weekly Probes in the Occupational Therapy Room. Data collected during this time period (see Appendix C) shows that the social activity of all five subjects improved after the treatment program had been implemented. Maggie refused to attend, preferring to go to chappel a half hour earlier. No particular pattern of responding can be seen across the five subjects that could be attributed to changes associated with the exercise program. The fact that gradual improvement over all the sessions can be seen in a majority of the

subjects' data suggests the possiblity that these changes may be a function of the staff generated contingencies for passive behavior no longer having an effect in this setting. That is, initially residents passive behavior may have generalized from the ward to this new setting. However, since the contingencies for passive behavior were not in effect in this setting, the probability that passive behavior would occur in this setting gradually decreased. As well, residents had coffee during this time and any requests to another resident for sugar, milk, etc. were usually reinforced by other residents complying with this request. Thus social interaction would be reinforced.

Social Interaction After the Exercise Session. After the 20th session, it was noted that, following the exercise sessions, the subjects were socializing in the hallways on their way back to the wards. During these episodes there was no authority figure present, i.e, a dispenser of reinforcers, such as nursing staff or experimenters. It was possible, therefore, that the lack of generalization to the ward may have been a function of authority figures reinforcing passive behaviors. It was decided to create a new situation in which these contingencies were not present in order to obtain a less biased measure of social interaction in a non-training setting. Of course, at this date, no baseline measures could be taken, so evidence can not be provided as to the extent of change from their normal levels of social

interaction. However, at the point in time when these measures where undertaken, it was decided that it was still worth doing for the remaining reversal phases. As a consequence at the 27th session, the residents were brought to the Occupational Therapy room after the exercise session for a 10 min coffee break. Video equipment was used to record social interaction during this time period, eliminating the need for the presence of an observer, who might be considered an authority figure by the residents. Figures 7 to 9 present the percentage of intervals the subjects engaged in social interaction each day during the 10 min coffee break in the Ocupational Therapy room. The dotted lines indicate the mean social interaction during each experimental condition. Initial high levels of responding quickly dropped to a lower but still variable level during the coffee breaks that followed exercise periods where physical activity was reinforced (i.e., direct or response-exchange reinforcement of exercise behavior). After social activity became the target of reinforcement during the exercise sessions, all subjects increased their level of social interaction during the coffee breaks, although session to session variability was still present. Following the reintroduction of the physical activity contingencies in the exercise sessions, social interaction during the coffee breaks showed an overall decrease.

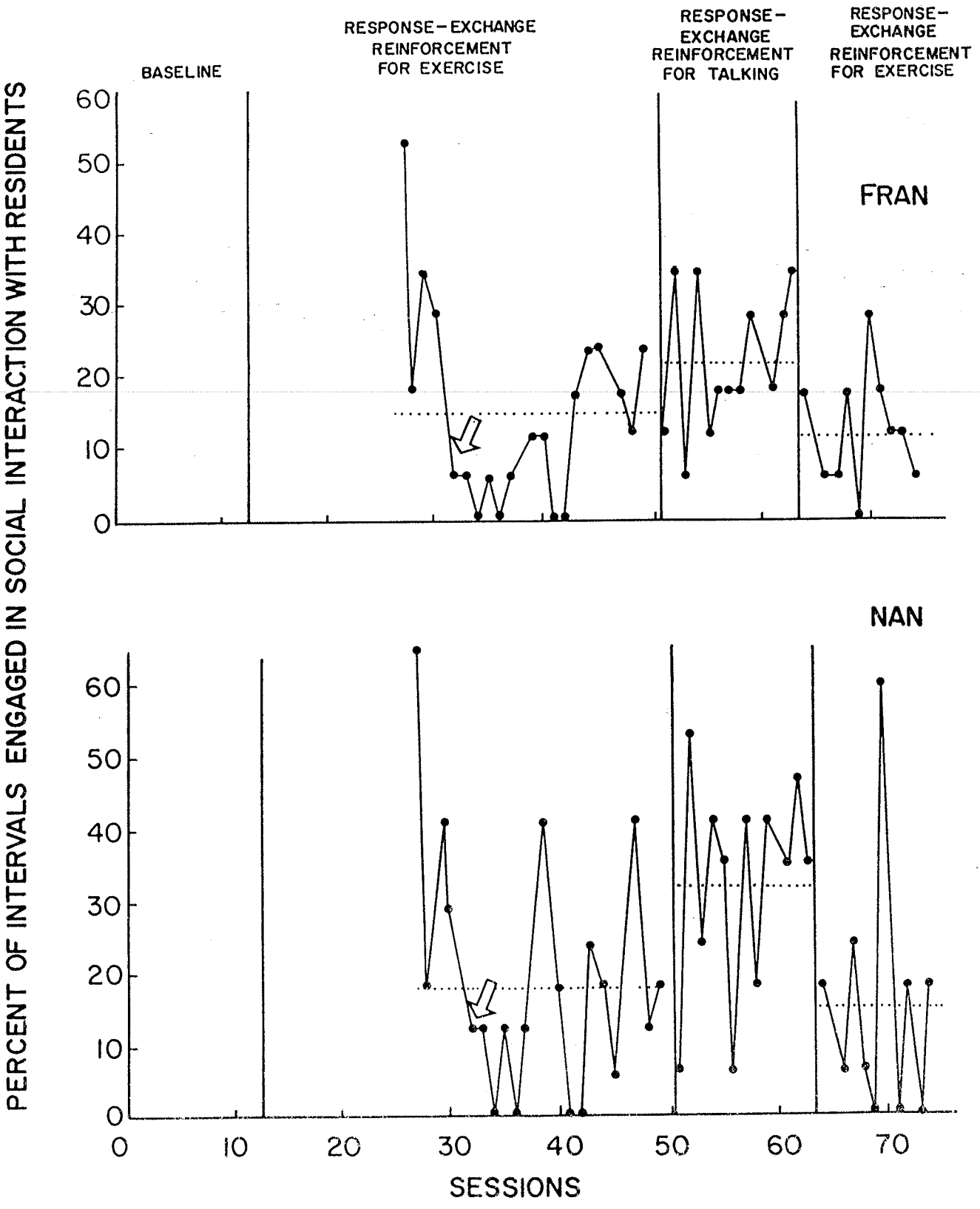
Figure 7 presents the social activity of Fran and Nan during the 10 min. coffee break after the training sessions. During the observation periods that followed the exercise sessions where she was receiving reinforcement for her partner's participation in a physical activity, Fran engaged in social interaction an average of 15.29 percent of the intervals. A slight overall increase is noted (to 22.06 percent) after the experimental conditions had changed to response exchange reinforcement of a social activity. A subsequent reduction in social interaction during the coffee breaks is noted when the experimental conditions in the exercise sessions had returned to response-exchange reinforcement of a physical activity.

Nan's data indicate a similar overall pattern of responding. Although the data are extremely variable there is an increase in her coffee break social interaction when the experimental condition changed from being contingent on a phsycal activity to a social activity (an average of 18.22 percent and 31.86 percent respectively). Reintroduction of the intial experimental conditions (response-exchange reinforcement for exercising) produced a reduction in overall social interaction during the coffee break observation period, to 14.71 percent.

Figure 8 presents Maggie's and Jessie's social interaction during the 10 min coffee breaks. Their data are remarkably similar to that of the previous two subjects.

Figure Caption

Figure 7. Percentage of intervals that Fran and Nan (Response-Exchange Reinforcement) engaged in social interaction with other residents during the 10 min coffee break (after the exercise session) in the Occupational Therapy Room. (The dotted line indicates the average percentage of social interaction for each experimental condition. The arrow indicates the session the two groups were combined.)


BASELINE
RESPONSE–EXCHANGE REINFORCEMENT FOR EXERCISE
RESPONSE–EXCHANGE REINFORCEMENT FOR TALKING
RESPONSE–EXCHANGE REINFORCEMENT FOR EXERCISE
FRAN
NAN
PERCENT OF INTERVALS ENGAGED IN SOCIAL INTERACTION WITH RESIDENTS
0
10
20
30
40
50
60
70
SESSIONS

Maggie's average level of social interaction during coffee breaks rose from 4.71 percent to 14.71 percent after the reinforcement contingencies in the exercise sessions changed from being contingent on a physical activity to a social activity. A subsequent drop in her coffee break social interaction (to an average of 7.06 percent) is noted when the experimental contingencies once again targeted a physical activity.

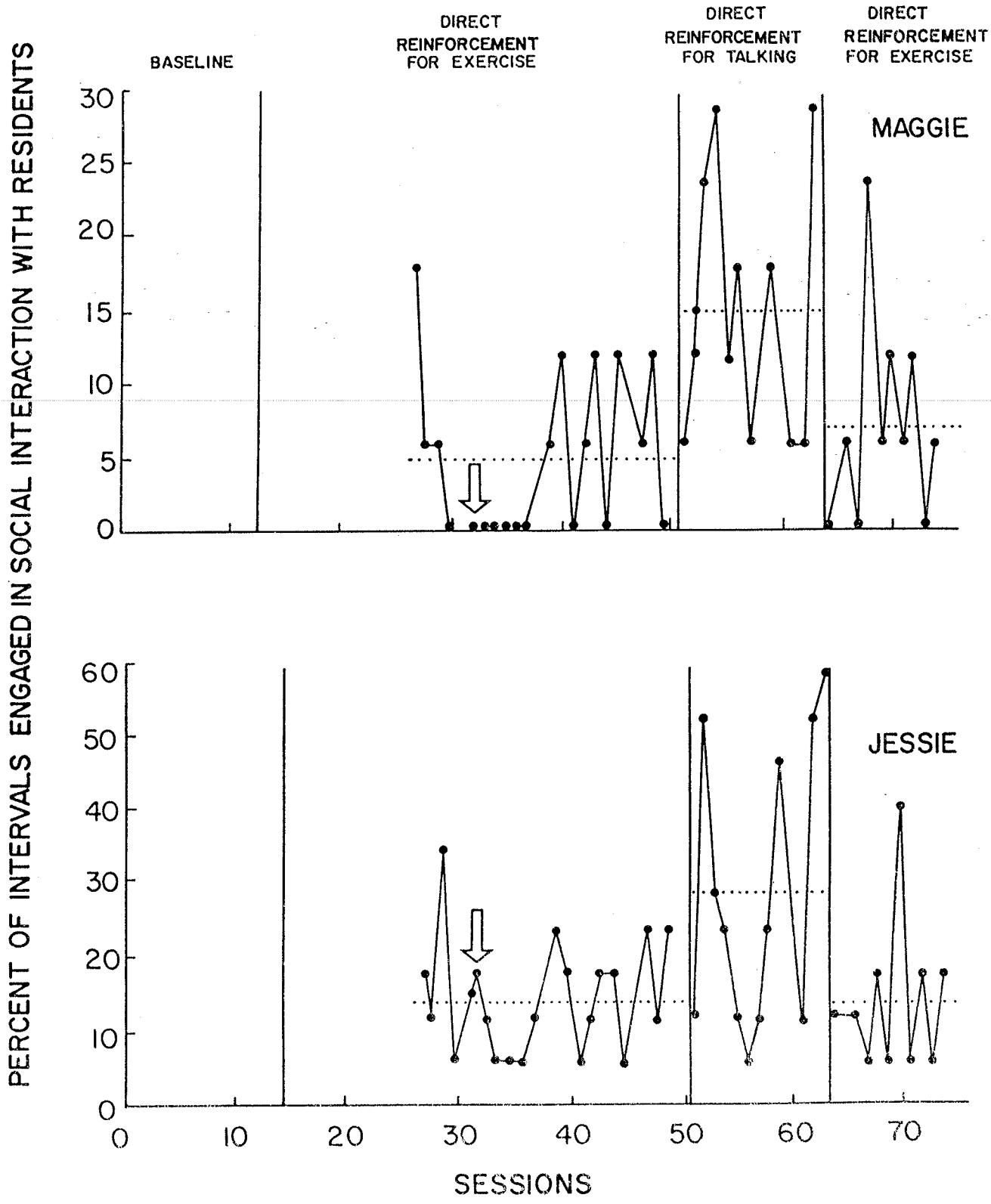
Jessie showed a similar increase in her coffee break social interaction when the experimental contingencies changed from targeting physical to social activities (an average of 14.41 percent to 28.92 percent). This decreased to an average of 14.12 percent when the experimental conditions once again involved direct reinforcement of a physical activity.

Figure 9 shows the results of observations of Lucy's and Rita's social interaction during the 10 min. coffee breaks. Lucy's and Rita's data show patterns of responding similar to the other subjects.

Lucy showed a drop in her coffee break social interaction during the initial coffee break periods which followed exercise sessions where she was receiving reinforcement for her own exercising. Her average social activity during this time period (17.65 percent) was slightly above that found when she began to receive reinforcement in the exercise sessions for her partner's physical activity (14.02 percent). She more than doubled her coffee break social interaction

Figure Caption

Figure 8. Percentage of intervals that Maggie and Jessie (Direct Reinforcement) engaged in social interaction during the 10 min coffee break (after the exercise session) in the Occupational Therapy Room. (The dotted line indicates the average percentage of social interaction for each experimental condition. The arrow indicates the session the two groups were combined.)


BASELINE
DIRECT REINFORCEMENT FOR EXERCISE
DIRECT REINFORCEMENT FOR TALKING
DIRECT REINFORCEMENT FOR EXERCISE
MAGGIE
JESSIE
PERCENT OF INTERVALS ENGAGED IN SOCIAL INTERACTION WITH RESIDENTS
SESSIONS
0
5
10
15
20
25
30
40
50
60
70

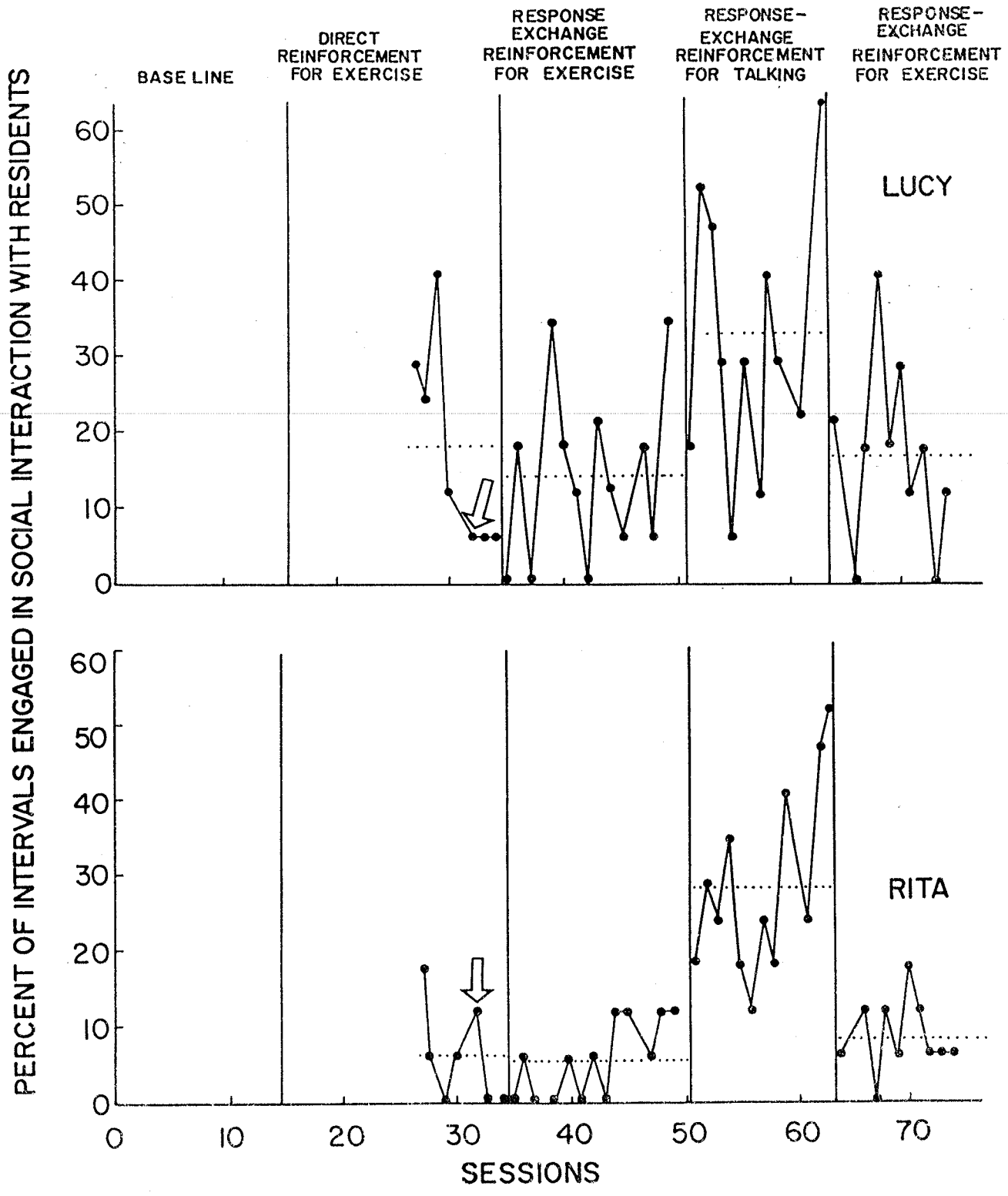
(to an average of 32.84 percent) after reinforcement during the exercise sessions was made contingent on her partner's social activity. This decreased to an average of 17.06 percent when the experimental conditions returned to response-exchange reinforcement of a physical activity.

Little difference is noted in Rita's coffee break social interaction during experimental phases where reinforcement was continent on her own physical activity (an average of 5.88 percent) or her partner's physical activity (an average of 5.43 percent). A sharp increase was noted in her overall social activity during coffee breaks (to an average of 28.43 percent) after the experimental conditions had changed to reinforcement of her partner's social activity. Again a reduction in overall coffee break social interaction (to 8.24 percent) was noted when the experimental conditions returned to response-exchange reinforcemnt of a physical activity.

Social Interaction On the Ward. An examination of the data collected on the subjects' social activity on the wards indicates that there are no significant changes in the amount of time five of the six subjects spent interacting with other residents (see Appendix D). Throughout over 90% of the observation periods, these five subjects typically did not socialize with an other resident at all. Maggie, whose data is not presented, had no opportunity to socialize because during this time period she was always sitting by

Figure Caption

Figure 9. Percentage of intervals that Lucy and Rita (Direct and Response-Exchange Reinforcement) engaged in social interaction during the 10 min coffee break (after the exercise session) in the Occupational Therapy Room. (The dotted line indicates the average percentage of social The arrow indicates the session the two groups were combined.)


BASE LINE
DIRECT REINFORCEMENT FOR EXERCISE
RESPONSE EXCHANGE REINFORCEMENT FOR EXERCISE
RESPONSE-EXCHANGE REINFORCEMENT FOR TALKING
RESPONSE-EXCHANGE REINFORCEMENT FOR EXERCISE
LUCY
RITA
PERCENT OF INTERVALS ENGAGED IN SOCIAL INTERACTION WITH RESIDENTS
SESSIONS
0
10
20
30
40
50
60
70

herself in the chappel waiting for the services to begin. Nan was the only resident to demonstrate any improvement in terms of an overall increase in resident directed social interaction. Her data, although extremely variable, suggest that her overall social interaction improved after she began to receive reinforcement for her partner's behavior during interaction for each experimental condition. the exercise sessions. However, no definite statements can be made attributing the changes to treatment. The improved level of social interaction continued through until the end of the program, as did the intervention procedures. Thus there was no return to baseline with the comcommitent opportunity to see changes in her behavior on the ward when the treatment program was withdrawn. As well, Nan was the only resident to show such a change in her behavior. Thus, the lack of replication over subjects does not support positive statements concerning generalization. One factor that should be noted, however, is that Nan's baseline level of social interaction differed dramatically from the other residents baseline levels. Of the five other subjects, social interaction did not occur or occurred during only one observation period. In comparison, Nan's interactions occurred quite consistently over the observation periods during baseline, usually involving another resident who visited Nan in her room. When such behavior exists, it can be trapped by existing contingencies in the environment. Much of the im-

provement in social interaction is associated with a greater frequency of visits to the lounge area where she participated in an ongoing card game, (48 percent of the treatment sessions versus 16.67 percent of the sessions during baseline).

Activity Level

Appendix E presents the daily activity level of all subjects. Activity level was measured in actometer units for an 8 hr period a day. The data suggest that, for four of the subjects there was no improvement in their overall activity level. Any day to day fluctuations were well within baseline levels. Readings were unavailable for Maggie since she refused to wear an actometer. Nan's activity level differed slightly from the other subjects. Her data reflect an increasing trend in activity over the baseline period which continued when the intervention program was introduced. A decreasing trend was observed over the last four data points in this condition. The decreasing average of the last two phases as well as the increasing trend in baseline, suggests that the increased activity level may be a function of factors other than the experimental variables. For example, as was mentioned when reporting her social interaction on the ward Nan began to spend a greater amount of time in the lounge. Traveling to and from the lounge would entail more activity on her part.

DISCUSSION

The results will first be addressed in terms of the effects of the operant procedures on the disengaged elderly's activity level. After consideration of this issue, the relation of the operant procedures to the social interaction of the residents will be discussed both from the perspective of the group as a verbal community and from the perspective of those subjects under the response-exchange contingency of reinforcement.

Exercise

The results clearly demonstrate that the two operant procedures were effective in controlling the residents' participation in a vigorous physical activity such as a walking exercise program. The residents showed marked improvement each time direct or response-exchange reinforcement was made contingent on the physical activity of walking. For two of the residents, who initially had moderate exercise levels, this increase meant that they were able to achieve the first stage of Cooper's (1970) progressive walking exercise program (1/2 mile). This is in marked contrast to their exercise level found during the baseline period or when reinforcement (both direct and response-exchange) was contingent

on participation in a social activity (talking to others). These findings are consistent with the behavioral literature regarding similar exercise programs with a younger population and with results of the stationary bicycling program with geriatric residents in the Libb et al. study (1969). Participation in a vigorous activity such as an exercise program is of particular benefit to the disengaged inactive elderly because of the resulting positive, physiological changes.

The actometer readings, however, indicate that the increased levels of gross motor activity were limited to the exercise sessions. Residents' daily activity levels did not vary substantially from periods when they were exercising to periods where they spent the exercise sessions sitting in small groups talking together. It becomes obvious, therefore, that while operant procedures can radically alter the activity level of the disengaged elderly within a training setting, the stimulus control exerted by the contingencies within the training program and those found in the resident's natural setting differ so much that little generalization takes place to other periods of time.

Social Interaction

The Verbal Community. Little support was found for the assumption that reinforcing disengaged elderly for exercising in close proximity to other residents results in the

side effect of increased social interaction between residents while they exercised. As a group (i.e., a verbal community), during periods where exercise was targeted for reinforcement, levels of resident to resident socializing during exercise sessions did not differ dramatically (if at all) from baseline levels.

There are at least two possible reasons why such social behavior did not occur. First, the disengaged may lack the necessary social behaviors that typically classify a verbal community. However, that the disengaged elderly have the social skills within their behavioral repertoire is evident from the dramatic increase in social interaction when residents were reinforced for speaking to others. As well, observation of social interaction during coffee breaks in the Occupational Therapy room indicated that the residents were capable of socializing during periods when they were receiving reinforcement for exercising.

A second possibility for the lack of social interaction during exercise sessions, is that exercise is a behavior incompatable with socializing. Individual physical characteristics and limitations strongly influenced the rate of walking that fulfilled that criterion. As a consequence, residents typically walked at different rates creating a situation were they seldom walked in proximity to other residents for more then a few seconds.

Although this lack of social interaction appears to be inconsistent with the anecdotal reports in the literature, of the occurrence of social interaction during exercise sessions, it is possible that such interaction occurred either before or after a subject exercised. For example, in the Stamford et al. (1974) study, they reported that part of the socializing involved greetings and farewells. As well, although they were reported as exercising in a group, the exercise program involved walking on a tread-mill. Since only one subject could use the machine at a time, the other subjects in the group were free to socialize. The present research measured social interaction immediately after the exercise sessions, when it was noticed that the residents were socializing in the hallways following the exercise sessions. As a consequence, no baseline levels were available for this time period. As such, these observations provided evidence only that the subjects were socializing after the exercise sessions and did not demonstrate that participation in the group exercise program was the factor that generated such social interaction. Further research should be directed towards evaluating this notion. That the training sessions have some affect on behavior during the period immediately after the sessions is demonstrated by the greater amount of socializing during periods when talking was reinforced.

Observations on the ward showed that the residents did not interact with each other or with other residents

throughout the entire program, indicating that different stimulus control is operating on the wards than in the Occupational Therapy room. Since no staff (nor any other authority figure) was present during the coffee breaks after exercising, reinforcement for passive behavior was not available. This, of course, was not the case on the ward.

Response-Exchange Contingencies of Reinforcement. The response-exchange reinforcement contingency was not any more successful than direct reinforcement in facilitating social interaction when the behavior involved was walking. Causual observations provide some evidence as to why these subjects (Fran, Lucy and their partners Nan and Rita) did not attempt to control each others exercise behavior through social interaction so that they might to maximize the opportunity of receiving reinforcement. First the partners' of both Lucy and Fran very seldom came in contact with this contingency since both Lucy and Fran usually walked the mininum number of laps required for their partners to receive reinforcement. Thus, Rita and Nan had no need to attempt to control their partners' behavior. Further research directed towards evaluating this procedure should control for this factor by raising the criterion such that the situation creates more of a demand for the partners to control each others behavior. Secondly, on those occasions when Fran's and Lucy's partners did not walk to criterion, Fran and Lucy indeed attempted to control their partners' behavior but used re-

sponse modes other than social interaction with their partner. For example, they would ask the experimenters to "make" their partner exercise more or would ask for a different partner.

It is interesting to note that an interactional hierarchy emerged during the periods when talking was the target behavior for reinforcement. The majority of the resident-resident social interaction was with Lucy and was usually initiated by her. At the beginning of this phase she encouraged and physically prompted the other residents to exercise. For example, during one session she went from resident to resident pulling them out of their chairs, while admonishing them to walk. It is likely that during these initial sessions she had not come under control of the contingencies for talking. During the latter part of this phase, her "cheer leading" was directed towards the verbal behavior of the other residents. For example, telling the residents that if they talked to each other they would get tokens and that if they talked to her she would talk to them. This was especially prominant with her diad partner, Rita. While the resident-resident social interaction of the other diad was primarily with Lucy, the frequency of any remaining social interaction was usually with each other (see Appendix B). This was not the case with Jessie and Maggie, who distributed their remaining interactions amongst all residents. Thus, two factors seemed to influence whom the

residents talked to, first the modeling and prompting of Lucy, and secondly, the contingency under which they were receiving reinforcement. The response-exchange contingency can, therefore, generate social interaction between diad members when the target behavior focused on for reinforcement is talking.

Generalization. The actometer readings indicated that the activity of the residents did not generalize to settings other then the training setting. That is they tended to be inactive regardless of whether they were in baseline, being reinforced for exercising or for talking. However, the maintenance and generalization of this behavior was to be programmed for by the creation of a common group of individuals who would reinforce each other for engaging in this behavior. As can be seen, the creation of this socially reinforcing group did not occur. So in fact, in terms of generalization and maintenance, the training procedure became more one of "train and hope" (Stokes & Baer, 1977).

Perhaps a more efficient way to program for generalization would be to insure greater stimulus control over the exercise behavior during the exercise sessions, and then transfer those stimuli to the natural setting. Although one would expect that the presence of the other residents (especially their partners in the case of a diad) would act as effective discriminative stimuli for increased activity, one must first acknowledge that the researchers were by far

greater predictors of the delivery of reinforcers for exercising and as such probably were more effective as discriminative stimuli then the presence of the other residents. Since the residents were likely to be present when staff reinforced passive behavior, or at least, when exercise behavior was not reinforced, their presence could not act as an effective discriminative stimulus. Thus, it becomes apparent that in order to use residents in as discriminative stimuli outside of the training setting, it is imperative that reinforcement be available for the target behavior, and that it is delivered in the presence of the peers. Further research should be directed towords this possibility.

In summary, the present research demonstrated that the relatively low levels of activity associated with institutionalized disengaged elderly can be changed using operant procedures. This is of particular benefit to the elderly, since continued inactivity can accelerate the normal deterioration found with aging. However, the research also points out that extensive examination of the factors involved in such procedures are necessary in order to program for generalization and maintenance. It appears that neither having the individuals exercise in proximity or under a response-exchange reinforcement contingency, are sufficient in and of themselves to develop a socially reinforcing verbal community that can be used to maintain the exercise behavior outside of the training setting.

Of particular interest, however, is the demonstration that social interaction is best programmed for by targeting this behavior for reinforcement. In fact, it is only when such behavior is the focus of training that any generalization to other settings is noted. It can be concluded therefore that, while enhancing both activity and socializing is important for the disengaged elderly, each must be explicitly programmed. In addition, in order to assure generalization to other settings and maintenance over time, arrangements must be made to ensure that contingencies for such behaviors exist in the natural environment.

REFERENCES

Adams, G.M. & de Vries, H.A. Physiological effects of an exercise regimen upon women aged 52 to 79. Journal of Gerontology. 1973, 28, 50-55.

Baer, D.M. & Wolf, M.M. The entry into natural communities of reinforcement. In R. Ulrich, T. Sachnik, & J. Malory (Eds), Control of Human Behavior: Vol II. Glenview, Illinois: Scott, Foreman, 1970.

Baltes, M.M. & Lascomb, S.L. Creating a healthy institutional environment for the elderly via behavior management: the nurse as a change agent. International Journal of Nursing Studies, 1975, 12, 5-12.

Barry, A.J., Daly, J.W., Pruett, E.D.R., Steinmetz, J.R., Page, H.F., Birkhead, N.C., & Rodahl, D. The effects of physical conditioning on older individuals. I. Work capacity, circulatory-respiratory function, and work electrocardiogram. Journal of Gerontology. 1966, 21, 182-191.

Birjandi, P.F., & Sclafani, M.J. An interdisciplinary team approach to geriatric patient care. Hospital & Community Psychiatry, or Mental Hospital, 1973, 24, 777-778.

Blackman, D.K., Howe, M., & Pinkston, E.M. Increasing participation in social interaction of the institutionalized elderly. Gerontologist, 1976, 16, 69-76.

Bonner, C.O. Rehabilitation instead of bed rest? Geriatrics, 1969, 24, 109-118.

Buccola, V.A., & Stone, W.J. Effects of jogging and cycling programs on physiological and personality variables in aged men. The Research Quarterly, 1975, 46, 134-139.

Burnside, I.M. Loneliness in old age. Mental Hygiene, 1971, 55, 391-397.

Cautela, J. Behavior Analysis for Clinical Intervention. Champaign, Illinois; Research Press Company, 1977.

Comstock, R.L., Mayers, R.L., & Folsom, J.C. Simple physical activities for the elderly. Hospital and Community Psychiatry, 1969, 20, 377-380.

Cooper, K.H. The New Aerobics. New York: Bantam Books, 1970.

Cooper, K.H. Personal Communication, March 25, 1981.

Cooper, K.H., & Cooper, M.S. Aerobics for Woman. New York: M. Evans and Co., 1972.

Cuff, G.N., & Martin, G.L. Desireable social interaction in a pair of retarded girls as a side effect of a back-scratching contingency for reinforcement for picture naming. Unpublished manuscript 1974

Cuff, G.N., & Martin, G. Generalization of social interaction as a function of a backscratching contingency of reinforcement with severly retarded girls. Unpublished manuscript, University of Manitoba,1975.

Cumming E., & Henry, W.E. Growing Old-The process ofDisengagement. New York: Basic Books Inc., 1961.

Cunningham, C.E., & Barkley, R.A. The interactions of normal and hyperactive children with their mothers in free play and structured tasks. Child Development, 1979, 50, 217-224.

de Lerma Salter, C., & Salter, C.A. Effects of an individualized activity program on elderly patients. The Gerontologist, 1975, 404-406.

de Vries, H.A. Exercise intensity threshold for improvement of cardiovascular respiratory function in older men. Geriatrics, 1971a, 26, 94-101.

de Vries, H.A. Physiological effects of an exercise training regimen upon men aged 52 to 88. Journal of Gerontology, 1970 25, 325-336.

de Vries, H.A. Prescription of exercise for older men from telemetered exercise heart rate data. Geriatrics, 1971b, 26, 102-111.

de Vries, H.A. Physiolgoy of exercise and ageing. In Gar, H.S. (Ed) , Health Care of the Elderly. New York: Lesnoff Caravaglis Press, 1980.

de Vries, H.A. Physilogy of exercise and aging. In Aging: Scentifica Perspectives and Social Issues. D.S. Woodruff & J.E. Birren (Eds.). New York: D. Van Nostrand Co., 1975.

Dishman, R.K. Aerobic power, estimation of physical ability, and attraction to physical activity. Research Quarterly, 1978. 49, 285-292.

Epstein, L.H., & Wing, R.R. Behavioural approaches to exercise habits and athletic performance. In J. Ferguson & C.B. Taylor (Eds), Advances in Behavioral Medicine. New York; Spectrum, 1980.

Epstein, L.H., Wing, R.R., Thompson, J.K., & Griffin, W. Attendance and fitness in aerobics exercise. Behavior Modification, 1980, 4, 465-479.

Frekany, G.A., & Leslie, D.K. Effects of an exercise program on selected flexibility measurements of senior citizens. The Gerontologist, 1975, 182-183.

Greendorfer, S.L. Role of socializing agents in female sport involvement. Research Quarterly, 1977, 48, 304-310.

Hoyer, W.J., Kafer, R.A., Simpson, S.C., & Hoyer, F.W. Reinstatement of verbal behavior in elderly mental patients using operant procedures. The Gerontologist, 1974, 149-152.

Hoyer, W.J., Mishara, B.L., & Riebel, R.G. Problem behaviors as operants. Gerontologist, 1975, 15, 452-456.

Johnston, J.M., & Johnston, G.T. Modification of consonant speech-sound articulation in young children. The Journal of Applied Behavior Analysis, 1972, 5, 233-246.

Kavanagh, T., Sheppard, R.J., Doney, H., & Pandit, V. Intensive exercise in coronary rehabilitation. Medical Science Sports, 1973, 5, 34-39.

Kazdin, A.E. Methodological Strategies in behavior-therapy researach. In G. Wilson & C. Franks (Eds), Contemporary Behavior Therapy. New York: The Guilford Press, 1982, pp. 403-444.

Keefe, F.J., & Blumentahal, J.A. The life fitness program: A behavioral approach to making exercise a habit. Journal of Behavior Therapy and Experimental Psychiatry, 1980, 11, 31-34.

Kraus, H., & Raab, W. Hypokinetic Disease,. Springfield, Illinois: Charles C. Thomas Pub., 1961.

Lavouvie-Vief, G., Hoyer, W.J., Baltes, M.M., & Baltes, P.B. Operant analysis of intellectual behavior in old age. Human Development, 1974, 17, 259-272.

Lewinsohn, P.B., & MacPhillamy, D.J. The relationship between age and engagement in pleasant activities. Journal of Gerontology, 1974, n, 290-294.

Libb, J.W., & Clements, C.B. Token reinforcement in an exercise program for hospitalized geriatric patients. Perceptual and Motor Skills, 1969, 28, 957-958.

MacDonald, M.L. Environmental programming for the socially isolated aging. The Gerontologist, 1978, 18, 350-354.

MacDonald, M.L., & Butler, A.K. Reversal of helplessness: producing walking behavior in nursing home wheelchair residents using behavior modification procedures. Journal of Gerontology, 1974, 29, 97-101.

McClannahan, L.E. Therapeutic and prosthetic living environments for nursing home residents. The Gerontologist, 1973, 13, 424-429.

McClannahan, L.E., & Risley, T.R. Design of living enviroments for nursing home residents: recruiting attendance at activities. The Gerontologist, 1974, 14, 236-240.

McClannahan, L.E., & Risley, T.R. Design of living environments for nursing-home resiendts; Increasing participation in recreation activities. Journal of Applied Behavior Analysis, 1975, 8, 261-268.

Martin, G., & Pear, J. Behavior Modification: What it is and how to do it. Englewood Cliffs, N.J.: Prentice Hall, Ltd., 1978.

Mueller, D.J., & Atlas, L. Resocialization of regressed elderly reidents: a behavioral mangement approach. Journal of Gerontology, 1972, 27, 390-392.

Patterson, R.L., & Jackson, G.M. Behaviour modification with the elderly, In (Eds), Progress in Behaviour Modification. :Academic Press Inc., 1980.

Powers, R.B., & Powers, E. Responding of retarded children on a backscratch contingency of reinforcement. Psychological Aspects of Disability, 1971, 18, 27-34.

Quattrocki-Turbin, S., & Jason, L.A. Enhancing social interactions and activity among the elderly through stimulus control. Journal of Applied Behavior Analysis, 1980, 13, 159-164.

Rachlen, H. Behavior and Learning. SanFrancisco: W.H. Freeman & Co., 1976.

Rincover, A., & Koegel, R.L. Setting generality and stimulus control in autistic children. Journal of Applied Behavior Analysis, 1975, 8, 235-246.

Rodahl, K., Birkhead, N.C., Blizzard, J., Issekutz, B., & Pruett, E.D. Physiological changes during prolonged bedrest. In G. Blix, (Ed), Nutrition and Physical Activity. Stockholm; Almquist & Wilsell, 1967.

Saltin, B. Blomquist, G., Mitchel, J.H., Johnson, R.L., Wildenthal, K., & Chapman, C.B. Response to exercise after bed rest and after training. American Heart Association Monograph #23. New York: The American Heart Association, 1968.

Schwartz, B. Psychology of Learning and Behavior. New York: W.W. Nortan and Co., Inc., 1978.

Shephard, R.J. Physical Activity and Aging. : Croon Helm Ltd., 1978.

Skinner, B.F. Contingencies of Reinforcement. New York: Appleton-Century-Crofts, 1969.

Sommer, R. Ross, H. Social interaction on a geriatrics ward. International Journal of Social Psychiatry, 1958, 4, 128-133.

Stalonus, P.M., Johnson, W.G., & Christ, M. Behaviour modification for obesity: The evaluation of exercise contingency management and program adherence. Journal of Consulting and Clinical Psychology, 1978, 45, 463-469.

Stamford, B.A., Hambacher W., & Fallica, A. Effects of daily physical exercise on the physical state of institutionalized geriatric mental patients. Research Quarterly, 1974, 45, 34-41.

Stokes, T.F., & Baer, D.M. An implicit technology of generalization. Journal of Applied Behavior Analysis, 1977, 10, 349-367.

VanHouten, R., Hill, S., & Parsons, M. An analysis of a performance feedback system: The effects of timing and feedback, public posting, and praise upon academic performance and peer interaction. Journal of Applied Behavior Analysis, 1975, 8, 449-457.

Williams, L., Martin, G., & Abrami, D. The comparative effects of a backscratch contingency of reinforcement and backscratch verbal feedback on social interaction in two diads of severely retarded children. Unpublished manuscript, University of Manitoba, 1974.

Williams, L., Martin, G.L., MacDonald, S., Hardy, L., & Lambert, L. Effects of a backscratch contingency of reinforcement for table serving on social interaction with severely retarded girls. Behavior Therapy, 1975, 6, 220-229.

Wysocki, T., Hall, G., Iwata, B., & Riordan, M. Behavioral Management of exercise: Contracting for aerobic points. Journal of applied Behavior Analysis, 1979, 12, 55-64.

Appendix A

MEDICAL CONDITIONS THAT PROHIBIT EXERCISE

1. Moderate to severe coronary heart disease that causes chest pain with minimal activity.
2. Recent heart atack.
3. Severe disease of the heart valves.
4. Congenital heart disease.
5. Greatly enlarged heart resulting from high blood pressure or other types of progressive heart disease.
6. Severe heartbeat irregularities.
7. Uncontrolled sugar diabetes which fluctuates between too much and not enough blood sugar.
8. High blood pressure not controlled by medication.
9. Obesity, if more than 35 pounds overweight.
10. Any infectious disease in its convalescent or chronic stage.
11. Internal bleeding, recently or in the past.
12. Kidney disease, chonic or acute.
13. Anemia.
14. Acute or chronic lung disease that causes breathing difficulty.
15. Blood vessel disease of the legs that produces pain when walking.

16. Arthritis in the back, legs, feet or ankles, requiring frequent medication to relieve the pain.
17. Convulsive disease not completely controlled with medication.

Appendix B

Total Percentage of Resident-Resident Social Interaction and Percentage Directed Towards Each Resident During Exercise Sessions

	Baseline					
Subject Directed To	Subject					
	Fran	Nan	Maggie	Jessie	Lucy	Rita
Total	00.0	00.0	00.0	03.3	03.3	01.8
Fran	--	00.0*	00.0			
Nan	00.0*	--	00.0			
Maggie	00.0	00.0	--			
Jessie				--	1.5	0.9
Lucy				01.5	--	0.91*
Rita				00.6	01.2*	--
Resident	00.0	00.0	00.0	01.2	00.6	00.0

	Response-Exchange Reinforcement for Exercise		Direct Reinforcement for Exercise				Response Exchange Reinforcement for Exercise	
Subject Directed To	Subject							
	Fran	Nan	Maggie	Jessie	Lucy	Rita	Lucy	Rita
Total	00.1	00.8	00.2	02.2	03.1	02.0	09.8	09.1
Fran	--	00.0*	00.0	00.0			00.4	00.4
Nan	00.1*	--	00.2	00.2			00.0	00.0
Maggie	00.0	00.0	--	00.2			00.0	00.0
Jessie	00.0	00.1	00.0	--	00.9	00.3	00.4	00.4
Lucy	00.0	00.6	00.0	01.7	--	00.9*	--	07.0*
Rita	00.0	00.1	00.0	00.2	01.1*	--	08.4*	--
Resident	00.0	00.0	00.0	00.0	01.1	00.9	00.7	01.4

	Response-Exchange Reinforcement for Talking		Direct Reinforcement for Talking		Response-Exchange Reinforcement for Talking	
Subject Directed To	Subject					
	Fran	Nan	Maggie	Jessie	Lucy	Rita
Total	20.5	32.6	20.2	29.9	20.8	20.4
Fran	--	09.9*	01.1	02.3	01.1	00.4
Nan	03.8*	--	01.1	01.1	00.8	00.4
Maggie	01.5	01.1	--	00.8	00.5	01.1
Jessie	08.7	02.3	00.8	--	04.1	01.9
Lucy	02.3	18.2	17.2	23.9	--	16.7*
Rita	00.4	00.4	00.0	01.9	12.9	--
Resident	00.0	00.8	00.0	00.0	00.4	00.0

	Response-Exchange Reinforcement for Exercise		Direct Reinforcement for Exercise		Response-Exchange Reinforcement for Exercise	
Subject Directed To	Subject					
	Fran	Nan	Maggie	Jessie	Lucy	Rita
Total	00.8	01.2	00.8	03.7	09.1	08.3
Fran	--	00.0*	00.0	00.0	00.4	00.0
Nan	00.0*	--	00.0	00.4	00.0	00.0
Maggie	00.0	00.0	--	00.4	00.0	00.0
Jessie	00.0	00.4	00.0	--	01.2	00.4
Lucy	00.8	00.8	00.8	02.3	--	07.4*
Rita	00.0	00.0	00.0	00.0	07.4*	--
Resident	00.0	00.0	00.0	00.0	00.0	00.4

NOTE: * indicates absence of resident

Appendix C

Percent Of Intervals Subjects Engaged In Social Interaction During Weekly Probes In The Occupational Therapy Room

	Condition									
	Baseline Session	Response-Exchange Reinforcement for Exercise Sessions					Response-Exchange Reinforcement For Talking Sessions			Response Exchange-Reinforcement for Exercise Sessions
Subject	3	4	5	6	8	9	11	12	13	14	15
Fran	00.0	30.0	00.0	05.0	59.0	00.0	00.0	13.5	13.5	18.0	17.5
Nan	00.0	10.0	10.0	11.0	77.0	27.0	23.0	06.0	27.0	04.5	*

	Baseline Session	Direct Reinforcement for Exercise Sessions					Direct Reinforcement for Talking Sessions			Direct Reinforcement for Exercise Sessions	
Subject	3	4	5	6	8	9	11	12	13	14	15
Jessie	00.0	10.0	10.0	00.0	68.0	40.5	04.5	*	35.0	27.0	35.5

	Baseline Sessions	Direct Reinforcement For Exercise Sessions			Response-Exchange Reinforcement For Exercise Sessions		Response-Exchange Reinforcement For Talking Sessions			Response-Exchang Reinforcement For Exercise Sessions	
Subject	3	4	5	6	8	9	11	12	13	14	15
Lucy	00.0	20.0	00.0	00.0	63.5	13.5	18.0	09.0	00.0	00.0	13.5
Rita	00.0	10.0	20.0	05.0	63.5	13.5	32.0	36.0	22.5	10.0	31.5

NOTE: * indicates absence of resident.

Appendix D

Mean Percent Of Weekly Social Interaction Engaged In By Subjects On The Ward

	Condition															
	Baseline Sessions			Response-Exchange Reinforcement For Exercise							Response-Exchange Reinforcement For Talking Sessions			Response-Exchange Reinforcement For Exercise Sessions		
Subject	1	2	3	4	5	6	7	8	9	10	11	12	13	13	14	15
Fran	00.0	05.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0
Nan	35.0	18.8	00.0	18.8	62.5	37.5	41.7	31.3	75.0	25.0	50.0	50.0	75.0	00.0	62.5	50.0

	Baseline Sessions			Direct Reinforcement For Exercise Sessions							Direct Reinforcement For Talking Sessions			Direct Reinforcement For Exercise Sessions		
Subject	1	2	3	4	5	6	7	8	9	10	11	12	13	13	14	15
Jessie	00.0	10.0	00.0	00.0	00.0	00.0	00.0	00.0	12.5	12.5	00.0	00.0	00.0	00.0	62.5	50.0

	Baseline Sessions			Direct Reinforcement For Exercise Sessions				Response-Exchange Reinforcement For Exercise Sessions				Response-Exchange Reinforcement For Talking Sessions			Response-Exchange Reinforcement For Exercise Sessions		
Subject	1	2	3	4	5	6	7	7	8	9	10	11	12	13	13	14	15
Lucy	10.0	35.0	50.0	25.0	43.0	56.3	41.7	25.0	50.0	08.3	16.7	50.0	50.0	25.0	25.0	25.0	50.0
Rita	12.5	00.0	06.3	12.5	00.0	12.5	08.3	25.0	06.3	12.5	12.5	00.0	00.0	00.0	25.0	12.5	00.0

Appendix E

Mean Weekly Actometer Units

	Condition															
	Baseline Sessions			Response-Exchange Reinforcement for Exercise								Response-Exchange Reinforcement For Talking Sessions			Response-Exchange Reinforcement For Exercise Sessions		
Subject	1	2	3	3	4	5	6	7	8	9	10	11	12	13	13	14	15
Fran	020	406	328	241	259	277	280	216	225	291	282	319	186	186	427	245	261
Nan	079	155	234	298	252	245	251	220	257	291	197	157	242	156	123	191	223

	Baseline Sessions			Direct Reinforcement For Exercise Sessions							Direct Reinforcement For Talking Sessions			Direct Reinforcement For Exercise Sessions		
Subject	1	2	3	4	5	6	7	8	9	10	11	12	13	13	14	15
Jessie	025	039	042	038	033	027	036	025	024	025	027	020	029	021	019	024

	Baseline Sessions			Direct Reinforcement For Exercise Sessions				Response-Exchange Reinforcement For Exercise Sessions				Response-Exchange Reinforcement For Talking Sessions			Response-Exchange Reinforcement For Exercise Sessions		
Subject	1	2	3	4	5	6	7	7	8	9	10	11	12	13	13	14	15
Lucy	063	106	073	047	056				082	067	070	094	068	110	057	095	147
Rita	015	030	043	016	037	038	054	053	028	094	057	037	043	036	013	024	022