PERFORMANCE ON A MOTOR-SKILL TASK AS A FUNCTION OF LOCUS OF CONTROL AND CONTINGENCY OF REINFORCEMENT.

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PERFORMANCE ON A MOTOR-SKILL TASK AS A FUNCTION
OF LOCUS OF CONTROL AND CONTINGENCY OF REINFORCEMENT

by

Michael John Uriel

M. A. University of Windsor, 1972

A Dissertation
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ABSTRACT

The construct of internal versus external control of reinforcement (Rotter, 1954, 1966) is meant to distinguish individuals according to their perceptions of the relationship between their behaviour and reinforcement. Internals are those individuals who feel that their behaviours are instrumental in obtaining reinforcements.Externals, on the other hand, attribute outcomes to factors beyond their control such as fate, luck or the influence of powerful others.

It has been hypothesized that internals and externals will prefer and perform better in situations where the occurrence of reinforcement is congruent with their perceptions of how reinforcers are generally obtained (Watson & Bauml, 1967). Thus, internals would be expected to perform better in situations of contingent reinforcement while externals would be expected to perform better in situations of non-contingent reinforcement. These hypotheses have been subsumed under what has been termed a congruency principle concerning the performance of internals and externals.

In this study, the pursuit-rotor performance of internals and externals was tested under conditions of contingent social reinforcement, non-contingent social reinforcement, and no social reinforcement. Amount of reinforcement was balanced in the social reinforcement conditions, and knowledge-of-results (time-on-target scores) was available to subjects in all reinforcement conditions. Subjects were given sixteen trials on the pursuit-rotor. No social reinforce-
was administered during the first four trials (block 1). The dependent measure was the degree of improvement on blocks 2, 3 and 4, relative to scores on block 1.

Hypotheses pertaining to the congruency principle were not confirmed. Internals did not improve to a greater degree when given contingent rather than non-contingent reinforcement, and externals did not improve more in the non-contingent as compared to the contingent reinforcement condition.

Other hypotheses of the study concerned the performance of internals and externals in conditions of social reinforcement versus knowledge-of-results only. It was hypothesized that externals in both social reinforcement conditions would improve more than externals who were given only knowledge-of-results. This hypothesis was partially supported in that externals in the non-contingent social reinforcement condition improved more than externals in the knowledge-of-results only condition \(p < .05\). Also, in the knowledge-of-results only condition, internals improved more than externals, although the difference was only marginally significant \(p < .10\). The relatively poor performance of externals when given only objective feedback was discussed in relation to previous similar findings. Suggestions were presented concerning means of enhancing the self-esteem of externals, in order to make them less dependent on the approbation of others.
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CHAPTER I
INTRODUCTION

A great number and variety of personality theories have been put forth which have attempted to describe and explain human behaviour and have done so in relatively intuitive terms. Few personality theories have included constructs that could be operationally defined and tested with respect to their value in predicting human behaviour. One theory which is exceptional in this regard is the social learning theory of personality, developed by Julian Rotter and his students (Rotter, 1954, 1966). In describing key concepts of his theory such as reinforcement value and expectancy, Rotter (1954) also suggested means of measuring them and combining them in a formula which could be used to predict behaviour in specified situations. Reinforcement value in Rotter's system refers to the degree of a person's preference for a particular reinforcement to occur given a choice of potential alternative reinforcements. Expectancy, on the other hand, refers to the probability held by an individual that a particular reinforcement will occur as a function of a specific behaviour by that individual in a given situation.

Social Learning Theory - An Integration of Reinforcement and Cognitive Theories

In describing the foundations of his theory, Rotter (1975)
states that social learning theory is an "attempt to integrate two
diverse but significant trends in American psychology - the stimulus-
response, or reinforcement, theories on the one hand and the cognitive,
or field, theories on the other" (p. 57). An aspect of this attempted
integration is exemplified in Rotter's definition of reinforcement.
Rotter defines reinforcement not only in terms of its effect in strength-
ening immediately preceding behavior, but also in terms of its effect
in heightening an expectancy that a "particular behavior...will be
followed by (that) reinforcement in the future" (Rotter, 1954, p. 2).
Thus, both an expectancy construct and an empirical law of effect are
used in Rotter's social learning theory.

Having added the concept of expectancy to the Skinnerian defini-
tion of reinforcement, it became necessary for Rotter to investigate
the relationship between reinforcement and expectancy in different
situations. Thus, early investigations by Rotter and his students
(Phares, 1957; James & Rotter, 1958; Rotter, Liverant & Crowne, 1961)
set out to specify the conditions under which reinforcement would have
a good deal of, or little, impact on an individual's expectancy for
future reinforcements. These early studies revealed that such factors
as the nature of an experimental task and the nature of instructions
given to subjects influenced expectancies to a greater degree when
these factors emphasized skill rather than chance as the main deter-
minant of performance. Patterns of reinforcement were also found to
be important in influencing subjects' expectancies. For example,
consistent patterns of reinforcement were found to have more effect
on subjects' expectations for future reinforcement than did patterns
of reinforcement perceived by subjects as being random (Blackman, 1962).

Generalizing the latter finding from the laboratory to patterns of reinforcement experienced as a child, Rotter hypothesized the development of fairly stable individual differences in generalized expectancy of reinforcement. These differences presumably would reflect a person's history of learning experiences, for example, whether reinforcement had consistently followed certain behaviours or whether similar behaviours sometimes met with reinforcement and sometimes resulted in punishment. Rotter (1954) theorized that such different experiences would lead to individual differences in the perception of the relationship between behaviour and reinforcement.

To encompass his idea of individual differences in generalized expectancy of reinforcement, Rotter (1966) developed the construct of locus of control, and the "Social-Reaction Inventory" was used as a measure of locus of control. High scorers on the "Social-Reaction Inventory" are said to have an external locus of control in that they attribute outcomes to factors beyond their control, such as fate, luck or the influence of powerful others. Low scorers (internals) on the other hand feel that the reinforcements they obtain are due to the effort they have invested in some situation. Internals can be said to have a generalized expectancy that their behaviour and efforts will be successful in securing reinforcements, while externals have no such expectancy. Since externals are thought to have no expectancy that their behaviour will be instrumental in obtaining reinforcement,
it has been hypothesized (Watson & Baumal, 1967) that they will prefer and show higher performance levels in situations where reinforcement is contingent on chance factors. Internals, in contrast to this, are thought to prefer and perform better in skill situations where reward is contingent on their efforts.

The above hypotheses assume a congruency principle. This principle asserts that internals will generally prefer and perform better in situations where the occurrence of reward is congruent with their personal expectations of control over reward. Externals, according to the congruency principle, will prefer and perform better when the occurrence of reward is congruent with their generalized expectancy of not having control over reinforcements. There is some evidence (Rotter & Mulry, 1965; Watson & Baumal, 1967) in support of hypotheses derived from a congruency principle. The overall evidence, particularly as it relates to performance variables, will now be considered.

**Congruency Principle -- Review of the Literature**

Watson and Baumal (1967) obtained results consistent with a principle of congruency. They used a paired-associate learning task and informed subjects that the paired-associates learned would be instrumental later in avoiding shock (skill condition) or that shock would be administered at random intervals (chance condition). Results showed that externals made more errors in the skill condition where instructions had led them to believe that reinforcement (shock avoidance) was to be contingent on what had been learned while internals made more errors in
the chance condition where instructions had stipulated that reinforcement was not to be contingent on previous learning. In interpreting their results, Watson and Baumal (1967) suggest that internals and externals may have experienced anxiety or a "non-facilitative level of motivation" (p. 214) in the conditions non-congruent with their general expectancies. Thus, Watson and Baumal suggest, in contrast to Rotter and Mulry (1965), that both internals and externals are more motivated in non-congruent situations.

However, speculation as to the motivation of externals and internals in situations congruent or incongruent with their general expectancies seems premature. Investigators should first attempt to conclusively demonstrate that consistent differences in task performance will result when externals and internals are given reinforcement under skill or chance conditions. Thus far, experimental data pertaining to performance variables has been inconsistent with respect to supporting or disconfirming the congruency principle. For example, while Watson and Baumal (1967) found that both externals and internals made more errors in situations incongruent with their general expectancies, Stafford (1972) found no between-group differences due to incongruence, either of locus of control and task instruction or locus of control and manner of reinforcement (contingent or non-contingent).

Results of a study by Petzel and Gynther (1970) not only fail to confirm, but are contradictory to what might be expected according to a congruency principle. In the Petzel and Gynther experiment, internals and externals were required to solve anagrams after having been given
instructions that performance on the task was either skill or chance-
determined. Success attained in solving the anagrams was the only
source of reinforcement available to subjects. Under these condi-
tions, externals solved more anagrams when given skill instructions
while internals solved more anagrams under instructions stating that
performance was chance-determined.

The results obtained by Petzel and Gynther are contrary to hy-
potheses derived from a congruency principle; such results high-
light the inconsistency in experimental findings relevant to tests of
the principle. There are various possible reasons for the inconsistent
results obtained thus far. Variations in experimental tasks, task
conditions and nature of reinforcement administered may account for
some of the inconsistent findings. Another more basic reason may lie
in the fact that investigators are often not successful, through their
manipulations of tasks or task instructions, in establishing the de-
sired conditions of psychological congruence or incongruence between
subjects' generalized expectancies and the (experimental) situational
expectancy. To be specific, subjects may not believe an experimenter's
instructions that a task is either skill or chance-determined or they
may actually convert an experimental situation from one of chance to
one in which skill plays an important role. A study conducted by
Ducette and Wolk (1973) suggests that subjects are quite capable of
altering an experimental situation in this way.

In the Ducette and Wolk experiment, subjects were required to
guess whether an A or a B was printed on a card being held by the ex-
perimenter. Subjects in the skill condition were told that a non-verbal cue would be emitted by the experimenter which would indicate whether an A or a B was printed on the card, while subjects in the chance condition were simply told that the task involved primarily luck. Ducette and Wolk found that internals performed significantly better than externals in the card-guessing game under both skill and chance conditions. To answer the question of why internals performed better than externals in a condition ostensibly determined by chance alone, Ducette and Wolk suggest that internals may have discovered methods to change the situation from one of chance to one of skill. Internals, who are thought to prefer situations in which they are in control, may have discovered cues (unconsciously emitted by the experimenter) to help them guess which card was being held.

Thus, there may be a problem in testing a congruency principle by comparing the performance of internals and externals on chance tasks. Internals may actively seek out cues and perhaps often be successful in finding ways of converting (experimentally-defined) chance situations into situations where they have a better-than-chance probability of giving correct answers. Externals presumably are more likely to accept a chance situation without seeking to gain control over it.

In the Ducette and Wolk study, both the nature of the task and instructions given subjects were manipulated. Most tests of the congruency principle, however, have simply varied instructions for a single task. This creates a problem, though, of finding tasks
that have an equal likelihood of being viewed as either chance or skill-determined. In addition to this problem, one must consider that the locus of control of subjects may be more important in determining how the task will be perceived (skill or chance) than any instructions given. For example, internals, consistent with their generalized expectancy, may perceive a task as involving skill regardless of instructions given. Therefore, variation in instructions given for a single task may not be a valid test of whether internals will perform better under "skill conditions" while externals do better under "chance conditions." The problems inherent in using different instructions for a single task may account (in part at least) for the inconsistent results obtained in tests of the congruence principle.

A way of circumventing the above problems in testing the congruence principle is to use a single task and also not vary the instructions given. Skill versus chance conditions can then be set up simply by reinforcing subjects contingent on some criterion of their performance or independently of their performance (non-contingent, random or chance reinforcement). Making reinforcements contingent or non-contingent on performance allows the aspect of psychological incongruence to be under the experimenter's control. For example, reinforcement given irrespective of performance would be inconsistent or incongruent with an internal's general expectancy. This approach contrasts with previous studies (e.g., Petzel & Gynther, 1970) where psychological incongruence depended on subjects' believing instructions that a task was either skill or chance-dependent.
Establishing Conditions of Contingent and Non-Contingent Social Reinforcement as a Means of Testing the Congruency Principle

The problem then for the present study relates to an investigation of the congruency principle, while avoiding difficulties which stem from using different tasks or altering instructions for a single task. To test the principle of congruency, the performance of internals and externals under contingent and non-contingent reinforcement conditions was evaluated. Contingency versus non-contingency was defined in relation to performance level. Stafford (1972) also used performance level as a basis for reinforcing subjects in a contingent or non-contingent manner. However, she informed subjects before they began performing the particular task that they would be rewarded (with money) for a certain level of performance or that they would be given money regardless of their performance. Subjects were rewarded after performance on the task. The Stafford study did not really assess the effects of contingent versus non-contingent reinforcement on performance, instead it examined the effects on performance of informing subjects beforehand about the specific contingency condition they would be working under. In the present study, social reinforcement was administered contingently or non-contingently during the acquisition of a motor-skill task. Thus, the effects of variations in manner of reinforcement could be evaluated in terms of subsequent changes in performance. To make the contingent or non-contingent nature of reinforcement more apparent to subjects and thereby perhaps strengthen the effects due to these conditions, all subjects in this study were pro-
vided objective feedback regarding performance. Knowledge-of-results was therefore available in each of the two social reinforcement conditions and also in a third (control) condition in which no social reinforcement was administered.

The performance variable in this study was time-on-target scores for a pursuit-rotor motor-skill task. Using a motor-speed rather than a motor-skill task, Pawlicki (1972) has previously shown that contingent social reinforcement resulted in better performance among children than non-contingent social reinforcement. The present study differs from Pawlicki's not only in that a motor-skill task was used, but also in that the effects of manipulating contingency were examined using two groups of adult subjects who differ in their perceptions of reinforcement contingencies. A study such as this which examines the interactive effects of specified treatment conditions applied to different groups of subjects has been termed an investigation of aptitude-treatment interaction (Bracht, 1973).

**Incentive Value of Social Reinforcement to Internals and Externals**

Since social reinforcement in the form of supportive comments was used in this study, the question arose as to whether internals and externals would respond differently to this form of reinforcement, regardless of contingency condition. There is evidence which suggests that social reinforcement has greater incentive value for externals than for internals. Some researchers who have suggested that externals are motivated primarily by social-approval type reinforcement are Baron and Ganz (1972) and Baron, Cowar, Ganz and McDonald (1974).
These investigators found that externals who received social reinforcement for correct responses on a discrimination task performed better than externals who were in a condition involving simply self-discovery of results. There is additional evidence which indirectly supports the idea that externals need social reinforcement in order to perform optimally. For example, there are findings that external locus of control is negatively correlated with self-esteem (Heaton & Duerfeldt, 1973), that externals have less self-confidence than internals (Joe, 1971), and that externals, relative to internals, are deficient in the use of self-reinforcement (Bellack, 1972; 1975).

Predictions Pertaining to Internals and Externals in Conditions of Contingent- and Non-Contingent Social Reinforcement

From the principle of congruency and from the postulate that social reinforcement has greater incentive value for externals than for internals, a number of hypotheses can be derived. The congruency principle leads to the following hypotheses:

1. Internals will show greater improvement in performance with contingent than with non-contingent social reinforcement.

2. Externals will show greater improvement in performance with non-contingent than with contingent social reinforcement.

Since social reinforcement is thought to have higher incentive value for externals than for internals, interaction effects between reinforcement condition and locus of control are predicted. Specifically, it is expected that:

3. In the social reinforcement conditions, externals will show
greater improvement in performance than internals. In the
knowledge-of-results only condition, internals will show
more improvement than externals.

4. Externals are expected to show greater improvement in
performance in both social reinforcement conditions than in
the knowledge-of-results only condition.
CHAPTER II

METHOD

Subjects

The sample consisted of 207 female students, drawn from undergraduate psychology classes at the University of Windsor. Subjects obtained one experimental credit point for participation in the study. Of the total sample, 90 subjects were selected for participation in the experiment proper, that is, performance on the pursuit-rotor. These 90 subjects ranged in age from 17 to 51. The mean age of subjects with an internal locus of control was 21.9, while the mean age of externals was 20.6.

Design

A 2 x 3 x 3 factorial design was employed, with repeated measures on the last factor. The factors and the levels of each are listed below.

Factor A: locus of control, internal versus external control.

Factor B: reinforcement condition, that is, contingent social reinforcement, non-contingent social reinforcement, no social reinforcement.

Factor C: blocks, four blocks of four trials each. (The main analysis of variance, however, was applied only to data for the last 3 blocks, during which reinforcement conditions were administered. The use of re-
sidual gain scores (see Method of Analysis) made this approach possible.

In order to evaluate the effects of Factor B (reinforcement condition) it was important to control the amount of social reinforcement administered to groups in which contingency was manipulated. Therefore, in each locus of control group, subjects were yoked for contingent and non-contingent reinforcement conditions. Each subject in the non-contingent condition was a member of a yoked pair who received the same number of supportive comments as the other member of the yoked pair in the contingent reinforcement condition.

Questionnaires

a) The Social Reaction Inventory (Rotter, 1966), more commonly known as the l-E scale, was used as a measure of locus of control (see Appendix A). Subjects, however, were classified as internals and externals on the basis of responses to a nine-item sub-scale of the total l-E scale. The reasons for using this sub-scale to classify subjects, rather than using scores derived from the total scale, stem from certain inadequacies of the latter. While the total l-E scale has been shown to have adequate discriminant validity (Rotter, 1966) and reliability (Hersch & Schiebe, 1967), it has been subject to considerable criticism for its lack of internal consistency. Specifically, there is evidence that the l-E scale measures two uncorrelated factors (Mirels, 1970; Abramowitz, 1973; Reid & Ware, 1973). For example, Mirels (1970) performed a factor analysis of the l-E scale and found clusters of items with loadings of ±.30 on two distinct factors. The
two dimensions discovered in Mirels' factor analysis have since been termed social system control and fatalism (Reid & Ware, 1973). The social system control (SSC) dimension seems to contrast feelings that people may have with respect to being able versus being unable to exert control over socio-political institutions. Fatalism items seem to reflect beliefs that outcomes are either (a) determined by personal effort and responsibility, or (b) chance determined.

A study by Abramowitz (1973) revealed that the item clusters found by Mirels for fatalism and social system control (SSC) are "sufficiently distinct to demonstrate discriminant validity" (p. 198). Abramowitz obtained a significant correlation between the SSC factor and a measure of political activism. However, the measure of political activism did not correlate significantly with scores on the Mirels' fatalism sub-scale, nor with total scores on the Rotter scale. From his findings, Abramowitz concluded that the 'researcher who relies on a global Rotter I-E scale score...appears to be combining variation on two independent dimensions of one's sense of mastery' (1973, p. 201).

The idea that items of the fatalism and SSC sub-scales measure independent dimensions is further supported by the low correlation (r = 0.18) which has been found to exist between the two sub-scales (Reid & Ware, 1973). With such a low correlation between the sub-scales, people may respond in a predominantly internal manner to fatalism items and with an external attitude (no feeling of control) on SSC items and a few other general items with low factor loadings.
A consequence in such a case might be that a subject would be classified as an external when he is in fact an internal in the sense of feeling that personal effort determines outcomes. To avoid the possibility of such mis-classification of subjects, the fatalism sub-scale, which was considered more relevant to the purposes of this study, was used as the basis for classifying subjects on the locus of control dimension. Nine items found by Mirels (1970) to have loadings of $\geq .30$ on the fatalism factor were used. This nine-item fatalism sub-scale (see Appendix B) has been tested previously and found to have an internal consistency (alpha) coefficient of .68 (Abramowitz, 1973) or .74 when corrections are made for a scale of 20-item length (Reid & Ware, 1973). The fatalism sub-scale can thus be considered to be fairly reliable, when reliability is defined in terms of internal consistency. There is no evidence pertaining to the test-retest reliability (stability) of the fatalism sub-scale. Internal consistency, however, is the more important indicator of a scale's reliability since stability in test scores is more a function of the trait or construct being measured than it is a function of the measuring instrument (Morf, 1974).

b) A post-experimental questionnaire (see Appendix C) was used to obtain subjects' self-evaluations of their pursuit-rotor performance and their reactions to the experimental procedures.

**Apparatus**

A pursuit-rotor (Lafayette Instrument Co., Model 30014) was used. The rotor was connected with a trial timer (Lafayette, Model
58010) and an electronic counter to record time-on-target scores (Hunter Mfg., Model 120A Klockcounter). Time-on-target in milliseconds was registered on the counter when the stylus which subjects held made contact with a rotating target light, which shone through the upper glass surface of the pursuit-rotor.

On the desk at which the experimenter was seated was an intertrial timer (Dimco-Gray Co., Model 171).

Procedure

The I-E scale was administered to subjects during their regularly scheduled class sessions. The test was explained to subjects as one which examined people's feelings about important life events. Instructions for the test were briefly reviewed with subjects. They were told to answer test items according to their subjective beliefs and were given approximately a half-hour to complete the scale. Following the administration of the test forms, scores were computed for the total scale and for the fatalism sub-scale. The median score for the total (23 item) scale was 11.5. The median of the fatalism sub-scale was found to be 4.4. Those subjects with scores falling in the mid-range (middle 12%) of the distribution on the fatalism sub-scale were excluded from further participation in the study. This was done in order to more clearly differentiate subjects according to their beliefs regarding locus of control. Subjects scoring in the middle of the distribution cannot be accurately classified as either internals or externals since the distribution of scores on the I-E scale tends to approximate a normal curve (Rotter, 1975). The mean (on
fatalism) of internal control subjects who participated in the experiment was 1.67, while the mean of the external control subjects was 6.40.

Subjects in each of the two locus of control groups were randomly assigned to one of three experimental conditions - contingent social reinforcement, non-contingent social reinforcement, or no social reinforcement. Fifteen subjects per treatment condition were used. Within the contingent and non-contingent reinforcement conditions, subjects were paired (yoked) on a random basis. All the work pertaining to the assignment of subjects to treatment conditions was carried out by a research assistant who then prepared for the experimenter a list with subjects' names, phone numbers and treatment condition, but no indication of their score on the I-E scale.

Approximately two weeks after completing the I-E test forms, subjects were contacted by telephone to arrange a time for participation in the experiment. They were informed that the participation time required of them would be approximately one half-hour.

When subjects appeared for the pursuit-rotor test procedure, they were seated at a carrel-like desk on which the pursuit-rotor was placed. Just above them, on a shelf, was a .001 second interval timer. Subjects were informed that the experiment was designed to determine how practice and individual differences affect performance on a perceptual-motor task.

The pursuit-rotor was set at a constant speed of 60 revolutions per minute. Each subject was given one practice trial and precise
instructions as to how to "read" the interval timer, which indicated
time on target after any given trial. Following the practice trial,
the experimenter verified each subject's ability to correctly "read"
the interval timer; when necessary, he reiterated the explanation
of how to "read" the time on target. On subsequent learning trials,
subjects were asked to read the interval timer on their own and check
it after each trial to get an idea of how long they were able to keep
the stylus on target. In addition to the practice trial, 16 trials
were given on the pursuit-rotor, each trial lasting 30 seconds with a
twenty-second interval between trials. The specific instructions
given to subjects are listed verbatim in Appendix D.

During the pursuit-rotor performance of subjects, the experimenter
was seated behind and to the right of a subject, at a distance of ap-
proximately four feet. All subjects were informed when eight trials
remained, but otherwise the experimenter made no verbal comments while
subjects were performing, except for those supportive comments which
comprised the social reinforcement procedure. Supportive comments
spoken by the experimenter were as follows:

1) Good.

2) Okay. That was good.

3) Very good. Keep it up.

4) You're doing well.

5) Very good.

The above supportive comments were given only after trials four
through sixteen. Trials one to three inclusive were not reinforced.
thus time-on-target scores on trials one to four provided an index of pre-treatment differences among the groups against which subsequent differences in scores (during treatment trials) could be evaluated.

Since a motor-skill task was used in this study and since performance improves with practice on such a task, the contingency established took such improvement into account. In the contingent reinforcement condition, social reinforcement was administered only after an improvement of at least one second (in time-on-target) from one trial to the next. Results of a pilot study had suggested that reinforcing improvements was a good manner of operationally defining a contingency of reinforcement on the pursuit-rotor test. In the pilot study, a group given social reinforcement contingent on improvement from one trial to the next improved to a significantly greater degree than a group given social reinforcement on a non-contingent basis. However, in contrast to the present study, reinforcement in the pilot study was not contingent on an improvement of at least one second. Reinforcement in the pilot study followed any degree of improvement in time-on-target.

The manner of reinforcing subjects non-contingently in this study was quite simple. Each subject in a non-contingent condition was reinforced on the same occasions (trials) as the subject in the contingent reinforcement condition with whom she had been yoked. This procedure was followed except for those instances when reinforcement was clearly inappropriate in view of the subject's performance. For example, if a subject was performing at a very low level
(less than 3 seconds on target) and her time-on-target score was lower still on the next trial, reinforcement was not administered on that trial. Instead, reinforcement was administered, again following a decline in time-on-target score, at a later point when the subject's level of performance had increased somewhat. This deviation from the standard procedure for non-contingent reinforcement was exercised on only three occasions, that is, on one occasion for each of 3 subjects.

Subjects in the knowledge-of-results only condition received no spoken supportive comments. Their only potential source of reinforcement came from being able to view their time-on-target scores after each trial on the pursuit-rotor. Subjects in the social reinforcement conditions also had access to this feedback.

Following the performance of subjects on the pursuit-rotor, they were given a post-experimental questionnaire (see Appendix C) which included an item pertaining to self-evaluation of their pursuit-rotor performance. Subsequently, subjects were given a general description of characteristics of internal and external control respectively. They were thanked for their participation and informed as to where and when they could meet the experimenter for feedback as to their score on the I-E scale and a more detailed explanation of the purposes of the experiment.

Method of Data Analysis

In this study, an average of subjects' time-on-target scores was calculated for each four trials. These mean scores for each block of four trials provided the basic data for the study. Scores on blocks
2, 3 and 4, in which social reinforcement was administered, provided an index of each subject's improvement, under treatment, relative to her score on the first block of trials (in which no reinforcement was given). However, simple difference scores (e.g., \( \bar{X} \) Block 2 - \( \bar{X} \) Block 1) were not computed.

Rankin and Tracy (1965) point out many of the flaws inherent in the use of simple difference scores. One of the most obvious problems in the use of these scores stems from the fact that when a specific skill such as pursuit-rotor performance is being measured, individual differences in proficiency exist prior to the implementation of any treatment procedure. A consequence of such pre-treatment differences in proficiency is that those with high scores on initial trials will generally improve to a lesser degree than those who obtain low scores on early trials (Rankin & Tracy, 1965). Differences in improvement on some performance measure may then be more a function of initial performance level rather than a function of some treatment procedure.

Various methods are available to circumvent problems related to differing initial skill levels. Subjects' scores may be stratified according to scores (high versus low) obtained on early trials, an analysis of co-variance may be applied to the data with initial scores representing the co-variate (see Appendix E for results of this analysis) or residual gain scores may be computed. A residual gain score is an error of estimate score, - predicted scores are computed and are subtracted from observed values on the dependent variable. Once residual gain scores are obtained in this way, they can be sub-
jected to an analysis of variance. Since analysis of variance is a less complex model to work from than is analysis of co-variance, residual gain scores were used in this study to control for differences in initial level of pursuit-rotor proficiency. Another reason for using residual gain scores stems from the fact that with a factorial design such as that used in this study (that is, one combining between and within factors), specific comparison tests in particular become very complex when a co-variance model is used to analyze the data.

As described by Manning and Dubois (1958), residual gain scores "represent the difference between actual final proficiency and final proficiency predicted from initial status" (p. 191). With residual gain scores, initial differences in performance do not contaminate the measure of improvement in performance (Rankin & Tracy, 1965).

The use of residual gain scores requires converting all raw scores to standard-score form. With measurements represented in standard-score form, a regression equation to predict one variable from another may be expressed simply by \( z_y = rz_x \) (Ferguson, 1971, p. 114), where \( r \) is the correlation coefficient between the two variables, \( z_y \) is the predicted variable and \( z_x \) the predictor variable. In this study, \( z \)-scores on block 1 were the predictor variables and were multiplied by the correlations between block 1 and each of the subsequent criterion blocks in order to obtain predicted scores for blocks 2, 3 and 4. Residual gain (R.G.) scores were then obtained by subtracting the predicted scores from the obtained scores on blocks 2, 3 and 4. For example, in the case of block 2, \( \text{R.G.}_2 = z_2 - I_{12}z_1 \),
where $z_2$ represents an obtained score on block 2 and $\sum_{12}z_1$ represents a predicted score on block 2. In order to eliminate negatives, the residual gain scores were converted to $Z$-scores ($Z = A + Bz$) with a mean of 30 and a standard deviation of 10.
CHAPTER III

RESULTS

Interpretations of experimental data depend significantly on the reliability of the measures used. In this study, the pursuit-rotor time-on-target scores were quite reliable if judged by correlations obtained between scores on different blocks of trials. The correlation between scores on blocks 1 and 2 was .91; between blocks 1 and 3 was .84, and between blocks 1 and 4, the correlation was .80.

With respect to performance levels on the pursuit-rotor, it is apparent (see Figure 1) that externals as a group performed at a consistently higher level than internals across all blocks of trials. The obtained differences in mean scores, however, did not reach statistical significance at the .05 level. An analysis of variance carried out on the raw-score data (time-on-target scores) across all four blocks of trials revealed no significant main or interaction effects, except that due to blocks ($F = 62.09$, df = 3, 252; $p < .001$).

The effect due to blocks indicates that, with practice, the performance of all subjects improved significantly.

While overall performance levels of internals and externals were of some interest, the primary purpose of this study was to assess the response of internals and externals to the reinforcement conditions. Since social reinforcement was administered during blocks 2, 3 and 4, scores on these blocks of trials provided an index of each subject's
Figure 1. Mean Time-on-Target Scores of Internals and Externals across Four Blocks of Trials.
improvement relative to the score on the first block in which no reinforcement was given. As mentioned above, residual gain scores, which correct for differences in initial level of task proficiency, were calculated for each subject.

Table 1 provides a listing of group mean residual gain scores during blocks 2, 3 and 4. A $2 \times 3 \times 3$ analysis of variance was applied to the residual gain scores and a summary of this analysis is provided in Table 2. It is apparent from Table 2 that effects attributable to the locus of control dimension and to treatment (reinforcement conditions) are both negligible. Also, the interaction of reinforcement conditions by locus of control is not significant. However, the blocks by locus of control interaction is significant at better than the .05 level. This interaction is illustrated in Figure 2. Since residual gain scores were used in this study, the downward slope illustrated in Figure 2 reflects the fact that, on successive blocks of trials, scores obtained by internals declined (although not at a statistically significant level) in relation to scores they had been expected to obtain on the basis of their pre-treatment performance in block 1.

The data for the significant blocks by locus of control interaction was analyzed for simple effects. The tests for simple effects (Winer, 1962) revealed no significant differences between internals and externals at either block 2, 3 or 4. Also, the effect of blocks was non-significant for each of the specific levels of locus of control; that is, the residual gain scores of internals did not decrease significantly across blocks of trials nor did the residual gain scores
Table 1
Mean Residual Gain Scores and Standard Deviations for Each Group

<table>
<thead>
<tr>
<th></th>
<th>Contingent Social Reinforcement</th>
<th>Non-contingent Social Reinforcement</th>
<th>Knowledge-of-Results only</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Standard Deviation</td>
<td>Mean</td>
</tr>
<tr>
<td>Internals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Block 2</td>
<td>30.75</td>
<td>4.72</td>
<td>30.02</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>29.52</td>
<td>28.85</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>29.54</td>
<td>28.07</td>
</tr>
<tr>
<td>Externals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Block 2</td>
<td>30.66</td>
<td>4.35</td>
<td>30.17</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>30.67</td>
<td>31.85</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>30.14</td>
<td>32.87</td>
</tr>
</tbody>
</table>
Table 2
Analysis of Variance of Residual Gain Scores

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Subjects</td>
<td>7841.39</td>
<td>89</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal-External (I-E)</td>
<td>0.01</td>
<td>1</td>
<td>0.01</td>
<td>0.00</td>
</tr>
<tr>
<td>Reinforcement Condition</td>
<td>32.84</td>
<td>2</td>
<td>16.41</td>
<td>0.19</td>
</tr>
<tr>
<td>Reinforcement x I-E</td>
<td>402.08</td>
<td>2</td>
<td>201.04</td>
<td>2.28*</td>
</tr>
<tr>
<td>Error (Between Ss)</td>
<td>7406.46</td>
<td>84</td>
<td>88.17</td>
<td></td>
</tr>
<tr>
<td>Within Subjects</td>
<td>1739.71</td>
<td>180</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blocks</td>
<td>0.50</td>
<td>2</td>
<td>0.25</td>
<td>0.03</td>
</tr>
<tr>
<td>I-E x Blocks</td>
<td>60.24</td>
<td>2</td>
<td>30.12</td>
<td>3.11*</td>
</tr>
<tr>
<td>Reinforcement Condition x Blocks</td>
<td>14.44</td>
<td>4</td>
<td>3.61</td>
<td>0.37</td>
</tr>
<tr>
<td>Reinforcement Condition x I-E x Blocks</td>
<td>38.45</td>
<td>4</td>
<td>9.61</td>
<td>0.99</td>
</tr>
<tr>
<td>Error (Within Ss)</td>
<td>1626.08</td>
<td>168</td>
<td>9.68</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9581.10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .05.
Figure 2. Residual Gain Scores of Internals and Externals on Blocks 2, 3 and 4.

1 Averaged over Reinforcement Conditions.
of externals improve significantly across blocks. Although the tests for simple effects revealed no significant differences, the significant interaction effect nonetheless indicates a difference in the performance of internals and externals across blocks of trials, with the performance of externals tending to improve and that of internals tending to decline relative to predicted scores.

The congruency principle was not supported in this study. Between-group differences were in the direction predicted by the congruency principle in that internals did improve more under contingent social reinforcement than with non-contingent social reinforcement while externals improved more in the non-contingent than in the contingent social reinforcement condition. However, for both internals and externals, the differences obtained under the two contingency conditions did not reach required levels of statistical significance.

While the interaction of locus of control by reinforcement condition was not statistically significant, there did appear to be a trend towards an interaction effect (see Figure 3). Moreover, since a priori hypotheses concerning expected differences between particular groups had been formulated, specific comparison tests were carried out to determine whether differences in mean scores between these groups were statistically significant. The formula used to compare scores for particular groups was taken from Winer (1962, p. 344).

Externals in the non-contingent social reinforcement group were found to have obtained higher residual gain scores than externals in the knowledge-of-results only group ($F = 3.57$, $df = 1, 84$; $p < .05$).
Figure 3. Residual Gain Scores of Internals and Externals for each of Three Reinforcement Conditions.

1 Averaged over Blocks.
This result partially supports hypothesis 4 which stated that externals in both social reinforcement conditions would improve more than externals who received knowledge-of-results only. While externals in the contingent social reinforcement group also obtained higher residual gain scores than those who received knowledge-of-results only, the difference in this case was not statistically significant.

Since the F-ratio for the reinforcement condition by locus-of-control interaction was not significant, the importance of the finding that externals improved more with non-contingent social reinforcement than with only knowledge-of-results may be questioned. A secondary analysis that was done, however, suggests that the significant difference that was obtained did not occur by chance (see Appendix F).

The third hypothesis of this study predicted that externals in both social reinforcement conditions would improve to a greater extent than internals, while internals would improve more than externals in the knowledge-of-results only condition. Although results were in the directions predicted, the differences obtained between internals and externals in these reinforcement conditions were not statistically significant. The difference in degree of improvement between internals and externals in the knowledge-of-results only condition was marginally significant ($F = 2.69$, $df = 1.84$; $p < .10$), with internals improving more than externals.

It should be pointed out here that internals in both social reinforcement conditions received more supportive comments than did ex-
ternals. This occurred as a result of the fact that internals "earned" more supportive comments than did externals in the contingent reinforcement condition. Consequently, internals also received a greater number of reinforcing statements in the non-contingent condition since the latter was equated with the contingent condition for amount of reinforcement. The difference, however, in number of supportive comments received by internals and externals was non-significant. The mean number of supportive comments obtained by internals (in each reinforcement condition) was 3.73, while that for externals was 3.53 (t = 0.12, ns).

As an additional check, an analysis was done in order to determine whether any significant variations in the results would occur when internals and externals were equated for amount of reinforcement received. Since internals in each social reinforcement condition obtained 3 reinforcements more than externals in the same reinforcement condition, all internal and external-locus of control subjects who differed in amount of reinforcement obtained (by 3) were grouped in pairs. Of all possible pairs, one internal and one external subject in each social reinforcement condition was randomly dropped. Thus, the amount of reinforcement obtained by internals and externals was equated. For the knowledge-of-results only condition, one internal and one external were also randomly dropped in order to balance the number of subjects per group. An analysis of variance carried out with the data re-structured in this way (n = 14) showed results very similar to the previous analysis with 15 subjects per cell. More-
over, all significant effects obtained in the first analysis were retained when amount of reinforcement was equated (for internals and externals) in the social reinforcement conditions.

As mentioned previously, subjects in this study were categorized as internals or externals on the basis of scores on a nine-item sub-scale (fatalism) of the total I-E scale. The analysis of variance was originally carried out with subjects classified in this way. A subsequent analysis of variance using subjects classified on the basis of responses to the total I-E scale was carried out and failed to reveal any main or interaction effects that approached levels of significance. Specific comparison tests, however, showed that externals in the contingent reinforcement condition improved more than externals given only knowledge-of-results ($F = 3.52, \text{df} = 2,66; p < .05$). Also, externals given non-contingent reinforcement improved more than those given only knowledge-of-results, but the difference in this case was significant only at the .10 level.

The above results are somewhat different from those obtained when subjects were classified according to scores on fatalism. For one thing, the significant blocks by locus of control interaction was not obtained when subjects were classified according to total scale score. However, with subjects in the middle of the distribution being eliminated, fewer subjects were used in the analysis of data with subjects classified on the basis of total I-E score. Therefore, one cannot definitely state that more significant and psychologically more meaningful results were obtained when fatalism
scores were used to classify subjects on the locus of control dimension. One can, however, say that with the fatalism sub-scale, results were obtained which were consistent with previous findings (e.g., Baron et al. 1974) in which the total I-E scale was used to classify subjects. Moreover, considering the internal consistency of the fatalism sub-scale, the task of interpreting results is facilitated, at least from the viewpoint of having a coherent picture of the psychological characteristics of subjects.

In this study, the psychological characteristics of subjects were thought to be important in determining their self-evaluations of performance. This opinion stemmed from the fact that the pursuit-rotor represented a new task for subjects and they had no objective basis on which to evaluate their performance. In a post-experimental questionnaire, subjects were therefore requested to give subjective evaluations of their pursuit-rotor performance. The self-evaluation data which was obtained showed no significant differences between treatment groups, nor between internals and externals taken as a whole group. The mean self-evaluation score for internals was 4.62, while that for externals was 4.60.
CHAPTER IV
DISCUSSION

The two hypotheses derived from the congruency principle were not supported by the results of this study. Internals did not improve more when given contingent social reinforcement as opposed to non-contingent social reinforcement. Also, externals did not improve more in the non-contingent social reinforcement condition as compared to the contingent social reinforcement condition. Thus, the variation in contingency of reinforcement did not affect the performance of internals or externals to any significant extent. This lack of effect may have been due to the different contingency conditions not being sufficiently distinct. The possible lack of sufficient differentiation between the contingency conditions might be attributable to the small number of reinforcements obtained by subjects (3.73 for internals, 3.53 for externals). Thus, a subject in a non-contingent condition who obtained four reinforcements may have received two non-contingent reinforcements. On this basis, the non-contingent nature of reinforcement may not have been readily apparent to a subject.

Thus, although knowledge-of-results was provided to subjects in order to make the contingent or non-contingent nature of social reinforcement more apparent to subjects, it cannot be stated with any certainty that all subjects in the non-contingent condition were in fact aware of having been reinforced in a non-contingent manner. Responses to question 3 of the post-experimental
questionnaire revealed that most subjects were aware of their time-on-target scores from one trial to the next. A better question, however, might have inquired directly of subjects whether they were aware that supportive comments (a) always followed increases in time-on-target, or (b) sometimes followed increases and sometimes were made after decreases in time-on-target.

Another possible reason for the lack of effects due to variation in contingency of social reinforcement was the degree of intrinsic interest shown by subjects for the pursuit-rotor task. The effects of social reinforcement are apt to be reduced when subjects' intrinsic motivation for a task is high (Martens, 1971). In this study, it was not expected that female subjects would have a great deal of intrinsic motivation for a perceptual-motor task which becomes rather monotonous when performed for sixteen consecutive trials. However, in response to question 4 of the post-experimental questionnaire, very few subjects (13%) reported that they found the pursuit-rotor task to be boring. The task was most often described by subjects as being challenging or challenging and enjoyable. An approximately equal number of internals (47%) and externals (42%) rated the pursuit-rotor task as being challenging and enjoyable. Thus, many subjects may have been intrinsically motivated to the extent that they continued to perform well even when reinforcement was administered in a manner incongruent with their generalized expectancy.

A factor that may have contributed to the intrinsic motivation
of subjects on the pursuit-rotor was the fact that knowledge-of-results was available as a source of reinforcement to subjects in all groups. With knowledge-of-results available, subjects were able to see their time-on-target scores for each trial and were presumably motivated to try to improve these scores. Several subjects made spontaneous comments expressing their satisfaction on those occasions when they did improve their score. Knowledge-of-results was provided to subjects in an attempt to heighten the effects due to varying contingency, since knowledge-of-results was intended to make it apparent to subjects when they were being reinforced on a contingent or non-contingent basis. However, it appears instead that the reinforcing effects of knowledge-of-results may have been such as to offset the potential effects of the variation in contingency of social reinforcement.

When discussing the reinforcing effects of knowledge-of-results, it is important to consider internals and externals separately. In the case of externals, knowledge-of-results did not seem to have much reinforcing power when it was available but social reinforcement was not administered. Externals performed more poorly in the knowledge-of-results alone condition as compared to the non-contingent social reinforcement condition. One can therefore surmise that externals are more motivated to perform better when given social reinforcement (and knowledge-of-results) than when they are given only knowledge-of-results. Internals, on the other hand, perform equally well or better
(for example, in the Baron, Cowan, Ganz & McDonald study, 1974) in
a situation where only objective feedback is available as com-
pared to one where social reinforcement is administered.

The congruency principle was not supported in this study and
the weight of evidence in general concerning this principle is
equivocal. As mentioned above, in the case of internals, it may
have been the reinforcing effect of knowledge-of-results which
provided sufficient intrinsic motivation as to overcome the poten-
tially negative effects of being reinforced non-contingently. For
externals, the lack of difference in their performance under con-
ditions of contingent and non-contingent social reinforcement
may also stem in part from the availability of knowledge-of-
results, but it may be principally due to the fact that the in-
centive value of social reinforcement might have been more sig-
nificant to externals than the manner (contingent or not) in
which it was administered.

**Limiting Conditions Under Which the Premises of the Congruency
Principle May Be Confirmed**

Since the hypotheses of the congruency principle have not been
confirmed in several studies (e.g., Feizel & Gynther, 1970; Stafford,
1972), one can question whether the congruency principle lacks merit
and should be disregarded or whether the specific hypotheses may be
confirmed only under certain limiting conditions.

Watson and Baumal (1967) suggest that the congruency principle
will hold true when the means of attaining a highly desired outcome
are incongruent with a subject's preferred and expected means of obtaining rewards. In such situations, Watson and Baumal hypothesize that internals and externals become overly motivated (to the point of being anxious) and that performance is impaired as a consequence. In the Watson and Baumal experiment (1967), internals did make more errors in the chance condition while externals made more errors in the skill condition. The inference that subjects were more motivated in these (non-congruent) conditions was based on the finding that internals requested more practice trials in the chance condition while externals requested more practice trials in the skill condition.

The anxiety interpretation attached by Watson and Baumal to their findings seems to be a reasonable one. However, subjects were informed in the Watson and Baumal experiment that errors made (in learning paired-associates) would result in "moderately painful electric shock". One wonders whether the threat of being shocked played a more significant role in evoking anxiety than did instructions which had subjects anticipate a contingency incongruent with generalized expectancy. It is questionable whether the results of Watson and Baumal would be the same if subjects were told that errors made would result in the loss of a positive reinforcer rather than punishment in the form of shock. It would seem worthwhile to replicate the Watson and Baumal study using positive rather than negative reinforcement.
The anxiety hypothesis of Watson and Baumal may be more applicable to the performance of externals in situations of contingent reinforcement than it is to internals in situations of non-contingent reinforcement. Internals, in a situation of non-contingent reinforcement, may experience some degree of anxiety. This anxiety, however, is likely to motivate them to try to find a new response which is more consistently followed by reinforcement. Internals, feeling that reinforcement is generally dependent on their behaviour, apparently try harder and are more adept at discovering new contingencies of reinforcement than are externals (Ude & Vogler, 1969). In the Watson and Baumal study, only one correct response was available to subjects while in most non-experimental situations various alternative means to some goal are usually available.

The anxiety interpretation of the congruency principle would seem to be more sound theoretically when considered in relation to the performance of externals in non-congruent situations. To begin with, there is evidence that externals are in general more prone to anxiety than are internals. Watson (1967), for example, found a significant correlation between external locus of control and anxiety as measured by the Manifest Anxiety Scale. Also, there is some evidence that externals have less self-confidence than internals (Joe, 1971). Consequently, when put in a situation where some highly desired reinforcement is contingent on some appropriate response or level of performance, externals may lack confidence and become anxious about their capabilities of meeting the requirements for reinforcement.
This anxiety may then result in impaired performance, as was the case in the Watson and Baumal study.

In the present study, if subjects had been told that pursuit-rotor performance is highly correlated with intelligence, it is possible that externals in particular may have become more anxious about their performance. Consequently, this anxiety might have interfered with learning the skill, particularly when reinforcement depended on an improvement in performance. In a situation of high ego-involvement where reinforcement is contingent on performance, externals may be overly motivated, try too hard to perform well and obtain lower scores as a consequence. By contrast, in a situation of non-contingent reinforcement, supportive comments given irrespective of performance may re-assure externals, resulting in less anxiety and a higher performance level. Such an effect of non-contingent reinforcement however, would likely only occur if criteria for adequate performance on a task were relatively vague. If performance norms were very obvious and an external subject was reinforced in a non-contingent manner, this would likely have the effect of being a threat to the subject's self-esteem and would result in anxiety.

Non-contingent reinforcement apparently did not have such an effect in the present study since subjects seemed to be generally unaware as to what constituted an adequate level of performance. This was evident in the low correlations obtained between subjects' time-on-target scores and their self-evaluations of performance,
that is, with no norms to base their self-appraisals on, subjects' self-evaluations often did not accurately reflect their level of performance on the pursuit-rotor.

Another factor suggesting that non-contingent reinforcement in this study could be accepted by most subjects (especially externals) was the novelty of the task, and also some degree of uncertainty among subjects as to the role played by skill or luck on the task. Most internals (82%) perceived adequate performance on the pursuit-rotor to be exclusively a function of skill, while almost half the externals (45%) saw chance factors as playing some role in pursuit-rotor performance. The difference in the number of internals and externals who perceived pursuit-rotor performance to be exclusively a skill-function was highly significant ($\chi^2 = 7.47; \text{df}=1; p<.01$).

**Level of Motivation in Situations Congruent or Incongruent With Generalized Expectancies**

The inference that internals and externals are more motivated in situations incongruent with their generalized expectancies (Watson & Baumal, 1967) has been discussed above. In contrast to Watson and Baumal, Rotter and Mulry (1965) hypothesized that internals and externals are more motivated in situations congruent with their generalized expectancies. The results of their study supported this hypothesis. Rotter and Mulry found that internals and externals had longer decision times (on an angle-matching task) when instructions were given which described the task as being congruent rather than incongruent with their general expectancies.
Instructions congruent with internals' general expectancies were those emphasizing skill while instructions emphasizing chance were presumed to be congruent with the generalized expectancies of externals.

The rationales behind the present study was based on Rotter and Mulry's motivational interpretation of the congruency principle, yet no differences were found in the performance of internals or externals under conditions of contingent versus non-contingent reinforcement. It seems plausible to assume that internals will generally prefer to be reinforced on a contingent basis. However, this does not necessarily mean that they will perform better when reinforced contingently. If incentive value of a reinforcer is high or if intrinsic motivation for a task is high, internals are likely to perform just as well with non-contingent as with contingent reinforcement.

As for externals, in general they may prefer non-contingent reinforcement since, lacking in self-confidence, they may perceive and value such reinforcement as conveying an attitude of unconditional positive regard towards them, that is, positive regard for them as a person rather than positive regard in relation to some specific behaviour or performance level. It can also be expected, however, that the effects of contingent versus non-contingent reinforcement on externals also probably depend to some degree on specific situational factors. Contrary to Rotter and Mulry's general hypothesis, externals may be more
motivated (and perform better) when contingent, rather than non-contingent, reinforcement is given for a task on which they feel confident and competent. On the other hand, when faced with a difficult and unfamiliar task, externals may become anxious when a highly desired reinforcer is contingent on performance level. Thus, task difficulty and degree of ego-involvement are two variables that may significantly affect the performance of externals in situations of contingent versus non-contingent reinforcement. Future research should perhaps be directed at examining the effects of these variables.

Results and Implications Pertaining to Interaction Effects Between Locus of Control and Other Factors (Reinforcement Condition and Blocks)

In this study, an interaction effect between reinforcement conditions and locus of control was predicted, and certain specific hypotheses related to this interaction were formulated. No support was found for the hypothesis that externals would improve more than internals in the conditions of social reinforcement. The fact that knowledge-of-results was available to internals likely accounts for the fact that they improved to the same degree as did externals in the social reinforcement conditions.

When residual gain scores were averaged over reinforcement conditions, a significant interaction between locus of control and blocks was found. Externals as a group showed a tendency to improve across blocks of trials, while the residual gain scores of internals
declined (although not significantly) across blocks. The tendency of externals to improve while internals declined in performance, relative to predicted scores, may reflect the greater desire of externals to comply with the perceived demands of the experimental situation. Externals have been shown to be more conforming than internals (Crowne & Likerant, 1963). Thus, externals may have put more consistent effort (than internals) into their pursuit-rotor performance across blocks of trials, resulting in the blocks by locus of control interaction.

Externals given non-contingent social reinforcement improved to a greater degree than did externals given only knowledge-of-results. Also, in the knowledge-of-results only condition, internals improved to a greater extent than did externals, although the difference was only marginally significant (p < .10). The above results are consistent with the findings of Baron, Cowan, Ganz and McDonald (1974) who showed that externals given social reinforcement and internals given objective feedback performed better than externals who were given only objective feedback on a concept-learning task. The evidence of the present study and the Baron et al. experiment indicate that externals do not perform at optimal levels when given objective feedback (knowledge-of-results) only. Externals seem to be more dependent on reinforcement in the form of social approval in order to function optimally.
The finding that externals are more dependent on social reinforcement than are internals in order to achieve their best performance is consistent with data obtained by Bellack (1975). Bellack showed that externals, relative to internals, give themselves less self-reinforcement for similar levels of performance. The lesser amount of self-reinforcement administered by externals was related to self-evaluations of performance that were consistently lower than the self-evaluations of internals. It would seem important, therefore, for externals to learn to evaluate themselves in a more positive manner. More positive self-evaluations by externals might make them less dependent on approval in the form of social reinforcement from others. Enhancing the self-esteem of externals could be accomplished through a method such as assertiveness training and also through heightening the contingency awareness of externals, that is, making them aware of those aspects of their behaviour that are successful in securing reinforcement as well as those that generally do not result in reinforcement. The latter aspect must be made explicit to externals since, believing that reinforcements are determined by chance, they are likely to persist in mal-adaptive behaviour longer than do internals, much as the gambler continues to throw his money away while waiting for periodic reinforcement.

Desirability of Using Subjects Whose Locus of Control Orientation is the Same on Both Fatalism and the Total Scale

A final factor to be considered in the present study is the
different results obtained when subjects were classified on the locus of control dimension according to scores on fatalism or I-E total scale scores. As mentioned previously, results were somewhat more consistent with predictions when subjects were classified on the basis of scores on fatalism rather than scores on the total I-E scale. However, the best results (in terms of consistency with predictions and significance levels) were obtained when data was used for those subjects whose scores were in the internal or external locus of control range on both the fatalism sub-scale and the total scale (see Appendix F).

Discriminant validity has not been established between the fatalism and the total I-E scale. It is therefore difficult to predict whether a person who is, for example, an internal on fatalism and an external according to his/her total scale score will respond in a given situation as an internal or an external might be expected to. When only subjects are used who are internal or external on both fatalism and the total I-E scale, it is quite possible that a more consistent pattern of responding will occur among a group of such subjects. This effect apparently was obtained in this study as evidenced by the results of the analysis done with those subjects (n = 11) who scored in the same direction on both fatalism and the total I-E scale.
APPENDIX A

SOCIAL REACTION INVENTORY
Social Reaction Inventory

This is a questionnaire to find out the way in which certain important events in our society affect different people. Each item consists of a pair of alternatives lettered a or b. Please select the one statement of each pair (and only one) which you more strongly believe to be the case as far as you’re concerned. Be sure to select the one you actually believe to be more true rather than the one you think you should choose or the one you would like to be true. This is a measure of personal belief. Obviously there are no right or wrong answers.

Your answers to the items on this inventory are to be recorded on the separate answer sheet which has been inserted in this booklet. FILL OUT THIS ANSWER SHEET NOW. Put down your identification number and sex in the appropriate spaces on the answer sheet, then finish reading these directions.

Please answer these items carefully but do not spend too much time on any one item. Be sure to find an answer for every choice. Find the number of the item on the answer sheet and blacken the space under the letter which corresponds to the statement you choose as most true.

In some instances you may discover that you believe both statements or neither one. In such cases, be sure to select the one you more strongly believe to be the case as far as you’re concerned. Also try to respond to each item independently when making your choice;
do not be influenced by your previous choices.

**REMEMBER**

Select the alternative which you **personally believe to be** more true.

I more strongly believe that:

1. a. Children get into trouble because their parents punish them too much.
   
   b. The trouble with most children nowadays is that their parents are too easy with them.

2. a. Many of the unhappy things in people’s lives are partly due to bad luck.
   
   b. People’s misfortunes result from the mistakes they make.

3. a. One of the major reasons why we have wars is because people don’t take enough interest in politics.
   
   b. There will always be wars, no matter how hard people try to prevent them.

4. a. In the long run people get the respect they deserve in this world.
   
   b. Unfortunately, an individual’s worth often passes unrecognized no matter how hard he tries.

5. a. The idea that teachers are unfair to students is nonsense.
   
   b. Most students don’t realize the extent to which their grades are influenced by accidental happenings.
6. a. Without the right breaks one cannot be an effective leader.
    b. Capable people who fail to become leaders have not taken advantage of their opportunities.

7. a. No matter how hard you try some people just don't like you.
    b. People who can't get others to like them, don't understand how to get along with others.

8. a. Heredity plays the major role in determining one's personality.
    b. It is one's experiences in life which determine what they're like.

9. a. I have often found that what is going to happen will happen.
    b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.

10. a. In the case of the well-prepared student there is rarely if ever such a thing as an unfair test.
    b. Many times exam questions tend to be so unrelated to course work, that studying is really useless.

11. a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.
    b. Getting a good job depends mainly on being in the right place at the right time.

12. a. The average citizen can have an influence in government decisions.
    b. This world is run by the few people in power, and there is not much the little guy can do about it.
13. a. When I make plans, I am almost certain that I can make them work.
    b. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyway.

14. a. There are certain people who are just no good.
    b. There is some good in everybody.

15. a. In my case getting what I want has little or nothing to do with luck.
    b. Many times we might just as well decide what to do by flipping a coin.

16. a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.
    b. Getting people to do the right thing depends upon ability, luck has little or nothing to do with it.

17. a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand, nor control.
    b. By taking an active part in political and social affairs the people can control world events.

18. a. Most people don't realize the extent to which their lives are controlled by accidental happenings.
    b. There really is no such thing as "luck".

19. a. One should always be willing to admit his mistakes.
    b. It is usually best to cover up one's mistakes.

20. a. It is hard to know whether or not a person really likes you.
    b. How many friends you have depends upon how nice a person you are.
21. a. In the long run the bad things that happen to us are balanced by the good ones.
   b. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.

22. a. With enough effort we can wipe out political corruption.
   b. It is difficult for people to have much control over the things politicians do in office.

23. a. Sometimes I can't understand how teachers arrive at the grades they give.
   b. There is a direct connection between how hard I study and the grades I get.

24. a. A good leader expects people to decide for themselves what they should do.
   b. A good leader makes it clear to everybody what their jobs are.

25. a. Many times I feel that I have little influence over the things that happen to me.
   b. It is impossible for me to believe that chance or luck plays an important role in my life.

26. a. People are lonely because they don't try to be friendly.
   b. There's not much use in trying too hard to please people, if they like you, they like you.

27. a. There is too much emphasis on athletics in high school.
   b. Team sports are an excellent way to build character.
28. a. What happens to me is my own doing.
   b. Sometimes I feel that I don't have enough control over the
direction my life is taking.
29. a. Most of the time I can't understand why politicians behave
   the way they do.
   b. In the long run people are responsible for bad government
   on a national as well as on a local level.
APPENDIX B
FATALISM ITEMS
Fatalism Items

The items listed below are those which were used as the basis for classifying subjects on the locus of control dimension. The items listed are those which had loadings of $\pm .30$ on Mirels' (1970) first factor (fatalism).

5. a. The idea that teachers are unfair to students is nonsense.
   b. Most students don't realize the extent to which their grades are influenced by accidental happenings.

10. a. In the case of the well-prepared student there is rarely if ever such a thing as an unfair test.
    b. Many times exam questions tend to be so unrelated to course work that studying is really useless.

11. a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.
    b. Getting a good job depends mainly on being in the right place at the right time.

15. a. In my case getting what I want has little or nothing to do with luck.
    b. Many times we might just as well decide what to do by flipping a coin.

16. a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.
    b. Getting people to do the right thing depends upon ability, luck has little or nothing to do with it.
18. a. Most people don't realize the extent to which their lives are controlled by accidental happenings.
   b. There really is no such thing as "luck".

23. a. Sometimes I can't understand how teachers arrive at the grades they give.
   b. There is a direct connection between how hard I study and the grades I get.

25. a. Many times I feel that I have little influence over the things that happen to me.
   b. It is impossible for me to believe that chance or luck plays an important role in my life.

28. a. What happens to me is my own doing.
   b. Sometimes I feel that I don't have enough control over the direction my life is taking.
APPENDIX C

POST-EXPERIMENTAL QUESTIONNAIRE
Post-experimental Questionnaire

1) Rate, on the scale below, how well you think you performed on the pursuit-rotor task.

1 2 3 4 5 6 7 8 9

very poorly very average very well excellent

2) Do you perceive performance on the pursuit-rotor task to be exclusively a function of skill, or do you believe that luck also plays a part?

______________________________________________________________

3) How did you monitor your performance on the pursuit-rotor task? Did you attend primarily to (circle a or b):
   a) time on target for each trial, as indicated on the counter.
   b) a general impression of your performance across one or a number of trials.

4) Did you find the pursuit-rotor task to be: (circle one)
   a) interesting d) enjoyable
   b) challenging e) challenging and enjoyable
   c) boring f) challenging, but boring

5) Which do you think is the more important factor affecting performance on the pursuit-rotor?
   a) visual-motor co-ordination
   b) effort and concentration
APPENDIX D

ROTARY-PURSUIT TASK-- INSTRUCTIONS TO SUBJECTS
Rotary-pursuit task—Instructions to Subjects

This is an experiment which involves learning of a motor skill. The experiment will consist of 16 trials on the pursuit-rotor, each trial lasting 30 seconds. The aim of the experiment is to see how practice and individual differences affect performance on a task involving visual-motor co-ordination.

What you are required to do is simply to try to keep the stylus on this target as much as possible. The disc here (indicate disc), once started, will rotate at a constant speed. When you are on target, the clock will operate and will record the length of time that you remain on target. Therefore, after each trial, you should look at the timer to see the total length of time you were on target for that trial. In between trials, you can put down the stylus and relax until given the signal that the next trial is about to begin.

If you have any questions, please ask them now since I won't be able to answer them once you have begun working on the task. This is to ensure that task conditions will be more nearly equal for everyone.
APPENDIX E

ANALYSIS OF CO-VARIANCE
Analysis of Co-variance

An analysis of co-variance was applied to the data of this study in order to determine to what extent results of this analysis would be consistent with the results of the analysis of residual gain scores. In the analysis of co-variance, block 1 data was treated as a co-variate in order to assess performance differences during blocks 2, 3 and 4 (when social reinforcement was administered) free from the linear regression effects of initial scores on subsequent criterion scores. As is evident from Table 3, results of the analysis of co-variance correspond fairly well with the results of the analysis of residual gain scores (Table 2, p. 29).
### Table 3
Analysis of Co-variance

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal-External (I-E)</td>
<td>0.09</td>
<td>1</td>
<td>0.09</td>
<td>0.01</td>
</tr>
<tr>
<td>Reinforcement Condition</td>
<td>2.80</td>
<td>2</td>
<td>1.40</td>
<td>0.20</td>
</tr>
<tr>
<td>Reinforcement Condition x I-E</td>
<td>38.26</td>
<td>2</td>
<td>19.13</td>
<td>2.67*</td>
</tr>
<tr>
<td>Error (Between Ss)</td>
<td>593.79</td>
<td>83</td>
<td>7.15</td>
<td></td>
</tr>
<tr>
<td>Within Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blocks</td>
<td>77.85</td>
<td>2</td>
<td>38.92</td>
<td>46.39**</td>
</tr>
<tr>
<td>I-E x Blocks</td>
<td>4.17</td>
<td>2</td>
<td>2.09</td>
<td>2.49*</td>
</tr>
<tr>
<td>Reinforcement Condition x Blocks</td>
<td>1.23</td>
<td>4</td>
<td>0.31</td>
<td>0.37</td>
</tr>
<tr>
<td>Reinforcement Condition x I-E x Blocks</td>
<td>3.60</td>
<td>4</td>
<td>0.90</td>
<td>1.07</td>
</tr>
<tr>
<td>Error (Within Ss)</td>
<td>140.95</td>
<td>168</td>
<td>0.84</td>
<td></td>
</tr>
</tbody>
</table>

* *p < .10.
** *p < .01.
APPENDIX F

RESULTS OF DATA ANALYSIS WITH LOCUS OF CONTROL
OF SUBJECTS CONSISTENT ON FATALISM AND THE TOTAL I-E SCALE
Results of Data Analysis With Locus of Control of Subjects Consistent on Fatalism and the Total I-E Scale

In the initial analysis, subjects were classified as internals or externals on the basis of scores on the fatalism sub-scale. An examination of subjects' test scores later revealed that for some subjects, their classification as an internal or an external on fatalism differed from the classification according to their total scale score. In the second analysis of variance of residual gain scores, only the data was used for subjects whose scores indicated they were an internal or an external on both the fatalism sub-scale and the total scale. Using this data (n = 11), the reinforcement condition by locus of control interaction was found to be marginally significant (F = 2.56, df = 2,60; p < .10). Specific comparison tests showed that externals in the non-contingent social reinforcement condition improved to a significantly greater degree than those who received knowledge-of-results only (F = 5.81, df = 2,60; p < .01). This result seems to lend support to the significant difference previously found between the same two groups (when subjects were grouped according to fatalism scores only). Additional results of the secondary analysis showed that externals in the contingent social reinforcement condition and internals in the knowledge-of-results only condition both improved to a greater degree than externals in the knowledge-of-results only group. The difference in degree of improvement between externals given contingent social reinforcement and those given only knowledge-of-results was significant at the .01 level. In the case of
internals given knowledge-of-results compared to externals in this condition, the difference was marginally significant (p < .10).
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Rankin, E. F., & Tracy, R. J. Residual gain as a measure of individual differences in reading improvement. *Journal of Reading*, 1965, 8, 224-253.


VITA AUCTORIS

Place and Date of Birth: Barkhausen, Germany; Dec. 10, 1946.

1951: Immigrated to Montreal, Canada.

1970: Married to Ginette de Bellefeuille; one child, Jean-Philippe, was born in July, 1976.

Education:
Secondary: Dunton High School and High School of Montreal (1960-65).
University: B.A., Sir George Williams University, Montreal (1968).
M.A., University of Windsor (1972).
Doctoral candidate at the University of Windsor, 1976-1978.

Experience:
1974-1976: Employed as a psychometrist by the Essex County Board of Education.
July 1978: Accepted position as a psychologist with the Royal Ottawa Hospital.
RAW DATA
Internals - Contingent Social Reinforcement

1) 6.34, 5.94, 7.67, 5.48, 7.23, 7.22, 7.00, 10.06, 7.76, 9.63, 7.07, 7.78, 7.49, 7.02, 8.03, 6.79.

2) 9.62, 9.73, 10.95, 8.81, 10.65, 12.74, 11.35, 9.14, 8.30, 9.75, 10.58, 8.38, 11.33, 9.81, 13.56, 10.07.


4) 4.22, 4.24, 3.04, 3.28, 3.79, 3.16, 5.53, 3.08, 3.01, 3.94, 3.16, 3.60, 6.02, 4.98, 4.02, 3.35.

5) 1.27, 1.21, 2.41, 1.31, 2.87, 3.12, 2.93, 2.04, 2.05, 3.38, 4.53, 3.75, 3.66, 4.18, 3.87, 2.53.

6) 0.71, 2.22, 1.32, 3.49, 5.48, 4.60, 5.78, 7.09, 5.57, 4.25, 5.67, 6.51, 6.37, 7.86, 8.09, 7.94.

7) 2.38, 3.07, 0.99, 1.92, 4.28, 1.67, 3.92, 3.62, 2.61, 3.43, 4.28, 4.20, 1.59, 2.97, 3.42, 2.85.

8) 2.27, 2.17, 2.90, 2.92, 2.79, 4.13, 3.14, 3.82, 4.99, 5.90, 4.75, 4.85, 3.45, 3.88, 2.86, 4.84.

9) 5.63, 8.31, 6.07, 6.17, 3.94, 5.02, 5.63, 4.75, 4.67, 6.03, 2.26, 5.13, 6.81, 5.95, 6.72, 4.93.

10) 2.02, 4.03, 3.66, 5.56, 4.19, 5.29, 4.48, 6.03, 6.79, 5.82, 6.22, 6.75, 6.99, 6.95, 7.09, 5.80.

11) 3.70, 5.88, 6.74, 5.47, 7.30, 7.74, 7.47, 8.95, 6.73, 7.50, 8.37, 10.67, 7.47, 6.57, 8.41, 6.57.

12) 1.22, 1.76, 2.68, 2.51, 3.10, 3.84, 4.86, 3.43, 3.23, 2.60, 3.36, 3.59, 2.24, 4.09, 4.42, 3.31.


14) 4.35, 5.76, 5.39, 3.68, 4.82, 7.10, 8.11, 6.56, 8.65, 7.15, 8.45, 8.56, 11.00, 10.44, 8.46, 10.22.

15) 5.51, 6.22, 6.06, 7.50, 8.00, 8.72, 6.78, 7.80, 7.89, 6.97, 8.27, 6.55, 10.55, 9.99, 9.56, 10.10.
Internals—Non-continent Social Reinforcement

1) 4.43, 7.11, 3.70, 1.42, 4.16, 4.05, 4.76, 5.79, 5.10, 3.38, 5.20, 4.73, 4.78, 6.11, 4.85, 7.51.

2) 5.14, 6.24, 4.99, 6.38, 5.65, 4.66, 6.42, 4.73, 6.06, 7.38, 7.02, 8.34, 6.87, 6.96, 5.79, 6.96.

3) 1.77, 2.60, 2.45, 2.57, 4.33, 4.50, 3.77, 3.82, 3.18, 4.21, 5.58, 4.85, 5.68, 5.59, 4.98, 5.52.

4) 1.83, 3.30, 2.94, 2.69, 4.73, 3.04, 3.48, 2.74, 3.47, 4.49, 5.13, 4.56, 4.69, 5.12, 2.57, 3.32.

5) 3.10, 2.06, 1.55, 1.22, 0.73, 0.67, 1.71, 1.37, 1.81, 1.51, 1.05, 1.06, 0.69, 0.83, 1.18, 1.65.

6) 5.10, 3.97, 5.56, 5.78, 4.30, 5.86, 6.23, 5.43, 5.67, 5.42, 6.44, 5.82, 6.25, 7.79, 7.38, 7.18.

7) 8.15, 9.81, 9.20, 12.20, 11.57, 10.67, 8.30, 8.73, 10.76, 9.87, 11.98, 11.98, 11.39, 13.05, 12.42, 8.55.

8) 3.33, 3.41, 5.85, 4.46, 4.73, 6.40, 6.37, 8.16, 7.37, 7.73, 10.06, 9.13, 8.51, 5.75, 10.73, 10.26.

9) 1.83, 2.67, 3.01, 2.67, 4.53, 4.22, 6.37, 5.82, 4.84, 4.98, 5.05, 5.53, 4.07, 4.88, 5.85, 4.11.

10) 8.92, 5.26, 6.77, 6.49, 7.52, 7.84, 7.28, 7.61, 7.25, 6.51, 7.59, 7.13, 7.96, 7.20, 8.14, 7.27.

11) 4.11, 4.24, 3.24, 6.20, 5.59, 6.43, 6.75, 6.90, 8.36, 8.16, 6.11, 8.01, 7.45, 9.37, 9.22, 7.87.

12) 10.37, 11.48, 12.22, 10.32, 8.50, 8.47, 8.53, 9.97, 11.43, 7.19, 8.87, 4.72, 6.50, 8.53, 11.01, 9.26.

13) 0.83, 1.44, 0.84, 2.43, 0.72, 0.36, 1.66, 1.65, 0.70, 2.42, 1.53, 2.46, 1.41, 2.58, 3.06, 1.90.


15) 5.42, 6.08, 10.72, 14.61, 13.17, 9.80, 8.76, 11.17, 14.47, 10.92, 11.61, 8.35, 12.67, 11.20, 7.53, 6.50.
Internals - Knowledge-of-results only

1) 3.44, 4.21, 4.48, 3.80, 3.11, 4.50, 6.19, 4.87, 2.99, 5.28, 3.37, 3.80, 3.25, 4.48, 3.78, 4.44.

2) 0.71, 1.15, 0.95, 0.93, 0.60, 0.78, 2.91, 1.49, 0.62, 1.03, 1.15, 0.56, 0.87, 1.76, 1.52, 1.04.

3) 3.31, 4.36, 4.40, 5.91, 5.60, 6.44, 3.57, 7.67; 7.20, 6.19, 7.56, 6.23, 5.43, 7.02, 5.53, 6.25.

4) 0.81, 4.40, 6.19, 9.14, 7.17, 7.33, 7.33, 5.87, 7.11, 5.74, 5.94, 5.80, 7.58, 6.62, 8.34, 8.57.

5) 6.42, 10.22, 8.71, 4.31, 7.96, 13.21, 8.50, 10.39, 12.08, 10.76, 7.08, 11.55, 11.34, 10.84, 12.17, 11.88.


7) 0.42, 0.74, 0.63, 0.80, 0.80, 0.52, 0.87, 3.54, 1.76, 2.37, 1.61, 1.95, 1.06, 1.99, 2.30, 3.13.

8) 1.74, 1.89, 2.51, 0.88, 1.68, 4.39, 5.39, 3.76, 5.29, 5.31, 8.16, 9.56, 10.09, 7.71, 8.36, 11.31.

9) 2.06, 3.50, 2.26, 3.24, 3.28, 1.68, 3.97, 3.90, 4.61, 2.92, 3.30, 5.75, 3.02, 1.68, 3.77, 2.85.


11) 4.77, 4.10, 4.33, 6.90, 8.07, 5.50, 6.62, 6.25, 5.47, 5.54, 8.63, 8.04, 9.51, 10.16, 10.04, 10.07.

12) 8.05, 6.72, 5.79, 6.41, 6.99, 7.95, 7.30, 9.85, 10.07, 8.53, 10.39, 11.50, 9.93, 8.41, 8.49, 8.16.

13) 8.46, 8.85, 7.37, 7.62, 7.51, 6.25, 8.00, 9.88, 8.01, 7.18, 10.93, 10.71, 8.08, 10.51, 9.83, 10.15.

14) 5.50, 5.96, 3.86, 7.74, 5.82, 5.70, 5.35, 7.58, 8.79, 7.69, 7.59, 9.89, 6.13, 8.20, 6.52, 8.62.

15) 3.65, 1.95, 2.05, 1.46, 4.65, 7.26, 8.13, 8.33, 7.81, 6.72, 8.10, 7.58, 4.81, 6.99, 8.77, 8.92.
Externals—Continents—Social Reinforcement

1) 5.53, 7.10, 6.66, 6.24, 5.94, 8.42, 8.10, 10.29, 7.98, 9.79, 7.33, 7.06, 6.88, 4.71, 5.47, 9.25.

2) 0.83, 2.54, 4.11, 3.55, 3.84, 5.42, 4.97, 6.54, 11.61, 6.34, 7.49, 5.58, 5.13, 6.22, 7.05, 9.48.

3) 3.37, 2.60, 5.61, 6.70, 6.91, 7.38, 7.46, 8.97, 7.37, 8.19, 12.91, 8.83, 10.35, 11.44, 11.35, 9.04.

4) 4.61, 6.71, 4.71, 3.00, 5.19, 4.47, 5.48, 4.84, 7.60, 5.71, 7.65, 6.03, 5.85, 4.12, 6.17, 6.20.


6) 11.04, 11.34, 12.84, 12.46, 11.37, 12.08, 5.26, 10.19, 8.32, 8.94, 8.38, 13.28, 6.91, 7.94, 11.78, 9.90.

7) 3.16, 4.16, 4.46, 3.51, 2.50, 3.07, 3.31, 4.18, 4.07, 3.47, 4.70, 4.41, 4.76, 3.72, 3.74, 3.43.

8) 1.88, 0.93, 2.43, 3.62, 3.21, 3.59, 3.49, 4.49, 3.82, 4.32, 4.86, 3.44, 4.84, 4.23, 5.78, 6.67.

9) 9.18, 10.79, 11.67, 10.56, 10.62, 9.19, 10.26, 11.01, 10.86, 10.41, 14.46, 13.69, 13.47, 14.52, 13.28, 15.18.

10) 3.55, 5.66, 4.85, 2.24, 4.87, 2.29, 6.16, 5.91, 3.41, 2.66, 5.07, 2.59, 2.32, 4.01, 5.08, 6.98.

11) 5.09, 2.34, 4.91, 4.12, 4.12, 4.26, 4.73, 5.12, 6.77, 6.27, 6.94, 8.55, 7.45, 7.01, 7.81, 9.23.

12) 9.63, 10.62, 10.00, 10.87, 10.22, 12.03, 11.93, 11.28, 8.33, 12.14, 10.36, 7.94, 5.24, 12.70, 12.59, 11.71.

13) 9.95, 9.64, 8.48, 5.97, 8.85, 5.33, 9.58, 9.46, 9.50, 9.50, 8.52, 6.34, 6.72, 7.45, 11.77, 10.59.

14) 8.57, 6.83, 5.61, 8.53, 6.05, 5.33, 9.01, 9.63, 8.01, 7.68, 8.15, 9.67, 5.64, 8.91, 9.44, 9.22.

15) 6.51, 7.31, 8.27, 6.63, 8.70, 8.14, 9.17, 11.00, 10.96, 11.11, 12.52, 10.16, 10.88, 11.33, 11.54, 13.21.
## Externals - Non-contingent Social Reinforcement

1. 8.37, 7.79, 11.41, 12.90, 12.86, 10.88, 12.34, 13.18, 13.59, 14.01, 10.19, 10.29, 10.63, 11.09, 9.48, 10.76.

2. 4.42, 2.08, 7.24, 7.65, 7.04, 8.33, 9.25, 8.51, 6.27, 5.89, 10.87, 3.12, 8.14, 9.78, 8.02, 9.53.


5. 0.58, 0.81, 2.07, 3.81, 3.63, 1.79, 2.57, 3.18, 5.77, 5.97, 5.91, 7.33, 7.75, 8.48, 5.78, 5.82.

6. 4.44, 5.74, 5.74, 9.27, 6.24, 6.69, 5.72, 7.63, 7.70, 6.66, 9.05, 9.67, 6.85, 10.02, 8.91, 8.51.


8. 4.22, 4.97, 2.80, 2.19, 1.41, 5.22, 5.31, 4.91, 6.75, 6.23, 4.96, 3.96, 4.30, 6.65, 6.44, 7.65.

9. 3.52, 3.93, 9.28, 4.59, 2.94, 8.09, 7.45, 8.89, 6.16, 5.56, 9.51, 6.15, 5.85, 7.61, 10.22, 10.20.

10. 5.49, 5.78, 5.36, 5.87, 5.69, 5.13, 5.76, 6.83, 7.39, 8.84, 11.02, 12.16, 12.78, 8.76, 9.42, 9.20.

11. 1.73, 5.57, 9.05, 6.68, 6.78, 10.40, 8.93, 8.75, 7.15, 7.02, 7.55, 5.78, 10.05, 11.73, 10.92, 12.35.

12. 4.96, 3.86, 2.10, 3.56, 2.38, 2.89, 7.21, 6.78, 5.98, 7.42, 8.77, 9.30, 7.76, 8.01, 7.69, 6.59.

13. 9.29, 8.53, 9.51, 4.12, 4.69, 5.90, 4.39, 7.09, 4.87, 6.25, 5.04, 5.59, 6.45, 6.56, 5.45, 8.80.


15. 4.81, 6.80, 5.49, 7.25, 9.07, 10.18, 7.43, 7.97, 9.82, 10.02, 9.23, 11.26, 11.15, 9.63, 10.17, 10.65.
Experiments: Knowledge-of-Results only

1) 2.85, 2.74, 2.23, 2.70, 3.81, 3.97, 3.33, 4.56, 3.80, 4.11, 5.35, 4.99, 4.53, 5.06, 3.58, 4.90.
2) 0.41, 2.19, 1.46, 3.15, 1.88, 2.63, 1.91, 2.90, 1.92, 2.48, 1.91, 1.97, 3.24, 2.07, 2.53, 2.89.
3) 7.23, 9.12, 10.35, 9.23, 8.64, 7.47, 9.20, 11.27, 8.40, 9.84, 8.57, 7.51, 9.32, 9.02, 6.42, 8.25.
5) 10.60, 13.45, 13.39, 7.97, 8.28, 9.90, 6.89, 8.45, 8.49, 8.76, 7.71, 8.19, 6.57, 7.34, 8.07, 6.83.
6) 0.34, 0.69, 1.00, 3.02, 3.51, 4.28, 4.55, 2.78, 4.31, 3.43, 4.21, 4.68, 4.89, 4.40, 6.03, 5.75.
7) 4.15, 3.44, 2.53, 3.60, 3.25, 3.32, 3.61, 4.50, 4.23, 4.89, 5.52, 5.28, 4.09, 4.56, 6.89, 6.23.
8) 6.56, 6.33, 5.89, 4.83, 4.02, 6.63, 6.87, 9.84, 6.90, 7.52, 7.71, 5.56, 6.73, 7.98, 8.29, 8.05.
9) 1.23, 2.57, 1.89, 2.04, 1.78, 2.87, 2.82, 2.81, 3.07, 4.33, 4.50, 3.74, 4.93, 5.53, 5.69, 5.62.
10) 7.93, 7.28, 6.52, 7.60, 5.13, 6.47, 8.23, 7.21, 8.50, 8.60, 5.75, 6.11, 7.95, 6.96, 13.44, 10.35.
11) 2.12, 5.47, 4.62, 6.51, 5.92, 4.13, 7.25, 8.32, 6.61, 6.40, 9.27, 8.10, 5.98, 5.57, 5.59, 9.03.
12) 3.19, 3.75, 6.05, 4.13, 3.71, 2.77, 3.33, 2.87, 6.33, 3.86, 9.26, 6.41, 6.00, 6.77, 8.73, 7.66.
13) 6.45, 5.25, 4.54, 3.20, 1.60, 2.33, 1.39 0.89, 1.96, 0.65, 2.22, 6.85, 2.25, 1.09, 2.42, 8.32.
14) 2.38, 5.44, 3.55, 4.32, 5.76, 4.35, 4.87, 6.37, 9.22, 9.17, 6.10, 8.89, 7.66, 7.03, 8.28, 8.46.
15) 6.06, 6.77, 6.02, 6.21, 10.06, 6.71, 5.82, 5.48, 8.92, 7.25, 10.38, 9.99, 10.25, 10.22, 8.35, 8.39.