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INTRINSIC MOTIVATION, EXTRAVERSION, IMPULSIVITY, AND REWARD IN A COMPUTER GAME SETTING

City University of New York Ph.D. 1986

University Microfilms International 300 N. Zeeb Road, Ann Arbor, MI 48106

INTRINSIC MOTIVATION, EXTRAVERSION, IMPULSIVITY, AND REWARD IN A COMPUTER GAME SETTING

by

Hilary James Liberty

A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirement for the degree of Doctor of Philosophy, The City University of New York.

1986

This manuscript has been read and accepted for the Graduate Faculty in Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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ABSTRACT

ADVISER: Professor Charles P. Smith

Research on intrinsic motivation indicates that subjects previously paid to perform interesting tasks subsequently rated them as less interesting than unpaid subjects and were less willing to re-engage them. This research tests the hypothesis that individual differences in sensitivity to reward and withdrawal of reward postulated by Gray (1972) should predict the magnitude of differences in intrinsic motivation when comparing paid (reward and withdrawal of reward) groups after payment is removed with an unpaid (control) group. Gray's theory predicts greater sensitivity to reward for extraverts and to punishment or withdrawal of reward for introverts and neurotics.

In the first of two experiments, volunteers either played a computer game for monetary reward (N=31) or no reward (N=24). Subjects were told that following this game, they would be allowed to continue playing with no further payment, rating how interesting they found each game. Reward subjects played significantly fewer games, and controlling for initial interest rating, found the game slightly less interesting. The predicted interaction of condition with extraversion did not occur but, unexpectedly, extraverts played significantly more optional games than introverts. This effect was due to the sociability component of extraversion. Also, a negative relationship was found between level of initial performance and amount of optional play.

In the second study, a withdrawal of reward (N=42) condition was added to the reward (N=44) and control (N=42) conditions. In this condition, subjects were informed they would be paid, but would lose a portion of this payment for each point they failed to make. There were no significant differences between payment conditions, so the payment groups were combined. A nonsignificant trend in the direction of paid subjects playing fewer games was found, however, paid subjects rated the game as slightly more interesting. No interaction between extraversion and condition was found, but again extraverts played more optional games than introverts. This effect was due to the impulsivity component of extraversion. Additionally, initial interest rating of the game, not performance, was a significant predictor of optional play. Both studies fail to confirm Gray's theory.

ACKNOWLEDGEMENTS

I wish to thank my dissertation sponsor, Prof. Charles P. Smith, for all the efforts he made on my behalf, for securing the space for each of the studies, for years of constructive criticism of my ideas, and for a profound attempt to improve my grammar.

I wish to thank Prof. Samuel Messick, not only for his help on this project, but also for teaching the best course I have taken in graduate school; one that altered my vision of what psychology ought to be.

I wish to thank Prof. David Rindskopf, friend and scholar, for wise counsel over the years, and for training me in so many of the skills I have used and will use to earn a living.

I wish to thank President Harold Proshansky for providing the microcomputer used in the second experiment, and for providing employment during the writing of this dissertation, but most of all for being a motivating force, always pushing me to finish, and when all other resources failed, willing to provide whatever was needed to keep the project progressing.

I wish to thank Prof. Louis Gerstman for being a reader on my committee.

I wish to thank Prof. Gertrude Schmeidler, who has throughout her career applied hard-headed rigor to "soft" topics and who through her intellectual courage has been an exemplar of the kind of psychologist I would like to be.

I wish to thank my brother, Jeremy G. Liberty, for building the apparatus, for drawing the proverbial frog which so many subjects saw, and for sharing this intellectual adventure as we have shared so many adventures since childhood.

I also wish to thank Prof. Shirley Feldman, who provided the microcomputer used for the first experiment; Prof. Salomon Rettig, who relinquished his office space for the summer to enable me to conduct the first experiment; Prof. Marilyn Rall and Mr. Marcus Ianesco, who shared their laboratory space with me enabling me, to conduct the second experiment; and Mr. Lincoln V. Walters and his staff, who worked for many hours on my apparatus and the various computers so that all the equipment would work together in happy harmony. My gratitude to Prof. Hans J. Eysenck for permission to reproduce the Eysenck Personality Inventory on a microcomputer.

I have saved until last the largest note of thanks. My wife, Joann, has shared this project with me from the first letter of acceptance to the Psychology Program through the last period in this dissertation and will probably proofread her own thank you. She has been a welcome sounding board for my ideas and has shown me time and again that common sense is as important as elaborate theory. She is so

much a part of this project that I have come to think of it as our degree. Yes, my dear, we did it.

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CHAPTER 1

INTRODUCTION

Various investigators (e.g. Deci, 1971; Kruglanski, Freedman, and Zeevi, 1971) found indicators of reduced intrinsic motivation for interesting tasks under certain conditions. The basic finding is that interesting tasks are rated as less interesting by paid groups after reward is withdrawn when compared with unpaid groups, and subjects are less willing to re-engage in interesting tasks for which they have previously been rewarded. There have been numerous replications of this decrement in motivation and the effect appears quite stable. While extrinsic rewards typically reduce subsequent intrinsic motivation, for some kinds of tasks, and under certain conditions, extrinsic rewards may also increase subsequent intrinsic motivation. Calder and Staw (1975) showed that for high-interest tasks reward reduced intrinsic motivation, but for low-interest tasks reward increased intrinsic motivation.

One of the problems in this area of research is that there is no single definition for intrinsic motivation which most researchers can agree upon. Definitions usually contain constructs specific to the particular theoretical framework in which a given author is working. For example, Hunt (1971, p. 1) defines intrinsic motivation as "motivation which is inherent in information processing." Researchers who do not approach the problem from an information processing perspective may not agree that information processing is the most important aspect of intrinsic motivation. Deci (1971) attempted to avoid defining intrinsic motivation in terms of constructs which could not be observed by stating that intrinsically motivated behavior was behavior in the absence of extrinsic rewards. However, this definition has the problem of defining the construct in terms of what it is not rather than what it is. In his latest formulation (Deci and Ryan, 1985, p. 43), Deci and Ryan define intrinsic motivation as "the innate, natural propensity to engage one's interests and exercise one's capacities, and in so doing, to seek and conquer optimal challenges."

Deci and Ryan's (1985) latest theory is called cognitive evaluation theory. According to this theory, people have the need to perceive themselves as self-determining and competent. The introduction of rewards for performing interesting tasks diminishes intrinsic motivation because the subject perceives his or her behavior as determined or controlled by the reward rather than by his or her own interest.

For our purposes intrinsically motivated behavior will be defined as behavior which an individual finds as interesting and enjoyable in itself without additional reinforcement. For reviews of the intrinsic motivation literature, see Bandura (1986), Condry (1977), Deci and Ryan (1985), Lepper and Greene (1976), Notz (1975), and Staw (1976).

The main contribution which the present research was designed to make with regard to this growing body of literature on the detrimental effects of reward is the inclusion of a measure which will predict individual differences in susceptibility to decrements in intrinsic motivation when extrinsic reinforcement is added. This factor is impulsivity, one of the two main factors measured by the extraversion scale of the Eysenck Personality Inventory (EPI).

Eysenck's Theory

Hans Eysenck (1957) has theorized that personality might best be represented by three dimensions: extraversion/introversion (E/I), neuroticism/stability (N/S), and psychoticism (P). While Eysenck (1957) has noted all three factors, his early work was primarily concerned with a two factor model, and much of the research centered on E/I and N/S as orthogonal dimensions of personality. In reviewing Eysenck's theory, I shall confine myself to those aspects directly related to conditioning and learning. H. J. Eysenck and M. W. Eysenck (1985, p. 241) note:

> A final point that must be made about the theoretical approach of H. J. Eysenck (1957, 1967a) is that differences in conditionability between introverts and extraverts were regarded as of fundamental importance. In the first place, the theory is primarily a biological one, and so conditioning performance provides a more direct test of its adequacy than could be obtained from most laboratory tasks. Second, Eysenck assumed that the differences between extraverts and introverts in degree of socialization and in susceptibility to various psychiatric disorders were attributable in large measure to the greater conditionability of introverts.

They also state (p. 246) that the distinctions drawn with regard to classical conditioning hold for operant conditioning as well.[1]

According to Eysenck (1957), extraverts are outgoing, sociable, and impulsive while introverts are more reserved and cautious. Extraverts work more quickly, make more errors, are less disturbed by extraneous stimulation, and prefer to work with people. Introverts work more slowly, make fewer errors, are more easily distracted by extraneous stimulation, and prefer to work alone. Eysenck argued that these differences had a biological basis.

Most of the evidence regarding differential conditioning of introverts and extraverts was obtained from classical conditioning of the eye-blink response (CR) to a tone (CS) using a puff of air (UCS). There were numerous

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[1]Throughout this report the name Eysenck will be used to refer to the work of the major figure Hans J. Eysenck. When reference is made to his collaborators (i.e., S. Eysenck and M. W. Eysenck) then their initials will be used.

studies which demonstrated the effect (Franks, 1956, 1957) as well as failures to replicate (Franks, 1963). Eysenck in his (1965) review, noted three conditions which are most conducive to demonstrations of superior eyeblink conditioning of introverts. They are: (a) partial as opposed to complete reinforcement; (b) weak as opposed to strong CS and UCS; and (c) discrimination learning as opposed to single stimulus conditioning. In a later statement (Eysenck and Levey, 1972) the third condition was listed as (c) small CS-UCS intervals. As Brody (1972) notes, the conditions postulated were never really proven to be essential.

Eysenck (1967) proposed a theory in which E/I reflects differing levels of arousal in the cerebral cortex and the ascending reticular activating system (ARAS), while the N/S dimension, also called emotionality/stability, refers to levels of arousal in the visceral brain particularly those structures known as the hippocampus, amygdala, cingulum, septum, and hypothalamus. Since introverts are characterized by higher levels of cortical arousal, and since arousal is known to enhance learning up to some optimal level, introverts are expected to condition better than extraverts. However, since arousal above some optimal level reduces learning, the arousal theory can be used to explain both null findings and superior conditioning of extraverts.

Dimensionality of Extraversion and Neuroticism

Carrigan (1960) reviewed the literature on extraversion in an attempt to answer two questions. First, are E/I and N/S independent, and second, is E/I a unitary dimension? With regard to the independence of E/I and N/S, Carrigan noted that most factor analytic studies of questionnaire data produced two dimensions which could reasonably be labeled E/I and N/S. She also noted that in those studies using oblique factor solutions, the correlation between E/I and N/S was usually close to zero. This last point suggests that the dimensions believed to underlie these factors may be independent. (Orthogonal solutions cannot provide evidence on this point since the factors are constrained to independence.) However, she reached two general conclusions. (1) The impressive consistency found in questionnaire data was not reflected across other media. Ratings, projective tests, and some behavioral measures showed little consistency. (2) While the evidence on the relationship of N/S and E/I is meager, many of the scales used to measure E/I in the analyses reviewed correlated with N/S. Introversion on these scales seemed to be related to neuroticism. Analyses of rating data provided similar findings. She concluded her review by stating that neither the unidimensionality of extraversion nor the independence of E/I from N/S had been conclusively proven.

The two criticisms leveled by Carrigan have been the most telling over the years. Researchers using the Maudsley Personality Inventory (MPI), the earliest of Eysenck's major questionnaires, often noted significant negative correlations between the MPI Extraversion Scale and Neuroticism Scale which according to the theory should have been independent. For example, Piers and Kirchner (1969) found E and N correlated -.39 ($p < .01$.) Findings such as this were one of the major factors which led Eysenck to replace the MPI with the Eysenck Personality Inventory (EPI) (H. Eysenck & S. Eysenck, 1968, p. 15.)

Next to be considered is the question of the unidimensionality of extraversion. Eysenck and Levey (1972) reanalyzed their data from an earlier publication (Eysenck and Levey, 1963) using impulsivity and sociability subscales which they devised from the MPI E Scale. They concluded that most of the differences between extraverts and introverts with regard to eye blink conditioning were due to the impulsivity but not the sociability scale.

H. Eysenck and S. Eysenck (1963) factor analyzed a special item pool which included the items of the MPI and produced three clear factors: impulsivity, sociability, and neuroticism. The first two of these factors correlated .5 which result, as they note, could be used to argue either that extraversion is a unitary dimension or that impulsivity and sociability should be treated as separate dimensions.

Finally, Eysenck (1983) indicates that learning variables such as eye blink conditioning should correlate higher with the total extraversion score than with the individual impulsivity and sociability scales.

Gray's Theory

Gray (1970, 1973, 1983) has proposed a revision of Eysenck's Theory. His theory, like Eysenck's, entails both a biological level of explanation, and a multivariate psychometric level.

Gray's (1972) theory begins by rotating Eysenck's two primary factors by 45 degrees. (See Figure 1.1.) When this is done, the primary dimensions of personality become impulsivity and anxiety rather than extraversion and neuroticism.[1] The rationale for this is, according to Gray, that current physiological and behavioral evidence suggests that anxiety is a more causally meaningful dimension than neuroticism. However, in order to maintain independence of factors, Gray also rotates E/I by 45 degrees and names this second factor impulsivity. In this rotation the two factors, anxiety and impulsivity, correspond to Gray's two hypothesized physiological arousal systems. The anxiety system reflects sensitivity to signals of punishment,

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[1]Gray does not specifically mention what happens to the sociability factor following this rotation. However, since it is known that impulsivity and sociability correlate about .5, if impulsivity is to be independent of anxiety, then sociability must extend in a third dimension slanting off the plane of the two dimensional space made by impulsivity and neuroticism.

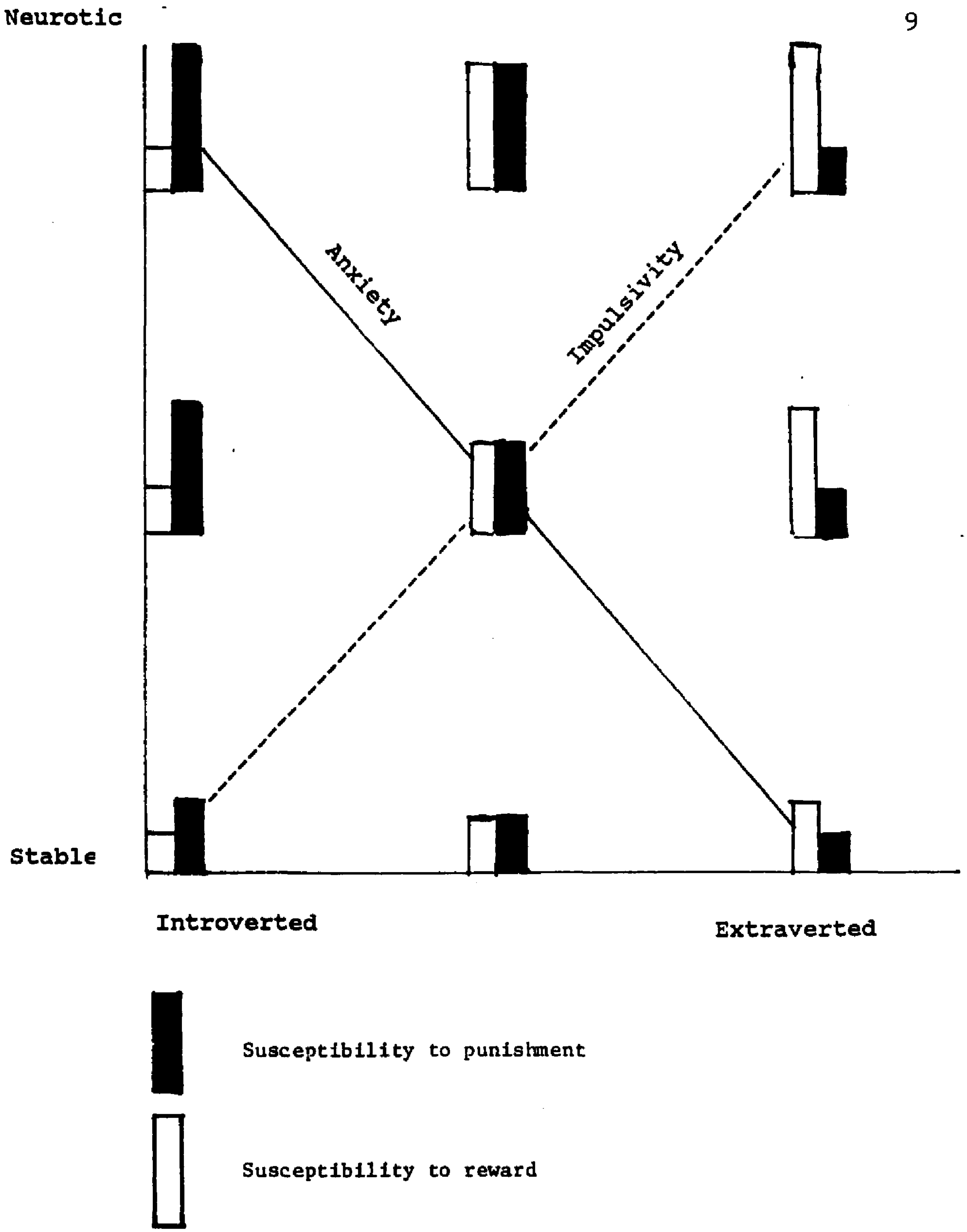

Figure 1.1. Gray's model.
From Gray (1973), p. 434.

non-reward, and novelty. The impulsivity system reflects sensitivity to signals of reward and non-punishment. Approach behavior is controlled by the impulsivity system, composed of the medial forebrain bundle and the lateral hypothalamus, while the inhibition of behavior is controlled by the anxiety system, attributed to mechanisms in the medial septal and hippocampal areas. Gray also calls this anxiety system the Behavioral Inhibition System (BIS).

Gray notes that differences in Eysenck's E/I reflect relative differences in sensitivity to reward and punishment while differences in N/S represent joint sensitivity to both positive and negative reinforcements. Thus, introverts are more sensitive to punishment, and extraverts are more sensitive to reward, while differences in neuroticism reflect increasing levels of sensitivity to both. Gray (1983, p. 182) notes that reward and withdrawal of punishment are functionally equivalent as are punishment and non-reward.

Comparison of Eysenck's and Gray's theories shows that they make one identical and one clearly different prediction with regard to conditioning. Both theories predict that introverts should demonstrate superior conditioning under conditions of punishment or withdrawal of reward. However, when the reinforcement used is positive, Eysenck's theory still predicts superior conditioning for introverts while Gray's theory predicts superior conditioning for extraverts.

Also, it should be noted that while both theories make the same behavioral prediction when a response is followed by negative consequences, the reasoning is different. Eysenck states that introverts' superior conditioning is due to their lower thresholds of arousal while Gray notes that it is due to their greater sensitivity to signals of punishment and nonreward.

Before turning to the research on extraversion and learning which is most relevant to Gray's theory, it is worth briefly noting the evidence on arousal which is relevant to Eysenck's theoretical position. Reviews by Stelmack (1981), Levey and Martin (1981), and by Wilson (1977) all suggest that introverts usually manifest arousal levels consistent with Eysenck's theory, and manipulations of arousal level, for example with drugs or sensory deprivation, usually produce findings consistent with Eysenck's theory. However, there are problems with the notion of arousal as a unitary concept which go beyond the scope of this discussion.

Research Regarding Extraversion and Learning

Corcoran (1972) found that extraverts performed better on several tasks under conditions of reward than introverts. However, the findings are complex, suggesting differences due to time of day interacting with reinforcement contingencies.

Gupta (1976) found that male extraverts conditioned better to reward than introverts on Taffel's (1955) verbal conditioning task when the experimenter was female but not when a male experimenter was used, and Gupta and Nagpal (1978) reported a similar finding for females with a male experimenter. In this second study, they reported separate significant effects for both impulsivity and sociability. In a third study Nagpal and Gupta (1979) report that neurotic extraverts condition better than stable introverts on the same verbal conditioning task. These findings can be viewed as supporting Eysenck's theory which predicts that the total extraversion factor should be the best predictor of learning differences; in other words, both impulsivity and sociability scales should predict learning about equally well. On the other hand, Gray's theory cannot explain why the sociability scale was found to be a significant predictor. However, one should bear in mind that both the behavior used as the dependent measure and the rewards administered were verbal in character. Individuals scoring high on sociability might be assumed to be more sensitive to verbal settings regardless of reward. Thus, I would suggest that the Gupta studies confound sensitivity to reward in general with type of reward and type of response.

Seunath (1975) found that extraverts were more sensitive to reward and introverts to punishment using a rotary pursuit task. However, he also found that after the reward was withdrawn, extraverts continued to perform better, as did introverts after the aversive stimulus was withdrawn. These findings seem, also, to stand in contrast to the hypotheses of the present research in that one would expect withdrawal of reward to reduce subsequent task interest and performance levels. However, Calder and Staw (1975) demonstrated that when the task is interesting, extrinsic rewards reduce subsequent intrinsic motivation, but if the task is not interesting, extrinsic rewards will increase subsequent intrinsic motivation. With regard to the Seunath study, the question is whether a rotary pursuit task is one that the subject would do for no additional reasons other than the enjoyment of doing it. It is possible that the task was not interesting and therefore, that extrinsic reinforcement increased intrinsic motivation.

Kantorwitz (1978) conditioned tumescense and detumescense in males to slides of female nudes. Repeated presentation of an erotic slide <u>pre</u>orgasmically produced conditioning of tumescence; repeated presentation of a similar slide <u>post</u>orgasmically (an aversive stimulus?) produced conditioned detumescence. Extraverts showed better conditioning of tumescence ($r = .88$), while introverts showed better conditioning of detumescence ($r = -.76$). Gray (1981) regards these results as consistent with his theory in that extraverts conditioned better with appetitive stimuli while introverts conditioned better with aversive stimuli.

Revelle, Humphreys, Simon, and Gilliland (1980) report performance differences between high and low impulsives on tasks similar to the Graduate Record Exam. These differences reflect a complex interaction of the impulsivity subscale of the EPI with time of day and caffeine. The findings suggest that low impulsives (like introverts) are more aroused in the morning and perform better than high impulsives and are less aroused and perform more poorly in the evening. To the extent that the findings implicate arousal, they support Eysenck's theory. However, the finding in this study that the impulsivity subscale of the EPI is a superior predictor to the total extraversion scale supports Gray's Theory. Rocklin and Revelle (1980) and Cambell and Reynolds (1984) provide evidence that effects attributable to the impulsivity component of the EPI extraversion scale may not be found when the Eysenck Personality Questionnaire (EPQ) is used instead. The EPQ is a newer questionnaire (1975). However, the extraversion items on it reflect largely sociability. Many of the impulsivity items have been dropped. Others have been moved into the new psychoticism scale. While Eysenck and Eysenck (1977, 1979) present the rationale for this change, the above researchers as well as Block (1978) argue that the meaning of extraversion has been changed in the new scale and that the behavioral correlates must also change. Additionally, the relationships between the EPI and the EPQ scales has not been adequately demonstrated to justify the use of the EPQ as an equivalent research instrument.

As the above review indicates, the lines of distinction between Gray's and Eysenck's Theories have been drawn. The most appropriate measure for a comparison of the theories is the EPI.

Statement of Problem

The findings noted above suggest two distinct effects. First, the intrinsic-extrinsic motivation literature has found that in general if a person is rewarded for an initially interesting task, he or she is likely to enjoy it less (or so rate the task) when reward is withdrawn and be less willing to re-engage the task without reward. Second, the research on E/I, which has not intentionally measured level of intrinsic motivation, has found that introverts are less sensitive to reward and more sensitive to punishment than extraverts. If Gray's Theory holds, extraverts should be more responsive to reward and, by implication, experience greater decreases in intrinsic motivation when reward is withdrawn. Furthermore, it should be the impulsivity component of extraversion which best predicts these decrements. When the contingencies involve punishment or withdrawal of reward, introverts should be more responsive than extraverts and experience greater losses of intrinsic motivation after the aversive contingencies are discontinued. Additionally, neurotics should be more responsive to all reinforcement, and increasing levels of N/S should increase differences between introverts and extraverts in positive or aversive conditions.

Two studies were conducted. In the first experiment volunteer subjects either played a computer game for (a) monetary reward or (b) in a control condition played for no reward (and were not informed that a reward condition existed.) In the second experiment a (c) withdrawal of reward or penalty condition was added. In this condition, subjects were informed upon arrival that they would be paid. However, they would lose a portion of this payment for every possible point they failed to make. All subjects were told that following this initial (paid/unpaid) play of the game, they would be allowed to play as much or as little as they wished (with no further payment), and that they would be interviewed afterwards regarding what they thought of the game. Subjects also rated how interesting they found the game after each game, and in the second experiment they filled out a paper-and-pencil overall interest rating of the game after they had concluded play.

Hypotheses

Experiment 1

The following hypotheses, derived from intrinsic motivation research and from Gray's theory are tested by experiment 1.

1. Paid (reward) subjects should play fewer optional

games, make fewer optional moves, and spend less optional time playing than unpaid (control) subjects. In these hypotheses, the term "amount of optional play" will be used to refer to these three dependent variables.

2. Paid subjects should rate the optional games as less interesting than unpaid subjects. (For this hypothesis and all others dealing with average interest ratings of the optional game(s), a truncated sample is used consisting of only those subjects who played one or more optional games.)

3. Let $Int_i - Int_o$ equal the difference between the interest rating of the initial paid/unpaid game and the average interest rating of the optional game(s). H_3: $Int_i - Int_o$ should be greater for paid subjects than for unpaid subjects (i.e., paid subjects are expected to show a greater decrement in interest.)

4. As impulsivity increases, the difference in amount of optional play between paid and unpaid subjects should increase.

   Two ways of testing this hypothesis are suggested by Gray's (1983) theory based on two different ways of assessing impulsivity.

   4A: As impulsivity (and possibly extraversion) increases, the difference in amount of optional play between paid and unpaid subjects should increase.

4B: With simultaneously increasing levels of extraversion and neuroticism, the difference in amount of optional play between paid and unpaid subjects should increase.

5. As impulsivity increases, the difference in rated level of interest of the optional games between paid and unpaid groups should increase.

   5A. As impulsivity (and possibly extraversion) increases, the difference in rated level of interest of the optional games between paid and unpaid groups should increase.

   5B. With simultaneously increasing levels of extraversion and neuroticism, the difference in rated level of interest of the optional games between paid and unpaid groups should increase.

6. As impulsivity increases, the difference in Int_i - Int_o between paid and unpaid subjects should increase.

   6A. As impulsivity (and possibly extraversion) increases, the difference in Int_i - Int_o between paid and unpaid subjects should increase.

   6B. With simultaneously increasing levels of extraversion and neuroticism, the difference in Int_i - Int_o between paid and unpaid subjects should increase.

7. Increasing levels of sociability should not be related to increasing differences in amount of optional play when comparing paid subjects with unpaid subjects. In

other words, there should not be a sociability by group interaction.

8. Increasing levels of sociability should not be related to increasing differences in rated interest of optional play when comparing paid subjects with unpaid subjects. In other words, there should not be a sociability by group interaction.

9. Increasing levels of sociability should not be related to increasing differences in $Int_i - Int_o$ between paid and unpaid subjects. In other words, there should not be a sociability by group interaction.

Experiment 2

A number of additional hypotheses are tested by experiment 2. The first group concern an additional interest rating variable, namely, "overall interest rating of the game" or RATE. Hypotheses concerning interest ratings in Experiment 1 (namely, 2, 3, 5, 6, 8, and 9), will also apply to the new dependent variable RATE. To indicate that these are parallel hypotheses for experiment 2, these hypotheses will be designated 2.2, 2.3, 2.5, 2.6, 2.8, and 2.9.

12. Paid (Penalized) subjects should play fewer optional games, make fewer optional moves, and spend less optional time playing than unpaid subjects.

13. Paid (Penalized) subjects should rate the optional games as less interesting than unpaid subjects.

14. Paid (Penalized) subjects should show decrements in rated lèvel of interest ($Int_i - Int_o$) between the paid and optional conditions whereas unpaid subjects should not.

15. Differences in amount of optional play between paid (Penalized) and unpaid subjects should increase with increasing levels of neuroticism.

16. Fig. 1 shows that the anxiety dimension may be thought of as resulting from decreasing extraversion scores and simultaneously increasing neuroticism scores. Hypothesis 16 attempts to relate sensitivity to punishment, as reflected by the anxiety dimension, to degree of optional play. Since no direct measure of Gray's anxiety dimension was available, however, it must be inferred from the neuroticism and extraversion scores. Thus, it is hypothesized that differences in amount of optional play between paid (Penalized) and unpaid subjects should increase with simultaneously increasing levels of neuroticism and decreasing levels of extraversion.

17. Differences in rated level of interest of optional games between paid (Penalized) and unpaid subjects should increase with increasing levels of neuroticism.

18. Hypothesis 16 refers to behavioral variables. However, the same effects should occur for interest rating variables. Thus, it is hypothesized that differences

in rated interest of optional play between paid (Penalized) and unpaid subjects should increase with simultaneously increasing levels of neuroticism and decreasing levels of extraversion.

CHAPTER 2

EXPERIMENT 1

Overview

Volunteer subjects were solicited from undergraduate classes at Hunter College and took a computerized version of the EPI. They then played a computer game called "Frogs'n'Puddles." The control group played it without payment while the experimental (reward) group received 25 cents for each frog removed. The control group was run first, and the experimental group second. Following this play all subjects rated how interesting they found the game, saw a scoring guide which provided performance norms, and were given the option of playing again as much or as little as they liked. Dependent variables consisted of three measures of voluntary play and average interest. Independent measures consisted of extraversion, impulsivity, sociability, neuroticism, and experimental condition.

METHOD

Subjects

Volunteers were solicited from 9 undergraduate classes in psychology, sociology, and education during the summer session at Hunter College in 1984. They were told the study was about the interest value of computer games, and what types of people liked or disliked computer games. Students indicated days and times during which they were available on forms which they filled out during their classes. I collected 99 completed forms and I attempted to schedule all subjects who volunteered. The order was essentially determined by matching available experimental time slots with subjects willing to participate at those times. Beyond that, subjects were run in roughly the order in which classes were approached. Of those people who completed volunteer forms, 59.1% were run. The remainder fell into three catagories: (1) Could not be reached by telephone (N = 6); (2) could not be scheduled at a mutually agreeable time (N = 18); and (3) made an appointment but did not show up for it (N = 17). Fifty eight subjects were actually run. Three of these were dropped from the experiment: In one case I failed to recycle the apparatus following the practice game; in one case the subject's poor command of English and poor performance on the game clearly indicated that she did not understand the instructions; and in one case the apparatus failed. Thus the final sample consisted of 55 subjects; the first 24 constituted the control group and the next 31 the experimental group. The difference in size between the control and experimental groups was designed to increase the power of the statistical analyses (Cohen, 1969, p. 363-365.)

Of the final sample, 41 subjects were female; 14 were male. Approximately the same proportion of males and females were in each condition. (Control: 18 females, 6 males; experimental: 23 females, 8 males.) The mean age of the subjects was 25.5 years; standard deviation 6.7 years.

Apparatus

The apparatus which the subjects used, both to answer the questions for the EPI and to play the computer game, consisted of a wooden box with a sloping front and a TV monitor sitting on top of it. On the sloping surface were two dials and two buttons. The dials were labeled "Up-down" and "Left-right"; the buttons were labeled "No-end game" and "Yes-make move." Inside the box was an Apple II Plus microcomputer with 48k of memory. The "Y" and "N" keys from the keyboard of the Apple were wired to the "Yes" and "No" buttons. The dials of the apparatus were actually Apple game paddles and were plugged into the Game input/output jack of the Apple in the usual fashion.

Procedure

When subjects arrived, they read and signed a consent form. Any questions regarding the form were answered before they signed. Even though the form stated the voluntary nature of the study, I reminded subjects that if they wished to, they could withdraw at any point during the study. They were then introduced to the apparatus described above. While the subject was seated at the apparatus, I reviewed the various parts of the study: EPI questionnaire, computer game, rating of the game, voluntary play, and interview; I also explained the role of the dials and buttons at each point in the study. Next, the subject was left to respond to the questions of the EPI. The subject was instructed to come and get me when the game appeared. I waited in my office adjacent to the experimental room. When the subject informed me that he or she had completed the questionnaire, we returned to the apparatus, reviewed the instructions and played part of the game together. The game which subjects played was called "Frogs'n'Puddles" and was designed especially for this experiment. A diagram of the initial display is given in Appendix B. The object of the game was to turn all the frogs except one into puddles. Frogs are turned into puddles by leaping over them with other frogs in checker-like fashion. A more detailed description of the computer game is given in the section entitled Software in the Chapter entitled "Experiment 2." While the instructions appeared to subjects in the form of prompts, piloting had demonstrated that only actual supervised practice made the instructions clear. Without such practice, the game might be viewed as threatening rather than interesting. Therefore, I read each instruction aloud with the subject, and practice played part of a game with him or her. The practice session took 5 to 10 minutes and during that time I guided the subject through four distinct phases of practice: (1) basic cursor (white dot) movement, (2) understanding the two components of each move, (3) basic move competence, and (4) beginnings of strategy. The object of the game was to remove all the frogs except one. When the subject had achieved basic move competence and was beginning to think about strategy, the practice session was terminated before the subject was able to implement strategies.

For the control group, the practice session began with my statement, "Now we are going to play Frogs'n'Puddles." For the experimental group, the practice session began with the statement, "Now the Computer Games Research Project is going to pay you to play Frogs'n'Puddles. We are going to pay you 25 cents for each frog you remove." Also, the written instructions for the experimental group included an additional prompt stating, "You will be paid 25 cents for each frog you eliminate." Subjects in both groups were led to believe the experiment was being conducted under the auspices of the "Computer Games Research Project." This deception was necessary because Hunter College students sympathized with the needs of graduate students. Many volunteered because they wished to be helpful and would have felt quite ambivalent about accepting money had they known I was paying them from my own pocket. Mean payment for experimental group subjects was $5.75.

Twelve subjects in the control group were asked a final question after the experiment was over. They were asked, "One way of assigning value to things, even interest value, is to ask 'How much is it worth to you?' Therefore, if you were paid to play Frogs'n'Puddles, how much money would be just the right amount per frog; not too much and not too little?" Half of all respondents answered $.25, 2 answered $.10 or $.25. 2 answered $.10, 1 answered $.05, and 1 answered $5.00 per frog. Thus the price of $.25 per frog was selected because the largest number of subjects viewed this amount as appropriate.

Following the practice session, the subjects played the game once, rated how interesting they found it, and then saw a set of performance standards called a "Scoring Guide." (See Appendix A.) (The Interest Rating Program is described in detail in the software section of the chapter entitled "Experiment 2".) Following the first play of the game and subsequent rating, all subjects had the option of playing again (and rating the game again) as many times as they wished, or stopping immediately and proceeding to the post-game interview. Any subject still playing the game one and a half hours after the èxperiment had begun, was asked to stop after he or she concluded that play of the game. Subjects who did not play optional games completed the whole study including the post-game interview in 40 minutes. Two subjects were stopped; one in the experimental and one in the control group. Optional play measures for both of these subjects were statistical outliers and were treated accordingly. (See Dependent Variables in Measures Section of this chapter.)

Subjects began the post-session interview by filling out a single paper-and-pencil item which asked them to rate how difficult they found the game on a scale of from 1 to 9; with 1 - very easy, 3 - moderately easy, 5 - intermediate, 9 - very difficult. Then, in a loosely structured interview, subjects were asked what they thought of the game, what they liked and disliked about it, and whether they found the instructions to be clear. Also, demographic data were collected and information regarding the subjects' recreational patterns including computer and non-computer games. Following this, I answered any questions which the subject had about the experiment without releasing specific information regarding hypotheses. They were told this information would be available at a later date. Then for subjects who wished, I discussed the possible roles of computers and computer games in society with the subject and how a study on the characteristics of computer games might relate to these topics. Then I gave the subject a blank envelope in which to obtain a report of the finished study and showed him or her a sealed box in an outer office of the laboratory where he or she could optionally deposit the self-addressed envelope if he or she wished to obtain a report of the findings. Subjects were enjoined to secrecy and thanked for their participation. Experimental group subjects were paid. Many subjects in both control and experimental groups thanked me and voluntarily offered that the experiment had been a positive and educational experience and that they were glad they had participated. Of the subjects actually run through the procedure, all but two deposited addressed envelopes. After the data were analyzed, each of these subjects was mailed a debriefing letter which explained the results of the study, the scientific merits of this type of enterprise, and also included my home phone number and the name and phone number of the Department of Social/Personality Psychology at the Graduate Center in case he or she wished to discuss the research further. This letter was also mailed to the chairman of the Hunter College Human Subjects Committee. (See Appendix for letter.)

Measures

Dependent Variables

Four main dependent variables were used in the study. There were 3 measures of how long the subject played: (1) number of optional games (NOG), (2) number of optional moves (NOM) and (3) amount of optional time spent playing the game (TIM). The computer used for this study did not have a program accessible clock. Therefore, I constructed an endless loop which sampled the keyboard entry buffer. If the buffer was empty, the counter was increased by one and the loop iterated. If the buffer contained a character, (i.e. a "Y" or an "N"), then the loop exited with the value of the character, plus the value of the index. This index is the amount of time the subject took to make the move with the amount of time the machine used removed. It provides a comparative measure between subjects, but no absolute value of move time. When this measure is accumulated for the whole game, we have a measure of comparative game time.

Preliminary examination of the data revealed that none of the three measures was normally distributed. Therefore log and square root transformations were applied to the data, and for each variable, the transformation which most successfully normalized the data became the dependent variable used for statistical analysis. The two transformations used, including corrections for zero or small cell frequencies, are:

$$\text{Log Variable} = \ln(\text{variable} + 1)$$

and

$$\text{Square Root Variable} = \sqrt{(\text{variable} + .5)}$$

Transformations were taken from Snedecor and Cochran (1967, pp. 325-333.) Tests of normality were applied to the original three variables and to each of the two transformations of each variable. The test used was a Kolmogorov-Smirnov D statistic (Bradley, 1968) provided by the SAS statistical package (Ray, 1982.) This value approaches zero if the data are normal. It approaches unity when the data are least normal. The results of these tests showed that the logarithm of number of optional games and the square root of number of optional moves and amount of optional play time provided the best approximation to normality. Table 2.1 shows the means and standard deviations of the original variables, transformations, and statistical tests.

The optional play measures of two subjects who persisted until I stopped them after one and a half hours became outliers and were winsorized following the procedure logic of Winer (1971, pp. 51-53); the most extreme subject in each of the two experimental conditions was set equal to the third most extreme score in the total sample.

The fourth major dependent variable is average interest rating of optional games (AVINT). This variable represents the case of a censored variable since subjects who did not optionally play the game at least once, could not rate it. This measure provides a conservative test of the hypotheses for two reasons. First the sample size is smaller, and second those subjects no longer represented in the sample are those most likely to respond most extremely in the direction of the hypotheses. To restate the second point, those who chose not to play were the subjects who were presumably most likely to have rated the game least interesting had they played.

Independent Variables

The main independent variables used were the extraversion and neuroticism scales of the EPI, condition (paid versus control), and the impulsivity and sociability scales from the EPI used by Revelle et al. (1980.) Other variables examined or tested as covariates include score on initial paid-unpaid game (G), interest rating of this game (Rt), number of errors on optional games, average move time, EPI lie scale, sex, and age.

For the EPI the means, standard deviations, and subscale reliabilities for the extraversion, impulsivity, sociability, neuroticism, and lie scales are displayed in Table 2.2, and Table 2.3 indicates the intercorrelations among the subscales.

Missing Data

Preliminary examination of the responses to the EPI questions revealed that a small group of items had time values of one tick (approximately one tenth of a second). Since the fastest responses occurring otherwise were 30 to 40 ticks, the one-tick responses were unlikely to be valid, and presumably indicated that the equipment had not properly recorded those responses due, perhaps to button pounding, button riding, or some other unknown factor. It was decided that these "one-tick responses" would be treated as missing data. There were only 27 of these out of over 3,000 responses, and they were not distributed systematically among subjects or conditions. For subjects with missing data (N =21), a correction was made in the score for those scales in which items were missing. The proportion of items scored in the direction of a scale (e.g. impulsivity) was multiplied by the total number of items in the scale. For example, if in the eight item impulsivity scale two items were missing, and three of the six answered items were scored in the direction of impulsivity, the corrected score was 3/6 x 8 or 4. For the actual game, there were no missing data.

RESULTS

A crosstabulation was constructed of the number of subjects who chose to play optional games versus those who did not to determine if the payment manipulation was successful. (See Table 2.4.) A Fisher's Exact Test (one-tailed) was applied to the table since the typical chi-square statistic is distorted by small cell frequencies. Inspection of Table 2.4 shows that the paid (reward) subjects played significantly fewer optional games than the unpaid (control) subjects. Additionally, Table 2.5 shows a crosstabulation of the number of subjects who chose to play more than one optional game versus those who played none or one by condition (paid versus unpaid). The Fisher's Exact Test is again significant at the same level indicating that more people in the unpaid (control) group played two or more optional games than did people in the experimental (reward) group. These data will be used for comparison purposes with the next study. The addition of payment did reduce intrinsic motivation as indicated by the finding that a smaller proportion of subjects in the payment condition played optional games.

Table 2.6 shows the means and standard deviations of the four dependent variables by condition and Table 2.7 shows the intercorrelations among them.

Four stepwise regressions were run on each of the three dependent variables measuring optional play. These four regressions were identical except for one variable. In the first, extraversion and interactions of extraversion with condition were entered. In the second extraversion was replaced by impulsivity. In the third and fourth, it was replaced by sociability and neuroticism.

It was assumed that a major predictor of optional play might be level of performance on the initial paid/unpaid game (G). (As G, the number of frogs left, becomes smaller, performance is better.) Four additional regressions were run using G as a covariate. This variable was used as a covariate because it was not of direct theoretical interest to the present research. Additionally, regressions were run using G as the dependent variable and employing all the main independent variables reported above to determine its appropriateness as a covariate. No significant predictors of initial paid/unpaid score were found. (F values of less than 1 were found for regressions using extraversion, impulsivity, sociability or neuroticism with condition.) Since initial paid/unpaid game score was unrelated to the independent variables of interest but substantially related to the dependent variables, paid/ unpaid score (G) was used as a covariate in each of the analyses. Tables 2.8 through 2.10 show the multiple regressions for each of the dependent variables measuring optional play: (1) number of games, (2) number of moves, and (3) amount of time. Tables 2.11 through 2.13 show the same regressions using G as a covariate.

In these tables we note that the overall F values for the multiple R's are significant for nearly all the models. (The exceptions are models employing neuroticism as an independent variable.) This finding indicates that some combination of the independent variables is useful for predicting the dependent variables.

The second finding is that the interaction terms of condition with personality (i.e., E, I, S, and N) are not significant. Condition is abbreviated in the tables as CA because an additional condition will be introduced in the second study which will be called CB. Additionally, the R^2 change when these interaction terms are added is near zero, and the F test for the significance of this change is less than one. The first three of these interaction terms are the most direct tests of the hypothesis in terms of both convergent and discriminant validity. Paid subjects high in extraversion and impulsivity should show less optional play when compared to unpaid subjects with equivalent levels of extraversion and impulsivity. Those paid individuals who are high in sociability should show little difference when compared to unpaid individuals with equivalent levels of sociability. Therefore, I predicted from Gray's hypotheses that there would be significant effects for CA, CAxI, and possibly CAxE. I also predicted significant increments in the R^2 when each of these terms was added to the model.

Additionally, I predicted that CAxS would not be significant. Except for the expected non-significant contribution of CAxS, (Hypothesis 7), clearly the data in Tables 2.8 through 2.13 do not support this hypothesis (4A). However, it is possible to arrive at a statistical model employing personality variables which fits the data for two of the three dependent variables, LOGNOG and SQTIM. The model has three terms. Each term adds a significant increment to the R^2; each term in the model is significant; and the overall model is significant. (See Tables 2.11 through 2.13 and 2.14 through 2.16.) Except for Table 2.15, the <u>beta</u> weight for G indicates that the greater the number of frogs remaining at the end of the paid/unpaid game, the longer an individual will persist. The <u>beta</u> weight for CA indicates that unpaid subjects played longer than paid ones. The main effect for extraversion is also significant. The higher the level of extraversion, the longer the individual played. No interaction term of extraversion by condition is needed. The equivalent models using impulsivity are not significant, and sociability is significant only in Table 2.16. These non-significant relationships may be due to the low reliabilities of these scales which attenuate possible relationships. These low reliabilities are due to the short length of these two scales. (See Table 2.2, above.)

One could also reasonably argue that the most direct test of the model, the combination of condition with impulsivity (CAxI), is seriously limited by the low reliability of the impulsivity scale. An alternative version of Gray's model (Hypothesis 4B) is suggested by Gray (1983, pp. 183-189.) The interaction of high extraversion scores with high neuroticism scores should produce the equivalent of high impulsivity. (See Figure 1 in Chapter 1.) This hypothesis uses two scales of higher reliabilities and thus avoids serious attenuation due to unreliability. In this case, the direct test of the hypothesis is a triple order interaction, condition by extraversion by neuroticism, (CAxExN). These data are presented in Tables 2.17 through 2.19. Again, the data do not support the hypothesis of differential sensitivity to reward.

Additional models were tested using initial interest rating of the paid/unpaid game (Rt) as a covariate. Regressions were tried with squared covariates, G^2 and Rt^2, as well as multiple covariates. None of these variables improved upon the reduced model regressions reported above.

The final dependent variable in the study was AVINT, Average Interest Rating of Optional Games. As noted above, the sample size is reduced for this variable since only those subjects who played optional games could rate them on interest. Regressions were run with each of the four personality variables to test Hypotheses 2, 3, 5A, and 6A. These regressions were run with and without covariates. The models without covariates were not significant, i.e., the groups did not rate the optional plays of the game significantly differently. (See Table 2.20) Since G was not significant as a covariate and did not significantly add to the R^2, initial rating of paid/unpaid game (Rt) was used as a covariate. Thus behavior (G) was employed as a covariate for the measure of behavior, game playing, and a rating (Rt) was employed as a covariate for the rating dependent variable, AVINT. The fact that initial interest rating of the game is highly correlated with the average of the subsequent interest ratings is not extraordinary. However, by controlling for initial interest, we are able to see the degree to which the interest ratings of the game change when the game is played without reward. First, the covariate alone produces a significant multiple R of .62. (See Table 2.21.) However, when we test the full model, the regression weights for the interaction terms of condition with personality (e.g.; CAxE, CAxI, CAxS, and CAxN) are all nonsignificant. The fact that the <u>beta</u> weights for CAxS are not significant supports the null hypotheses 8, and 9. Again, a reduced model with main effects terms for personality variables and no interaction term proves most parsimonious and for two models (extraversion and impulsivity) all the terms are significant. (See Table 2.22.) Since the <u>beta</u> terms for E and I are negative, this finding signifies that when initial interest ratings are controlled, extraverts and impulsives rated the game less interesting regardless of whether or not they were paid for the initial game. Additionally, the magnitude of the main effects for extraversion and impulsivity are about the same magnitude as the main effect for condition.

A regression was run using AVINT as the dependent variable to test the hypothesis that neurotic extraverts might rate the game as less interesting in the paid condition than subjects of equivalent levels of extraversion and neuroticism in the unpaid condition (Hypothesis 6B). The test of this hypothesis was the triple order interaction term of extraversion with neuroticism and experimental condition (i.e. CAxExN). The hypothesis was not confirmed. (No table of this regression is presented.)

There were no sex differences in any of the variables in the study: dependent variables, covariates, independent variables, or interactions of sex with independent variables.

<u>Summary</u>

1. Paid subjects played less than unpaid subjects as supported by a Fisher's Exact Test of subjects who chose versus those who did not choose to play optional games. Also, the effect for condition (CA) was significant in the reduced form regression model. Hypothesis 1 is supported.
2. Paid subjects did not rate the optional games as less interesting than unpaid subjects. However, using

initial interest rating (Rt) as a covariate, there is a significant decrement in rated interest for paid subjects. Hypothesis 3 is confirmed. Hypothesis 2 is not.

3. Subjects' score on the initial, paid/unpaid game (G) was a significant predictor of persistence. The greater the number of frogs which the subject failed to remove initially, the greater the number of optional games he or she played. G was unrelated to the subjects' average interest rating of the optional games (AVINT.) These findings, while not unexpected, are independent of the hypotheses.

4. Subjects' initial interest rating of the game (Rt) was positively correlated with their average interest rating of optional games (AVINT), but unrelated to persistence behavior. These findings are independent of the hypotheses.

5. Highly extraverted and/or impulsive subjects in the paid condition did not persist less than subjects in the control condition of equivalent levels of extraversion and/or impulsivity, i.e., the interaction terms of personality with condition, CAxE and CAxI, were not significant. Regression models were used with and without G as a covariate. Hypothesis 4A is not confirmed.

6. Regression models with and without covariate (G) were

computed using the triple order interaction term, CAxExN, which tests the hypothesis that paid neurotic extraverts will show less persistence than unpaid subjects of equivalent levels of neuroticism and extraversion. The model was not significant. Hypothesis 4B is not confirmed.

7. Reduced form regression models fit the data well for all three behavioral measures, LOGNOG, SQMOV, AND SQTIM. The models are G, CA, E, and G, CA, S, but not G, CA, I. These models indicate that aside from a main effect for condition (CA) there are unexpected main effects for extraversion, and sociability, but not impulsivity.

8. Differences in rated level of interest of the optional games (AVINT) between the paid (reward) group and the unpaid (control) group did not increase with increasing levels of extraversion and/or impulsivity. Regressions employing initial rating (Rt) as a covariate as well as models without covariates were not significant. Hypotheses 5A and 6A are not confirmed.

9. Again, a reduced form model employing a covariate (Rt) as well as condition (CA) and personality variables E or I are significant. The covariate indicates that the higher the initial interest rating, (Rt), the higher the subsequent average interest rating (AVINT). The significant term for condition indicate that subjects

in the paid condition rated the game less interesting. The significant personality variables indicate that individuals who are more extraverted or more impulsive rated the optional play as less interesting. These findings should be contrasted with the equivalent finding above (Item 7) for behavior. Only extraversion manifests consistency across both ratings and behavior.

10. Tests of the hypotheses (5B and 6B) that neurotic extraverts should rate the game as less interesting when paid than unpaid subjects of equivalent levels of neuroticism and extraversion were not significant with or without a covariate (Rt).

11. Null hypotheses 7, 8, and 9 are not disconfirmed. As predicted sociability did not interact with reward. However, there was as noted above, a main effect for sociability on behavior.

The findings noted suggest that payment decreases intrinsic motivation as supported by a large main effect for behavior, (unpaid subjects persisted longer), and a small main effect for ratings, (unpaid subjects rated their optional play slightly more interesting when initial ratings are controlled for).

The meaning of the findings for extraversion is less clear. Extraverts persist longer, they play more games, make more moves and spend more time playing. However, they experience a significant decrement in rated interest relative to introverts.

This study fails to confirm the prediction of Gray's theory of differential sensitivity to reward for extraverts or persons high in impulsivity. Eysenck's theory was not tested in this study since arousal was not measured.

TABLE 2.1

Tests of Normality of Variable Transformations using Kolmogorov-Smirnov D Statistic (Hunter College)

	M	SD	D
Optional games (NOG)	2.25	2.04	.2406
Log NOG (LOGNOG)	.99	.62	.1496*
Square root NOG (SQNOG)	1.55	.59	.1710
Optional moves (NOM)	50.42	44.38	.1861
Log NOM (LOGMOV)	3.27	1.57	.2679
Square root NOM (SQMOV)	6.31	3.37	.1253*
Optional time (TIM)	5369.85	4477.92	.1477
Log TIM (LOGTIM)	7.16	3.26	.3509
Square root TIM (SQTIM)	63.87	36.26	.1229*

*Transformation which most normalizes the distribution

NOTE: Kolmogorov-Smirnov D approaches zero when the distribution is normal, and one when it is least normal.

TABLE 2.2

Means, Standard Deviations, and Coefficient Alpha Reliabilities of Main Independent Variables (Hunter College)

	Mean[a]	SD	Alpha	No. Items
Extraversion	11.86	3.70	.68	24
Impulsivity	4.17	1.67	.41	9
Sociability	6.71	2.73	.66	13
Neuroticism	11.48	4.62	.80	24
Lie	3.52	1.54	.46	9

[a]N=55

TABLE 2.3

Intercorrelations of Main Independent Variables (Hunter College)

	E	I	S	N	L
Extraversion[a]	1.00	.69	.84	-.12	-.20
Impulsivity		1.00	.27	.14	-.24
Sociability			1.00	-.29	-.15
Neuroticism				1.00	-.25
Lie					1.00

[a]High correlation of extraversion with impulsivity and sociability is due to their dependent relationship; extraversion is nearly the sum of impulsivity and sociability.

TABLE 2.4

Crosstabulation of Optional Game Playing by Condition (Hunter College)

	Play Optional Games*		
Condition	No	Yes	Total
Unpaid (Control)	1	23	24
Paid (Reward)	8	23	31
Total	9	46	55

*Fisher's Exact Test (One-tailed), $p = .03$

TABLE 2.5

Crosstabulation of Playing Two or More Optional Games by Condition (Hunter College)

	Play Two*		
Condition	No	Yes	Total
Unpaid (Control)	7	17	24
Paid (Reward)	18	13	31
Total	25	30	55

*Fisher's Exact Test (One-tailed), $p = .03$

TABLE 2.6

Measures of Intrinsic Motivation for Each Condition (Hunter College)

Variable	M	SD	n
Condition 1 (Unpaid)			
Optional games (NOG)	3.16	2.20	24
Optional moves (NOM)	67.29	47.66	24
Optional ticks (NOT)	7335.00	4189.90	24
Avg. rated interest for optional games (AVINT)*	7.26	1.21	23
Condition 2 (Paid)			
Optional games (NOG)	1.55	1.61	31
Optional moves (NOM)	37.35	37.41	31
Optional ticks (NOT)	3848.45	4141.60	31
Average Rated Interest for Optional Games (AVINT)*	6.80	1.53	23

*Scale is 9-Very interesting, 7-Moderately interesting, 5-Neutral, 3-Moderately uninteresting, 1-Very uninteresting.

TABLE 2.7

Intercorrelations Among Dependent Variables (Hunter College)

	LOGNOG (N=55)	SQMOV (N=55)	SQTIM (N=55)	AVINT (N=46)
Lognog	1.00	.96	.89	.17
Sqmov		1.00	.93	.24
Sqtim			1.00	.13

TABLE 2.8

Stepwise Multiple Regression Analyses with LOGNOG, Number of Optional Games (Hunter College)

Extraversion

Variable	Beta	F	p	Multiple R
CA	-0.29	.47	.49	.37
E	.29	2.44	.12	.46
CAxE	-.02	.00	.95	.46

MS(reg)=1.74, MS(res)=.37, Overall F(3,51)=4.68, p=.005

Impulsivity

Variable	Beta	F	p	Multiple R
CA	-.10	.08	.77	.37
I	.28	1.79	.18	.40
CAxI	-.30	.60	.44	.41

MS(reg)=1.39, MS(res)=.39, Overall F(3,51)=3.53, p=.021

Sociability

Variable	Beta	F	p	Multiple R
CA	-.40	1.48	.22	.37
S	.23	1.61	.21	.45
CAxS	.08	.05	.82	.45

MS(reg)=1.65, MS(res)=.37, Overall F(3,51)=4.37, p=.008

Neuroticism

Variable	Beta	F	p	Multiple R
CA	-.31	.78	.38	.37
N	.04	.04	.84	.37
CAxN	-.06	.03	.86	.37

MS(reg)=1.13, MS(res)=.41, Overall F(3,51)=2.76, p=.051

CA = condition (control = 0; reward = 1)
N = 55

TABLE 2.9

Stepwise Multiple Regression Analyses with SOMOV, Number of Optional Moves (Hunter College)

Extraversion				
Variable	Beta	F	p	Multiple R
CA	-.27	.36	.55	.31
E	.26	1.80	.18	.40
CAxE	.01	.00	.98	.40

MS(reg)=43, MS(res)=13, Overall F(3,51)=3.29, p=.028

Impulsivity				
Variable	Beta	F	p	Multiple R
CA	-.01	.00	.99	.31
I	.29	1.80	.18	.34
CAxI	-.34	.74	.39	.36

MS(reg)=34, MS(res)=13, Overall F(3,51)=2.53, p=.067

Sociability				
Variable	Beta	F	p	Multiple R
CA	-.37	1.19	.28	.31
S	.20	1.21	.28	.39
CAxS	.10	.09	.76	.40

MS(reg)=41, MS(res)=13, Overall F(3,51)=3.17, p=.032

Neuroticism				
Variable	Beta	F	p	Multiple R
CA	-.18	.24	.62	.31
N	.09	.21	.64	.31
CAxN	-.14	.14	.71	.32

MS(reg)=26, MS(res)=14, Overall F(3,51)=1.90, p=.141

CA = condition (control = 0; reward = 1)
N = 55

TABLE 2.10

Stepwise Multiple Regression Analyses with SOTIM, Amount of Optional Time (Hunter College)

Extraversion				
Variable	Beta	F	p	Multiple R
CA	-.58	1.87	.17	.40
E	.18	1.03	.31	.48
CAxE	.24	.32	.57	.48

MS(reg)=5872, MS(res)=1140, Overall F(5,51)=5.14, p=.003

Impulsivity				
Variable	Beta	F	p	Multiple R
CA	-.21	.35	.56	.40
I	.21	.97	.33	.42
CAxI	-.21	.30	.59	.42

MS(reg)=4529, MS(res)=1219, Overall F(3,51)=3.71, p=.017

Sociability				
Variable	Beta	F	p	Multiple R
CA	-.65	3.97	.05	.40
S	.14	.65	.42	.47
CAxS	.32	.88	.35	.49

MS(reg)=6074, MS(res)=1128, Overall F(3,51)=5.38, p=.003

Neuroticism				
Variable	Beta	F	p	Multiple R
CA	-.03	.00	.93	.40
N	.21	1.21	.27	.40
CAxN	-.42	1.29	.26	.43

MS(reg)=4648, MS(res)=1212, Overall F(3,51)=3.83, p=.015

CA = condition (control = 0; reward = 1)
N = 55

TABLE 2.11

Stepwise Multiple Regression Analyses with LOGNOG, Number of Optional Games Using G as a Covariate (Hunter College)

Extraversion				
Variable	Beta	F	p	Multiple R
G	.29	6.10	.02	.34
CA	-.21	.27	.61	.48
E	.29	2.66	.10	.55
CAxE	-.08	.04	.83	.55

MS(reg)=1.82, MS(res)=.34, Overall F(4,50)=4.68, p=.001

Impulsivity				
Variable	Beta	F	p	Multiple R
G	.32	6.89	.01	.34
CA	.05	.02	.89	.48
I	.32	2.56	.12	.50
CAxI	-.44	1.42	.24	.52

MS(reg)=1.65, MS(res)=.35, Overall F(4,50)=4.68, p=.003

Sociability				
Variable	Beta	F	p	Multiple R
G	.29	5.68	.02	.34
CA	-.39	1.46	.23	.48
S	.20	1.31	.26	.53
CAxS	.08	.06	.81	.53

MS(reg)=1.73, MS(res)=.34, Overall F(4,50)=5.00, p=.002

Neuroticism				
Variable	Beta	F	p	Multiple R
G	.32	6.32	.01	.34
CA	-.30	.79	.38	.48
N	-.02	.01	.93	.48
CAxN	-.05	.02	.89	.49

MS(reg)=1.42, MS(res)=.37, Overall F(4,50)=3.87, p=.008

CA = condition (control = 0; reward = 1)
N = 55

TABLE 2.12

Stepwise Multiple Regression Analyses with SOMOV, Number of Optional Moves Using G as a Covariate (Hunter College)

Extraversion

Variable	Beta	F	p	Multiple R
G	.25	4.17	.05	.30
CA	-.19	.20	.65	.41
E	.26	1.90	.17	.48
CAxE	-.04	.01	.92	.48

MS(reg)=44, MS(res)=12, Overall F(4,50)=3.66, p=.011

Impulsivity

Variable	Beta	F	p	Multiple R
G	.28	4.95	.03	.30
CA	.13	.13	.72	.41
I	.33	2.41	.13	.43
CAxI	-.46	1.46	.23	.46

MS(reg)=40, MS(res)=12, Overall F(4,50)=3.29, p=.018

Sociability

Variable	Beta	F	p	Multiple R
G	.25	3.90	.05	.30
CA	-.36	1.14	.29	.41
S	.18	.96	.33	.46
CAxS	.11	.10	.75	.47

MS(reg)=42, MS(res)=12, Overall F(4,50)=3.49, p=.014

Neuroticism

Variable	Beta	F	p	Multiple R
G	.27	4.32	.04	.30
CA	-.17	.23	.63	.41
N	.04	.05	.82	.41
CAxN	-.13	.12	.72	.41

MS(reg)=33, MS(res)=13, Overall F(4,50)=2.60, p=.047

CA = condition (control = 0; reward = 1)
N = 55

TABLE 2.13

Stepwise Multiple Regression Analyses with SOTIM, Amount of Optional Time Using G as a Covariate (Hunter College)

Extraversion

Variable	Beta	F	p	Multiple R
G	.30	6.33	.01	.30
CA	-.50	1.51	.22	-.50
E	.18	1.12	.29	.18
CAxE	.18	.20	.66	.18

MS(reg)=6037, MS(res)=1032, Overall F(4,50)=5.85, p=.001

Impulsivity

Variable	Beta	F	p	Multiple R
G	.33	7.13	.01	.35
CA	-.58	.03	.86	.51
I	.25	1.52	.22	.52
CAxI	-.35	.92	.34	.53

MS(reg)=5337, MS(res)=1088, Overall F(4,50)=4.90, p=.002

Sociability

Variable	Beta	F	p	Multiple R
G	.29	6.21	.02	.35
CA	-.63	4.10	.05	.50
S	.11	.43	.51	.56
CAxS	.32	.99	.32	.57

MS(reg)=6146, MS(res)=1023, Overall F(4,50)=6.00, p=.000

Neuroticism

Variable	Beta	F	p	Multiple R
G	.31	6.60	.01	.35
CA	-.02	.00	.96	.51
N	.16	.73	.39	.51
CAxN	-.40	1.34	.25	.53

MS(reg)=5290, MS(res)=1092, Overall F(4,50)=4.84, p=.002

CA = condition (control = 0; reward = 1)
N = 55

TABLE 2.14

Stepwise Multiple Regression Analyses with LOGNOG, Number of Optional Games, Reduced Model (Hunter College)

Extraversion				
Variable	Beta	F	p	Multiple R
G	.26	5.01	.02	.31
CA	-.34	8.14	.01	.50
E	.27	5.39	.02	.56

MS(reg)=2.21, MS(res)=.28, Overall F(3,51)=8.01, p=.000

Impulsivity				
Variable	Beta	F	p	Multiple R
G	.27	4.94	.03	.31
CA	-.38	9.87	.00	.50
I	.14	1.37	.25	.53

MS(reg)=1.85, MS(res)=.30, Overall F(3,51)=6.22, p=.001

Sociability				
Variable	Beta	F	p	Multiple R
G	.25	4.64	.04	.31
CA	-.36	9.25	.00	.50
S	.24	4.03	.05*	.55

MS(reg)=1.58, MS(res)=.29, Overall F(3,51)=5.47, p=.001

CA = condition (control = 0; reward = 1)
*Rounded from .054.
N = 55

TABLE 2.15

Stepwise Multiple Regression Analyses with SOMOV, Number of Optional Moves, Reduced Model (Hunter College)

Extraversion				
Variable	Beta	F	p	Multiple R
G	.22	3.18	.08	.27
CA	-.29	5.56	.02	.43
E	.25	4.22	.04	.50

MS(reg)=59, MS(res)=12, Overall $F(3,51)=4.97$, $p=.004$

Impulsivity				
Variable	Beta	F	p	Multiple R
G	.23	3.20	.08	.27
CA	-.33	6.96	.01	.43
I	.13	1.02	.32	.45

MS(reg)=41, MS(res)=.10, Overall $F(3,51)=4.30$, $p=.009$

Sociability				
Variable	Beta	F	p	Multiple R
G	.21	2.93	.09	.27
CA	-.31	6.40	.01	.43
S	.23	3.59	.06	.49

MS(reg)=48, MS(res)=9, Overall $F(3,51)=5.35$, $p=.002$

CA = condition (control = 0; reward = 1)
N = 55

TABLE 2.16

Stepwise Multiple Regression Analyses with SQTIM, Amount of Optional Time, Reduced Model (Hunter College)

Extraversion				
Variable	Beta	F	p	Multiple R
G	.29	6.15	.01	.34
CA	-.34	8.53	.01	.52
E	.25	4.40	.04	.57

MS(reg)=7683, MS(res)=940, Overall F(3,51)=8.17, p=.000

Impulsivity				
Variable	Beta	F	p	Multiple R
G	.30	6.11	.02	.34
CA	-.38	10.20	.00	.52
I	.10	.74	.39	.54

MS(reg)=6550, MS(res)=1007, Overall F(3,51)=6.50, p=.000

Sociability				
Variable	Beta	F	p	Multiple R
G	.28	5.76	.02	.34
CA	-.36	9.59	.00	.52
S	.23	3.85	.05	.56

MS(reg)=7521, MS(res)=950, Overall F(3,51)=7.92, p=.000

CA = condition (control = 0; reward = 1)
N = 55

TABLE 2.17

Stepwise Multiple Regression Analyses with LOGNOG, Number of Optional Games , Model Testing Interaction of Extraversion and Neuroticism (Hunter College)

Variable	Extraversion and Neuroticism Beta	F	p	Multiple R
G	.27	4.78	.03	.31
CA	-.88	.75	.39	.50
E	.28	2.46	.12	.57
N	-.02	.01	.93	.57
CAxE	.53	.30	.58	.57
CAxN	.66	.39	.53	.57
CAxExN	-.61	.41	.53	.57

MS(reg)=.97, MS(res)=.30, Overall F(7,47)=3.25, p=.007

TABLE 2.18

Stepwise Multiple Regression Analyses with SQMOV, Number of Optional Moves , Model Testing Interaction of Extraversion and Neuroticism (Hunter College)

Variable	Extraversion and Neuroticism Beta	F	p	Multiple R
G	.22	2.90	.09	.27
CA	-.85	.64	.43	.43
E	.23	1.49	.23	.50
N	.06	.09	.76	.50
CAxE	.65	.41	.52	.50
CAxN	.57	.27	.60	.50
CAxExN	-.64	.40	.53	.51

MS(reg)=22, MS(res)=10, Overall F(7,47)=2.32, p=.041

CA = condition (control = 0; reward = 1)
N = 55

TABLE 2.19

Stepwise Multiple Regression Analyses with SOTIM, Amount of Optional Time , Model Testing Interaction of Extraversion and Neuroticism (Hunter College)

Extraversion and Neuroticism				
Variable	Beta	F	p	Multiple R
G	.28	5.33	.02	.34
CA	-.57	.33	.57	.52
E	.17	.95	.33	.57
N	.16	.75	.39	.57
CAxE	.51	.29	.59	.57
CAxN	.06	.00	.95	.58
CAxExN	-.35	.13	.95	.58

MS(reg)=3473, MS(res)=993, Overall F(7,47)=3.50, p=.004

CA = condition (control = 0; reward = 1)
N = 55

TABLE 2.20

Stepwise Multiple Regression Analyses with AVINT, Average Interest Rating of Optional Games, Full Model Without Covariates (Hunter College)

Extraversion

Variable	Beta	F	p	Multiple R
CA	-.48	.87	.36	.17
E	-.31	2.00	.16	.28
CAxE	.28	.30	.59	.29

MS(reg)=2.37, MS(res)=1.87, Overall $F(3,42)=1.26$, $p=.299$

Impulsivity

Variable	Beta	F	p	Multiple R
CA	-.40	.93	.34	.16
I	-.35	2.03	.16	.29
CAxI	.25	.31	.58	.30

MS(reg)=2.63, MS(res)=1.86, Overall $F(3,42)=1.41$, $p=.251$

Sociability

Variable	Beta	F	p	Multiple R
CA	-.297	.54	.47	.16
S	-.172	.62	.43	.21
CAxS	.126	.09	.76	.21

MS(reg)=1.30, MS(res)=1.95, Overall $F(3,42)=.66$, $p=.579$

Neuroticism

Variable	Beta	F	p	Multiple R
CA	-.04	.01	.93	.16
N	-.16	.50	.48	.28
CAxN	-.18	.18	.68	.29

MS(reg)=2.44, MS(res)=1.87, Overall $F(3,42)=1.31$, $p=.285$

CA = condition (control = 0; reward = 1)
N = 46

TABLE 2.21

Stepwise Multiple Regression Analyses with AVINT, Average Interest Rating of Optional Games, Full Model With Rt, Initial Rating of Paid/Unpaid Game as Covariate (Hunter College)

Extraversion

Variable	Beta	F	p	Multiple R
Rt	.65	34.67	.00	.62
CA	-.37	.94	.34	.66
E	-.29	3.17	.08	.71
CAxE	.12	.09	.75	.71

MS(reg)=10.81, MS(res)=1.04, Overall F(4,41)=10.38, p=.000

Impulsivity

Variable	Beta	F	p	Multiple R
Rt	.67	38.78	.00	.63
CA	-.29	.93	.34	.66
I	-.34	3.63	.06	.73
CAxI	.06	.04	.84	.73

MS(reg)=11.46, MS(res)=.98, Overall F(4,41)=11.71, p=.000

Sociability

Variable	Beta	F	p	Multiple R
Rt	.64	30.35	.00	.63
CA	-.34	1.18	.28	.66
S	-.15	.83	.37	.67
CAxS	.13	.16	.69	.67

MS(reg)=9.70, MS(res)=1.15, Overall F(4,41)=8.43, p=.000

Neuroticism

Variable	Beta	F	p	Multiple R
Rt	.66	30.59	.00	.63
CA	.26	.69	.41	.66
N	.16	.79	.38	.66
CAxN	-.54	2.63	.11	.69

MS(reg)=10.23, MS(res)=1.10, Overall F(4,41)=9.32, p=.000

CA = condition (control = 0; reward = 1)
N = 46

TABLE 2.22

Stepwise Multiple Regression Analyses with AVINT, Average Interest Rating of Optional Games, Reduced Model (Hunter College)

Extraversion

Variable	Beta	F	p	Multiple R
Rt	.65	35.88	.00	.63
CA	-.26	5.41	.02	.66
E	-.26	5.32	.03	.71

MS(reg)=14.38, MS(res)=1.02, Overall F(3,42)=14.11, p=.000

Impulsivity

Variable	Beta	F	p	Multiple R
Rt	.67	40.24	.00	.63
CA	-.23	4.82	.03	.66
I	-.30	8.45	.00	.73

MS(reg)=15.27, MS(res)=.96, Overall F(3,42)=15.96, p=.000

Sociability

Variable	Beta	F	p	Multiple R
Rt	.64	30.96	.00	.63
CA	-.22	3.67	.06	.66
S	-.10	.80	.37	.67

MS(reg)=12.87, MS(res)=1.12, Overall F(3,42)=11.41, p=.000

Neuroticism

Variable	Beta	F	p	Multiple R
Rt	.62	27.20	.00	.63
CA	-.21	3.43	.07	.66
N	-.06	.28	.60	.66

MS(reg)=1.31, MS(res)=.31, Overall F(4,50)=4.20, p=.005

CA = condition (control = 0; reward = 1)
N = 46

CHAPTER 3

EXPERIMENT 2

Overview

The purpose of this study was to retest the hypotheses of Gray's theory on a larger sample than that used in Experiment 1, and to extend the test to include those of Gray's hypotheses regarding withdrawal of reward not tested by Experiment 1. The design of the study is nearly identical to Experiment 1, with one additional condition, paid (withdrawal of reward or penalty), and one additional dependent measure, overall interest rating of the game (RATE.) Also, because it was not possible to run this second study at Hunter College, it was run at Brooklyn College.

Volunteer subjects solicited from undergraduate classes at Brooklyn College took a computerized version of the EPI, and played the computer game ("Frogs'n'Puddles"). A reward group received 25 cents per frog removed (ER); a withdrawal of reward or penalty group played it for $7.75 minus 25 cents for each frog above one which they failed to remove (EW); and a control group played it without payment. This control group was divided into two parts. Subjects in the reward control condition (CR) saw the same prompts as the subjects in the reward condition and the score was kept in terms of number of frogs removed. However, unlike the paid subjects, the CR subjects did not see monetary information. Subjects in the withdrawal of reward control condition (CW) saw the same prompts as the withdrawal of reward (EW) condition without monetary information, and the score was kept in terms of number of frogs remaining. It should be noted that in both the ER and EW conditions, subjects were paid the same amount of money for identical levels of performance.

All subjects then rated how interesting they found the game, saw a scoring guide which provided performance norms, and were given the option of playing again as much or as little as they liked, and rating the game after each play. After they concluded playing the game, subjects filled out a paper and pencil overall rating (RATE) of how interesting they found the game. Dependent measures consisted of three measures of voluntary play and two interest ratings: average interest of optional play (AVINT) and overall interest rating of the game (RATE.) Independent measures consisted of extraversion, impulsivity, sociability, neuroticism, and experimental condition.

METHOD

Subjects

Volunteers were solicited from 27 undergraduate classes at Brooklyn College. Although Brooklyn College has a subject pool as a requirement for Introductory Psychology, I chose not to use it for two reasons. First, I wanted my subject population to be as comparable as possible to the Hunter College population of the prior study. Since Hunter does not have a subject pool, I chose not to use the Brooklyn pool. Second, I did not want subjects volunteering for my study because they needed experimental hours to complete their course requirement. Rather, I wanted the highest interest population which I could obtain, i.e., those who came purely because they were interested and without the knowledge of possible extrinsic rewards. Therefore, 20 psychology and 7 music classes were solicited. They were told, as in the prior study, that the research was on the interest value of computer games, and what types of people like or dislike computer games. Students who wished to volunteer indicated days and times during which they were available on forms which they filled out during their classes. On the forms they also indicated sex. I collected 229 volunteer forms. These forms were then divided by sex, 143 female and 86 male. A 2 to 1 ratio of females to males was decided on for each condition. Therefore, each of the two stacks of volunteer forms was shuffled independently. Subjects were then drawn from each pile as needed, telephoned, and scheduled whenever possible. The two control conditions, CR and CW, were run first, in order to prevent future subjects from hearing about, and expecting payment. The two paid conditions, ER and EW, were run second. Block randomization was used throughout the study to achieve randomization of the control conditions and then the paid conditions, as well as to randomize the order in which males and females were run. For example, the control group block, which was randomized at each replication, was CR male, CR female, CR female, CW male, CW female, CW female. The ratio, once again, is one CR male to two CR females, and one CW male to each two CW females.

Of this total sample of 228 potential volunteers who filled out forms, 57.5% or 131 subjects were actually run in the experiment. The remainder can be categorized as follows: (1) could not be reached by telephone (N = 20); (2) unable to schedule at a mutually agreeable time or changed his or her mind about volunteering when called (N = 36); and (3) made an appointment but failed to show up (N = 41). Of the 131 subjects actually run, three were dropped from the study. Two subjects beat the game on the first try, having only one frog remaining. They had no reason to play again, and were thus not comparable to the other subjects in the study. One subject withdrew for religious reasons. She showed discomfort at the point where she learned she was to be paid for playing the game. I inquired about her discomfort and she responded, "Gambling is against my religion." I reminded her that participation was completely voluntary and that she could withdraw at any time. We discussed the merits of this kind of scientific research and the morality of paying people to play a game. We came to the conclusion together that she should not continue.

However, she hoped that I would be able to use the questionnaire data which I had collected from her. I assured her that whenever possible, I would include the data. I did not dismiss her until I felt she was at ease about the session and then I gave her several phone numbers where I could be reached if she wished to discuss the matter further.

An additional factor which concerned me given the greater number of women who responded to my solicitation for volunteers was whether the rates of volunteerism and attrition were the same for both sexes. Therefore, a letter was sent to the 12 professors and instructors whose classes I had addressed, asking them for the total enrollment broken down by sex for each of the classes. Since enrollments change throughout the semester, each letter contained the date on which I addressed the particular class, and the figures I requested were for the best estimate for that date. Three professors did not respond; census figures for each of their classes were obtained from the Psychology Department.

Brooklyn College has a required "Core Curriculum." All the music classes I visited were this basic course which every student must take. The psychology classes, on the other hand, reflected electives taken mostly by psychology majors, but also sociology, education, and some business majors. Inspection of Table 3.1 shows that there are more women in psychology than in the core music courses, which reflect the general makeup of the college. Table 3.1 further subdivides the total population who heard my appeal for subjects into three levels of response: (1) those who participated in the study, (2) those who were interested enough to volunteer but were not actually run; and (3) those who heard my appeal for subjects but did not respond. Category (2) includes everyone who filled out a form but was not actually run. Category (3) is arrived at by assuming the population figures computed from teacher's responses are marginals, and simply subtracting the other two categories from these totals thus producing the missing category, those who did not respond. The cross-classification is by sex (female/male) and by discipline (music/psychology). A loglinear model fitted to this table confirmed that there was no differential rate of volunteerism across sexes, and that the rate of volunteerism for music and psychology students was simply a function of the total number of students in each discipline who heard my appeal.

In Table 3.2, single letters are main effects of Response (R), Subject (C), and Sex (S), while double letters are interaction terms. The analyses are hierarchical. Thus, any model with an interaction term contains main effects for all terms in the interaction. The best fitting model in Table 3.2 is R,CS which contains three main effects, R, C, and S, and one interaction term, CS. Of special importance is the fact that interaction terms including response (show/not run/not volunteer) are not necessary to obtain a model that fits the data. Thus, sex (S) and subject category (C) are independent of volunteerism. The term CS results from a higher proportion of women taking psychology courses than music.

The final sample consisted of 128 subjects, of which 63.3% were female. The mean age of the subjects was 22.8 years; the standard deviation 6.6 years.

<u>Apparatus</u>

The apparatus which the subjects used was the same apparatus used in the prior study. It consisted of a wooden box with a sloping front and a TV monitor sitting on top of it. On the sloping surface were two dials and two buttons. The dials were labeled "Up-down" and "Left-right"; the buttons were labeled "No-end game" and "Yes-make move." Inside the box was again an Apple II plus microcomputer. The "Y" and "N" keys from the keyboard of the Apple were wired to the "Yes" and "No" buttons. The dials of the apparatus were the Apple game paddles and were plugged into the Game I/O of the Apple in the usual fashion.

<u>Procedure</u>

When subjects arrived, verbal consent to participate was obtained. Subjects were reminded that their participation in the study was completely voluntary and that they could leave at any time. Subjects were then introduced to the apparatus described above. While the subject was seated at the apparatus, I reviewed the various parts of the study: EPI questionnaire, computer game, rating of game, voluntary play, and post-game interview; and also I explained the role of the dials and buttons for each task study. Next, the subject was left alone to respond to the questions of the EPI with instructions to come and get me when the game appeared. I waited in an adjacent room which was set up as my office. When the subject informed me that he or she had completed the questionnaire, we returned to the apparatus, reviewed the instructions for the game, and played part of the "Frogs'n'Puddles" game together. (See Computer Game in Software section of this chapter.) As in the previous study, we played a 5 to 10 minute practice session of the game together. I guided him or her through four distinct phases of practice: (1) basic cursor (white dot) movement, (2) understanding the two components of each move, (3) basic move competence, and (4) beginnings of strategy. For the two control groups, the practice session began with the statement, "Now we are going to play Frogs'n'Puddles." The CR group saw the score kept in terms of number of frogs removed, while the CW group saw the score kept in terms of in number of frogs remaining. For the ER group, the practice session began with the statement, "Now the Computer Games Research Project is going to pay you to play Frogs'n'Puddles. We are going to pay you 25 cents for each frog you remove." Also, the written instructions for the ER group included an additional prompt stating, "You will be paid 25 cents for each frog you eliminate." For the EW group, the practice session began with the statement, "Now the Computer Games Research Project is going to pay you to play Frogs'n'Puddles. We are going to pay you $7.75 to play one game. However, we are going to subtract 25 cents for each frog above one which you leave remaining when the game is over." Also, the written instructions for the EW group contained an additional prompt which stated, "You will receive $7.75 minus $.25 for each frog above one which you leave remaining." It should be noted that with 32 frogs on the initial board, paying subjects $.25 per frog or $7.75 minus $.25 for each frog above one left, means that subjects in both payment conditions will be paid identically for equivalent performance levels. Mean payment was $6.60 for the ER condition and $6.50 for the EW condition.

Following the practice session, the subjects played the computer game once, rated how interesting they found it, and saw a set of performance norms called a "Scoring Guide." (See Interest Rating Program in Software section of this chapter.) Following this first play of the game and subsequent rating, all subjects had the option of playing again (and rating the game again) as many times as they wished, or stopping immediately. Any subjects still playing the game one and a half hours after the experiment had begun were asked to stop after they had concluded that play of the game. Subjects who did not play optional games completed the whole study in about 40 minutes. There were two subjects whom I asked to stop after one and a half hours.

When the subjects had completed playing the game, there was a post-session interview. Subjects began the post-session interview by filling out a paper-and pencil item which asked them to rate how interesting they found the game, in general, rather than for any particular play. They rated the game on a scale from 1 (very uninteresting) to 9 (very interesting.) They then responded to an item which asked them to rate how difficult they found the game on a scale from 1 (easy) to 9 (difficult). Then a brief questionnaire was used to collect general demographic data and information regarding whether the subject played computer games, and, if so, how often he or she played. Following this, I answered any questions which the subjects had about the experiment without releasing specific information about the hypotheses. Subjects were told that this information would be available at a later date. Then for subjects who wished, I discussed with them the possible roles of computers and computer games in society and how a study on the characteristics of computer games might relate to these topics. As in the previous research, it should be noted that this discussion turned out to be a most positive and rewarding experience both for the subjects and for myself as experimenter. Usually the discussion also included how computers affected those aspects of subjects' lives which they considered most important. However, I allowed the subject to determine what we would talk about. Finally, I gave the subject a blank envelope in which to obtain a report of the finished study and informed him or her that for a written report of the findings of the study he or she should deposit a self-addressed envelope in a special sealed mailbox in the Psychology Department Office which was located on another floor of the building in which the study took place. Subjects were paid, if applicable, enjoined to secrecy, and thanked for their participation with a clear statement that they were an important part of a valuable scientific endeavor.

Software

The actual software used in this experiment consisted of a number of programs which ran in tandem and wrote data to two files for each subject. These programs were modified versions of those used in the prior study and can be summarized in three units: self-scoring EPI program, computer game, and interest rating program. When differences exist between the programs used for Experiment 1 and Experiment 2 I will describe both versions highlighting the differences. I designed all the software for the research except that initial algorithms for a primitive version of the game without graphics were taken from Ahl (1978).

Eysenck Personality Inventory (EPI)

I developed a special version of the EPI[1] for administration on a microcomputer. This task required a slight modification of the instructions to remove those

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[1]Special thanks to Prof. Hans J. Eysenck for permission to create a computerized version of the EPI for this study.

portions specific to the filling out of the paper and pencil version and replacing them with directions to the subject to push the Yes or No button in response to the questions. The items used were those of the EPI Form A except that in item 25 the phrase "enjoy yourself a lot at a gay party" was changed to "enjoy yourself a lot at a lively party" because the colloquial meaning attached to the word "gay" in New York City in 1984 and 1985 was quite different from the author's presumed intent. Piloting had suggested that this question might produce defensive responding on the remainder of the questionnaire. The program stored responses to individual items, as well as response time data.

Computer Game

The game which subjects played was called "Frogs'n' Puddles" The frogs are bright emerald green; the puddles are bright peacock blue; and the background is dark. Popular variants of the game are known as "Jump a Peg," and "Hi-Q." As noted above, the algorithms used for the game were taken from Ahl (1978) and adapted to fit my graphics routines. The beginning board consists of 32 frogs and one puddle at the center. (See Appendix B.) The object of the game is to remove all the frogs except one, replacing each frog with a puddle. Frogs are removed by jumping over them with other frogs. Legal moves are up, down, towards the left, and towards the right; diagonal moves are not allowed. Only single frogs can be overleaped in any given move. Moves are made in two parts. First, in response to the prompt "Move which frog?" the subject uses the two dials marked "Up-down" and "Left-right" to position a small flashing white dot, the cursor, on the frog which he or she wishes to move. The subject then presses the "Yes-make move" button. Second, in response to the prompt "To which puddle?" the subject moves the flashing white dot to the puddle on which he or she wishes the frog to land. Then again presses the "yes-make move" button. This response is followed by a brief pause, then the machine makes the move, turning the frog into a puddle, the puddle where the frog should land into a frog, and the intervening overleaped frog into a puddle. This sequence is followed by another brief pause; then the prompt "Move which frog?" reappears and the cycle repeats. (In the first experiment, "Move which piece?" appeared instead of "Move which frog?" and "To where?" appeared instead of "To which puddle?") At the end of each move cycle, before the move is executed, the machine tests for legality. Illegal moves are met with an error message "Illegal move. Try again..." and the subject is returned to the beginning of the move cycle. Each of the two move-cycle prompts is accompanied by a beep. Error messages are accompanied by a quick succession of three beeps. The game ends either when there are no moves left or when the subject ends it by pressing the "No-end game" button. At the end of the game, the score is tallied and posted for the subject.

There were three versions of the game for each subject: the practice game, the paid/unpaid game, and the optional game. These versions differed slightly for each of the four experimental conditions.

The Practice Game. This practice game was preceded by instructional prompts. These were the prompts which I used to play part of the game with subjects before they fully understood the logic of the game and how to make moves. The instructions for all four groups were the same except that the two payment groups had an additional prompt which told them that they would be paid to play Frogs'n'Puddles. The reward group (ER) saw prompts which explained they would be paid 25 cents for each frog they removed, while the withdrawal of reward group saw prompts which explained they would be paid $7.75 but would lose 25 cents for each frog above one which they left remaining. When I felt that each subject had achieved basic competence, I asked if he or she was ready to play on their own. If the subject agreed, I terminated the practice game by pushing the "No" button. The Paid/Unpaid Game automatically loaded at this point.

The Paid/Unpaid Game. This version of the game began with the actual game display, in other words no additional instructions. It ended with a message displaying the subject's score and for paid subjects the amount of money they had earned. It appeared beneath the game board after the game had ended. CW and CR conditions subjects saw a message which read, "You have removed Y frogs, and have X frogs left" where Y is the number of frogs removed, and X is the number of frogs left. For example, "You have removed

26 frogs and have 6 frogs left." The EW condition saw an additional statement which read "and you lose (6 - 1) x 25 cents = $1.25." The equivalent statement for the ER condition read, "and have earned 26 x .25 = $6.50." The CR and ER conditions were the same as those employed in Experiment 1.

Next, the subject saw a scoring guide[1] which posted scoring norms for subjects. The scoring guide for both conditions in the first experiment was identical. In the second experiment the values on the scoring guide were lowered slightly to match the actual norms obtained in the first experiment. Additionally, the two payment conditions saw a scoring guide with monetary information while the guide for the control conditions did not contain this additional information. (See appendices for facsimiles of the scoring guides used in each of the experiments.)

The Optional Game. This version of the game was played by any subjects who persisted, and it was repeated as often as the subject wished to play again. It contained no instructions and was followed by a scoring guide without monetary information. All four groups played the same version of this game and saw the same scoring guide.

The Interest Rating Program

There were two versions of the interest rating program: One which followed the Paid/Unpaid game, and one which

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[1]Special thanks to Joann Natoli-Liberty who wrote the instructions for the game used in the first experiment and who suggested using a scoring guide.

followed optional games.

Paid/Unpaid Game Interest Rating Program. The interest rating program consisted of two parts. First, the following question appeared: "How interesting did you find this play of the game?" Beneath the question were nine numbered intervals labelled: very (9) and moderately (7) interesting, neutral (5), and moderately (3) and very uninteresting (1). An arrow was fixed at the neutral point and no response could be made until the subject jiggled the right hand dial moving the arrow off the neutral point. Then pushing the yes button froze the display with the arrow at the position the subject had selected, stored the response on a nine-point scale, and moved the subject on to the second part of the program which asked the subject if he or she would like to play again. Both control groups, CW and CR, saw a prompt which read, "That concludes this part of the experiment. Would you like to play again and try to better your score? (Answer 'Yes' or 'No') Play again? If the subject pushed the Yes button the game would reappear. If the subject pushed the No button the prompt "Go and get the experimenter or press 'Yes' to continue" will appear. In both paid conditions, EW and ER, the prompt read, "That concludes the paid portion of the experiment. Would you like to play again and try to better your score? (No money involved.) (Answer 'Yes' or 'No') Play again?" If the No button was pushed an additional time, the screen scrolls and the same prompts reappeared. However in the paid condition, if the No button was pushed an additional time, the subject's earnings appeared in a corner of the screen. This allowed me to know how much to pay each EW or ER subject upon completion of the experiment.

Optional Game Interest Rating Program. Following the optional plays of the game, a different version of the rating program appeared which only asked subjects to rate the interest value of the prior game and if they wanted to play again. In other words, all reference to "That concludes this portion of the experiment" was omitted. All subjects saw the same version of this program.

Measures

Dependent Variables

Five main dependent variables were used in the study. There were three measures of how long the subject played which are identical to those used in the prior study: (1) number of optional games (NOG), (2) number of optional moves (NOM), and (3) amount of optional time (TIM). There were two measures of rated interest of the game. The first of these is identical to that used in the prior study (1) average interest rating of optional play (AVINT). This measure, as noted above, will provide the most conservative test of the hypotheses for two reasons. First, the sample size is smaller since those who do not choose to play optional games will be excluded, and second, the subjects who are excluded are those most likely to have experienced the greatest decrement in rated interest. Because of the conservative nature of this variable, an additional measure of rated interest was added, (2) overall interest rating of the game (RATE). After all subjects completed playing the game, whether they played optional games or not, they filled out a single paper and pencil rating of the game. This measure was a nine-point scale as was AVINT, and was almost a paper facsimile of what subjects saw on the screen when they rated the game, except that they checked the appropriate response rather than positioning an arrow.

As in the prior study, the behavioral variables were not normally distributed. Again, log and square root transformations were computed, and tests of normality applied to the original variables and each of the transformations. The transformation which most normalized the data was used in every case except one. The square root transformation of number of games (SQNOG) provided a minuscule increment in normality over the log transform of number of games (LOGNOG). However, since LOGNOG had been the most effective transformation in the prior study and since the difference between that transformation and the square root one (SQNOG) was so small, I decided to use LOGNOG as the dependent variable to aid in comparisons between the two studies. Table 3.3 presents the original variables, each of the transformations, and statistical tests applied to the variables. The test used was again a Kolmogorov-Smirnov D statistic (Bradley, 1968) obtained from the SAS statistical package (Ray, 1982). It approaches zero if the data are normal. It approaches unity when the data are least normal.

Independent Variables

The main independent variables used in the study were identical to those employed in the first study. They were the extraversion and neuroticism scales of the EPI, condition (paid reward, ER; paid withdrawal of reward, EW; and control), and the impulsivity and sociability scales from the EPI used by Revelle, Humphreys, Simon, and Gilliland (1980.) Other variables examined or tested as covariates include score on initial game (G), interest rating of this game (Rt), number of errors on optional games, average move time, EPI lie scale, sex, and age. Prior to the main statistical analyses, a t test of the means of the CR and CW groups was calculated for each of the dependent variables and none of the t values was significant. Therefore the control conditions were treated as a single group.

The means, standard deviations, and reliabilities of the various EPI scales are provided in Table 3.4 and the intercorrelations among them are in Table 3.5.

Missing Values

Some of the responses to the EPI items were assigned missing values as in the first study. Of the 7467 items responded to by 131 Brooklyn College students, of whom 128 became the experimental sample, there were 38 items with time values of one. These 38 items were assigned missing values which were treated in the same manner as in the first study. Each missing item was assigned a value for each scale in which it was included, equal to the proportion of nonmissing items responded to positively after scales were adjusted by reversing negatively keyed items.

RESULTS

The first major consideration is whether the paid-unpaid manipulation was effective. Examination of Table 3.6 shows that the proportions of subjects who chose to play optional games in each of the payment conditions, ER and EW, were not significantly different from each other. Therefore, I combined both the payment conditions into one. Tables 3.7 and 3.8 show Fisher's Exact tests comparable to those presented for the first experiment in Tables 2.4 and 2.5. Table 3.7 reveals no significant difference between the paid and unpaid groups in the proportion of subjects playing one or more optional games. However, when the data are dichotomized at a higher level, namely whether or not subjects chose to play two or more optional games (see Table 3.8), we find that the Fisher's test approaches significance at the .07 level. Direct statistical comparisons between studies will be discussed in Chapter 4.

While the Fisher's exact test reveals no clear difference between the two groups, it might be possible for those in the control condition to play more games or to play longer than the ER or EW subjects. The means, standard deviations and N's are provided in Table 3.9. An examination of these means shows that they are in the expected direction. The significance of the differences will be tested by means of multiple regression. Table 3.10 shows the intercorrelations between the various dependent measures.

Regression models were run for each of the main dependent variables (LOGNOG, SQMOV, and SQTIM) using each of the main independent variables (E, I, S, N, and condition.) One-zero dummy coding was employed for each of the paid conditions. Therefore, the significance test of the regression weight for each of the paid groups is the test of the null hypothesis that there is no difference between that group and the uncoded group which in this case is the control group. Therefore, the variable CA compares the mean of the reward group (ER) with the control group and CB compares the withdrawal of reward group (EW) with the control group. Tables 3.11 through 3.13 present the appropriate regression models for each of the dependent variables. The interaction terms CAxE and CAxI test the hypothesis (4A) for the behavioral variables (LOGNOG, SQMOV, SQTIM) that paid (reward) (ER) extraverts and/or high impulsives should exhibit less optional play than unpaid (control) extraverts and/or impulsives. The interaction term CBxN tests the hypothesis (15) that paid (penalty) (EW) neurotics should exhibit less optional play than control subjects of an equivalent level of neuroticism. None of the regression models are significant. For the behavioral variables this may be due to the failure of the payment manipulation to produce large enough differences in intrinsic motivation between the payment groups and the control groups.

Next, the effect of the paid/unpaid manipulation on the interest-rating variables will be presented. In Table 3.9, the means for both interest rating variables, AVINT and RATE, are lower for the unpaid condition than in either of the paid conditions. This finding is clearly contrary to hypotheses 2 and 13 that payment reduces subsequent interest. The multiple regression analyses for the interest variables AVINT and RATE (Tables 3.14 and 3.15) test the hypotheses 2 and 13 that paid/unpaid (ER) and (EW) rated the game less interesting. The interaction term of CBxN, again tests hypothesis (17) that paid (penalty) (EW) neurotics should rate the game less interesting than control subjects of equivalent levels of neuroticism. None of the analyses supported the hypotheses.

Regression models were also computed using as covariates the initial paid/unpaid game score (G) and interest rating of the initial paid/unpaid game (Rt). The covariate, G, which had proved so powerful in the prior study, was unrelated to the dependent variables whereas the covariate, Rt, which in the prior study had been unrelated to behavior, was a significant predictor of both persistence and ratings in this study. These regressions using Rt as a covariate are shown in Tables 3.16 through 3.20. (Regressions using G as a covariate are not presented in tabular form since G was not a significant predictor of behavior or ratings.) The correlation of Rt with each of the behavioral variables was .22, all significant ($p < .01$) while the correlation with AVINT was .67 and with RATE, .86. Examination of Table 3.19 reveals several unexpected effects. It appears that the term for the reward condition (CA) is significant in the wrong direction in two of the models and also the interaction of this term with personality, CAxE approaches significance while CAxS is significant. However, one notes an increment in the multiple R across the final six steps of the equation of only .03. This means that all six terms entered after the covariate, Rt, account for less than one percent of the variance of AVINT. These are very small effects. I looked for independent confirmation of these effects in the other rating variable, RATE. None were significant. However, there is a similarly small effect for N with a trend for I, but no interaction. Only Rt produced sufficient consistency across both dependent variables to be worthy of attention.

Regressions were also computed testing hypotheses 16 and 18 that neurotic extraverts should be more sensitive to reward. This hypothesis is tested by the triple order interaction term CAxExN. These were not significant for any of the dependent variables and are not presented in tables.

At this point, it appeared that some aspect of the manipulation had been particularly ineffective. Referring back to Table 3.9, I again noted that fewer subjects in both payment groups persisted and also that the mean play time was less for both groups. However, whereas the reward condition should have had a distinct and negative interaction effect with extraversion or impulsivity on behavior (i.e., negative beta for CAxE and CAxI), the withdrawal of reward condition should have had either a positive effect (positive beta for CBxE or CBxI) or no effect. Regression models were computed employing interaction terms of each of the payment conditions (CA and CB) with personality to examine the directionality of the effects. Tables 3.21 and 3.22 show these effects for one behavioral, (LOGNOG), and one rating (AVINT), dependent variable. The other dependent variables produced similar effects. Ignoring the significance levels of the interaction terms, I noted that the beta's for CAxE and CBxE in Table 3.21 were both in the same direction and about of equal magnitude. Similar observations were made for CAxI compared to CBxI and also CAxS compared to CBxS. These findings indicate that both payment conditions had effects in the same direction and of roughly equal magnitude. Table 3.22 shows essentially the same thing except for a few negative betas which are close to zero.

Subjects in both payment groups arrived for the experiment without expectation of payment. Reward (ER) subjects were told that they would be paid 25 cents per frog removed. Withdrawal of reward (EW) subjects were told that they would be paid $7.75 but would lose 25 cents for each frog above one which they left remaining. My hope was that EW subjects' attention would center on the loss aspect of the situation rather than on the surprise gain of some unknown quantity up to $7.75. This does not appear to have happened. In retrospect it seems that the information regarding surprise payment and the information regarding potential loss should not have been contained in the same statement. Subjects are unlikely to perceive the statement "You will lose 25 cents for each frog ..." as a loss until they have fully accepted the idea that they will be receiving $7.75. I concluded that the subjective impact of both payment groups was similar.

Therefore, I collapsed the payment groups into a single group and recomputed the regressions using the covariate, Rt. Tables 3.23 through 3.27 present these models for each of the dependent variables. Again the interaction terms are not significant. Reduced models again containing only main effect terms are significant. These are presented in Tables 3.28 through 3.32.

Regressions were also computed using the covariates, G and Rt, as dependent variables. There were no significant effects for Rt. However, there were significant effects for G. Main effects for condition (CA), sex (SX), and personality (E, I, and S) were significant, but no interactions were. These regressions for G are presented in Table 3.33. However, as noted above, G was not significant as a covariate. Also multiple covariates using G and Sx did not add to the predictive power of the regression models. This was the only sex difference found in either study.

Summary

1. Paid subjects did not choose to play optional games less frequently than unpaid subjects. However, when the data were dichotomized at a higher level, none or one optimal games versus two or more, a Fisher's Exact test produced a non-significant trend in the expected direction. (See Table 3.8.) Also, paid subjects did not play fewer optional games than unpaid subjects. Regression terms for payment (Reward) and combined payment (Reward, ER, and Withdrawal of Reward, EW) groups were not significant. Although again in the combined case the term approached significance. (See Table 3.28.) Hypothesis 1 is not supported by the data.
2. Paid subjects (Reward, ER) and combined payment (Reward, ER, and Withdrawal of Reward, EW) subjects did

not rate optional games as less interesting than unpaid (Control) subjects (Table 3.14), nor did they show decrements in interest rating, AVINT, compared to their initial interest rating (Rt) (Table 3.19). Similar analyses using overall interest rating, RATE, also did not show significant differences (Table 3.20). Hypotheses 2, 3, 13, and 14 are not supported. In fact a tiny but significant trend in the wrong direction was found for one variable, AVINT, in Table 3.19 for one hypothesis, (hypothesis 3).

3. None of the predicted interactions of condition with personality variables was significant for behavior. Hypothesis 4 is not supported.

4. For ratings there was a very small interaction effect with personality for one dependent variable, AVINT. (See Table 3.19.) However, it was with the wrong independent variable, CAxS. Hypotheses 5, 6, and 9 are not supported.

5. Regressions testing whether neurotic extraverts would play less in the payment groups than unpaid subjects of equivalent levels of neuroticism and extraversion were not significant. Hypothesis 4B is not supported.

6. I concluded that the withdrawal of reward (EW) condition was ineffective. Therefore, the experimental manipulation did not permit a test of hypotheses 12 through 18.

7. Anomalously, the covariate, G, (initial paid/unpaid

game score), which was so powerful a covariate in experiment 1 was ineffective in experiment 2 while the covariate, Rt, (initial paid/unpaid game rating), which was not related to the behavioral dependent variables in the first study, was a highly significant predictor in this study of both persistence and ratings.

8. The covariate, G, which was uncorrelated with any of the dependent variables in the first study was tested again in this study. Significant main effects were found for paid versus unpaid groups, sex, and extraversion. Paid subjects did more poorly, i.e., left more frogs remaining. Females did more poorly. However, as noted above, G, was unrelated to subsequent persistence or ratings. Also, this was the only sex difference found in either study.
9. After collapsing the two payment conditions into one, reduced regression models produced significant effects for personality. Specifically, employing the covariate, Rt, significant main effects for impulsivity and sociability, were found for LOGNOG. A main effect approached significance for impulsivity for SQMOV. For RATE significant main effects were found for extraversion and sociability but not impulsivity.

Clearly further discussion is needed to bring order and theoretical perspective to these findings. However, I will defer this discussion until Chapter 5. First, a few additional analyses will be discussed in Chapter 4, which while they do not directly test the hypotheses in question, may shed some light on the differences in performance between introverts and extraverts. Also, some brief comparisons of the Hunter and Brooklyn subject populations seem in order.

TABLE 3.1

Crosstabulation of Subjects Who Heard Appeal for Volunteers by Response, Sex, and Discipline (Brooklyn College)

Sex (S)	Discipline (C)	Response (R)			Total
		Show	Not Run	Not Volunteer	
Female	Music	26	19	99	144
	Psychology	57	41	247	345
Male	Music	21	18	78	117
	Psychology	27	19	97	143
		131	97	521	749

TABLE 3.2

Loglinear Analysis of Cross-Classification of Volunteerism (Brooklyn College)

Model	DF	Likelihood Ratio Chi-Square	p
R	9	160.51	.00
C	10	504.76	.00
S	10	503.50	.00
R,C	8	89.73	.00
C,S	9	432.17	.00
S,R	8	89.73	.00
R,C,S	7	19.31	.00
RC	6	89.07	.00
RS	6	88.61	.00
CS	8	414.67	.00
R,CS*	6	1.64	.93
C,RS	5	18.19	.00
S,RC	5	18.64	.00
RC,RS	3	17.52	.00
RS,CS	4	.70	.70
CS,RC	4	1.15	.89
RC,RS,CS	2	.24	.89

*Most parsimonious good fit model, i.e., the model with the least number of terms which generates expected values not significantly different from the data.

R = Response (show, not run, not volunteer)
C = Discipline (music, psychology)
S = Sex (female, male)

TABLE 3.3

Tests of Normality of Variable Transformations using Kolmogorov-Smirnov D Statistic (Brooklyn College)

	M	SD	D
Number of Games (NOG)	1.76	1.61	.2128
Log NOG (LOGNOG)	.86	.56	.1805+
Square Root NOG (SQNOG)	1.41	.51	.1757*
Number of Moves (NOM)	42.11	39.12	.1801
Log NOM (LOGMOV)	3.01	1.64	.2839
Square Root NOM (SQMOV)	5.66	3.26	.1443*
Amount of Time (TIM)	3974.19	3634.32	.1371
Log TIM (LOGTIM)	6.59	3.41	.3297
Square Root TIM (SQTIM)	53.27	33.85	.1429*

*Transformation which most normalizes the distribution

+Although the square root transformation produced the smaller D statistic, the difference between this transformation and the log transform was minimal, therefore the log was used to enable comparisons between this study and the last one.

NOTE: Kolmogorov-Smirnov D approaches zero when the distribution is normal, and one when it is least normal.

TABLE 3.4

Means, Standard Deviations, and Coefficient Alpha Reliabilities of Main Independent Variables (Brooklyn College)

	Mean[a]	SD	Alpha	No. of Items
Extraversion	12.74	3.87	.71	24
Impulsivity	4.54	1.73	.42	9
Sociability	7.18	2.65	.62	13
Neuroticism	10.71	4.45	.76	24
Lie	3.00	1.45	.47	9

[a]N=55

TABLE 3.5

Intercorrelations of Main Independent Variables (Brooklyn College)

	E	I	S	N	L
Extraversion[a]	1.00	.77	.88	-0.15	-0.01
Impulsivity		1.00	.43	.13	-0.10
Sociability			1.00	-0.32	-0.09
Neuroticism				1.00	-0.20
Lie					1.00

[a]High correlation of extraversion with impulsivity and sociability is due to their dependent relationship; extraversion is nearly the additive sum of impulsivity and sociability.

TABLE 3.6

Crosstabulation of Number of Subjects Who Played Optional Games by Condition: Reward (ER), Withdrawal of Reward (EW) (Brooklyn College)

	Play Optional Games*		
Condition	No	Yes	Total
Paid (Reward)	9	35	44
Paid (Withdrawal of Reward)	11	31	42
Total	20	66	86

*Fisher's Exact Test (One-tailed), $p = .35$

TABLE 3.7

Crosstabulation of Optional Game Playing by Condition (Brooklyn College)

	Play Optional Games*		
Condition	No	Yes	Total
Unpaid (Control)	6	36	42
Paid (Reward)	20	66	86
Total	26	102	128

*Fisher's Exact Test (One-tailed), $p = .17$

TABLE 3.8

Crosstabulation of Playing Two or More Optional Games by Condition (Brooklyn College)

	Play Two*		
Condition	No	Yes	Total
Unpaid (Control)	18	24	42
Paid (Reward)	50	36	86
Total	68	60	128

*Fisher's Exact Test (One-tailed), $p = .07$

TABLE 3.9

Measures of Intrinsic Motivation for Each Condition (Brooklyn College)

Variable	M	SD	n
Condition 1 (Unpaid) Control			
Optional games (NOG)	2.00	1.64	42
Optional moves (NOM)	46.76	40.74	42
Optional ticks (TIM)	4338.71	3243.66	42
Avg. interest (AVINT)*	7.17	1.85	36
Overall interest (RATE)*	7.38	1.36	42
Condition 2 (Paid) Reward			
Optional games (NOG)	1.64	1.30	44
Optional moves (NOM)	41.61	35.50	44
Optional ticks (TIM)	4312.84	4085.65	44
Avg. interest (AVINT)*	7.68	1.37	35
Overall interest (RATE)*	7.43	1.51	44
Condition 3 (Paid) Withdrawl of Reward			
Optional games (NOG)	1.71	2.07	42
Optional moves (NOM)	39.24	45.63	42
Optional ticks (TIM)	3446.57	4259.25	42
Average interest (AVINT)*	7.38	1.42	31
Overall interest (RATE)*	7.59	1.15	42

*Scale is 9-Very, 7-Moderately interesting, 5-Neutral through 1-Very uninteresting.

TABLE 3.10

Intercorrelations Among Dependent Variables (Brooklyn College)

	Lognog	Sqmov	Sqtim	Avint	Rate
Lognog	1.00	.97	.88	.17	.33
Sqmov		1.00	.92	.27	.34
Sqtim			1.00	.26	.35
Avint				1.00	.79

TABLE 3.11

Stepwise Multiple Regression Analyses with LOGNOG, Number of Optional Games (Brooklyn College)

Extraversion

Variable	Beta	F	p	Multiple R
CA	-.26	.66	.41	.03
CB	-.27	1.20	.27	.13
E	.13	1.43	.23	.19
N	.09	.63	.42	.22
CAxE	.16	.24	.62	.23
CBxN	.11	.20	.65	.23

MS(reg)=.36, MS(res)=.32, Overall F(6,121)=1.13, p=.349

Impulsivity

Variable	Beta	F	p	Multiple R
CA	-.07	.08	.78	.03
CB	-.32	1.78	.18	.13
I	.20	2.93	.08	.23
N	.01	.02	.88	.24
CAxI	-.03	.01	.90	.24
CBxN	.16	.44	.51	.25

MS(reg)=.42, MS(res)=.32, Overall F(6,121)=1.32, p=.253

Sociability

Variable	Beta	F	p	Multiple R
CA	-.30	1.23	.27	.03
CB	-.24	.93	.34	.13
S	.02	.04	.85	.13
N	.09	.60	.44	.16
CAxS	.21	.59	.44	.18
CBxN	.09	.14	.71	.18

MS(reg)=.23, MS(res)=.33, Overall F(6,121)=.72, p=.635

CA = condition (control = 0; penalty = 0; reward = 1)
CB = condition (control = 0; reward = 0; penalty = 1)
N = 128

TABLE 3.12

Stepwise Multiple Regression Analyses with SQMOV, Number of Optional Moves (Brooklyn College)

Extraversion

Variable	Beta	F	p	Multiple R
CA	-.28	.77	.38	.01
CB	-.24	.97	.32	.12
E	.11	.95	.33	.18
N	.06	.30	.58	.19
CAxE	.22	.45	.50	.21
CBxN	.10	.17	.68	.21

MS(reg)=10.11, MS(res)=10.91, Overall $F(6,121)=.93$, $p=.478$

Impulsivity

Variable	Beta	F	p	Multiple R
CA	-.18	.53	.47	.01
CB	-.29	1.38	.24	.12
I	.13	1.29	.25	.21
N	.00	.00	.98	.21
CAxI	.13	.27	.60	.22
CBxN	.15	.35	.55	.23

MS(reg)=11.41, MS(res)=10.85, Overall $F(6,121)=1.05$, $p=.395$

Sociability

Variable	Beta	F	p	Multiple R
CA	-.24	.74	.39	.01
CB	-.23	.85	.36	.12
S	.02	.03	.87	.12
N	.05	.21	.64	.14
CAxS	.18	.41	.52	.15
CBxN	.10	.15	.69	.16

MS(reg)=5.67, MS(res)=11.13, Overall $F(6,121)=.51$, $p=.800$

CA = condition (control = 0; penalty = 0; reward = 1)
CB = condition (control = 0; reward = 0; penalty = 1)
N = 128

TABLE 3.13

Stepwise Multiple Regression Analyses with SOTIM, Amount of Optional Time (Brooklyn College)

Extraversion

Variable	Beta	F	p	Multiple R
CA	-.28	.78	.38	.03
CB	-.21	.72	.39	.15
E	.07	.45	.50	.18
N	.07	.37	.54	.19
CAxE	.24	.56	.45	.21
CBxN	.03	.02	.88	.21

MS(reg)=1,073, MS(res)=1,190, Overall $F(6,121)=.90$, $p=.496$

Impulsivity

Variable	Beta	F	p	Multiple R
CA	-.12	.23	.63	.03
CB	-.26	1.10	.29	.15
I	.12	1.00	.31	.21
N	.01	.01	.91	.21
CAxI	.08	.10	.74	.21
CBxN	.08	.11	.74	.21

MS(reg)=1,125, MS(res)=1,187, Overall $F(6,121)=.95$, $p=.464$

Sociability

Variable	Beta	F	p	Multiple R
CA	-.27	.95	.33	.03
CB	-.19	.59	.44	.15
S	-.01	.02	.89	.15
N	.06	.27	.60	.16
CAxS	.24	.71	.40	.18
CBxN	.03	.01	.91	.18

MS(reg)=775, MS(res)=1,204, Overall $F(6,121)=.64$, $p=.645$

CA = condition (control = 0; penalty = 0; reward = 1)
CB = condition (control = 0; reward = 0; penalty = 1)
N = 128

TABLE 3.14

Stepwise Multiple Regression Analyses with AVINT, Average Interest Rating of Optional Games (Brooklyn College)

Extraversion				
Variable	Beta	F	p	Multiple R
CA	.30	.70	.40	.12
CB	.05	.03	.85	.14
E	.03	.08	.78	.14
N	-.08	.45	.50	.16
CAxE	-.14	.16	.69	.16
CBxN	.02	.00	.94	.16

MS(reg)=1.09, MS(res)=2.55, Overall F(6,95)=.427, p=.859

Impulsivity				
Variable	Beta	F	p	Multiple R
CA	.20	.52	.47	.12
CB	.06	.05	.82	.14
I	.04	.08	.78	.14
N	-.08	.42	.52	.16
CAxI	-.04	.02	.88	.16
CBxN	.00	.00	.98	.16

MS(reg)=1.05, MS(res)=2.56, Overall F(6,95)=.41, p=.869

Sociability				
Variable	Beta	F	p	Multiple R
CA	.28	.83	.36	.12
CB	.05	.03	.86	.14
S	.11	.74	.39	.17
N	-.06	.19	.66	.17
CAxS	-.13	.18	.67	.18
CBxN	.02	.00	.95	.18

MS(reg)=1.33, MS(res)=2.54, Overall F(6,95)=.52, p=.788

CA = condition (control = 0; penalty = 0; reward = 1)
CB = condition (control = 0; reward = 0; penalty = 1)
N = 102

TABLE 3.15

Stepwise Multiple Regression Analyses with RATE, Overall Interest Rating of the Game (Brooklyn College)

Extraversion

Variable	Beta	*F*	*p*	Multiple R
CA	-.45	1.99	.16	.02
CB	.05	.03	.85	.07
E	.02	.02	.88	.15
N	-.11	.09	.29	.20
CAxE	.50	2.51	.12	.24
CBxN	.04	.02	.87	.24

MS(reg)=2.30, MS(res)=1.79, Overall $F(6,121)=1.29$, $p=.268$

Impulsivity

Variable	Beta	*F*	*p*	Multiple R
CA	-.04	.03	.85	.02
CB	-.04	.02	.88	.07
I	.12	1.03	.31	.14
N	-.19	3.00	.08	.22
CAxI	.09	.14	.71	.22
CBxN	.12	.24	.63	.22

MS(reg)=1.92, MS(res)=1.80, Overall $F(6,121)=1.06$, $p=.389$

Variable	Beta	*F*	*p*	Multiple R
CA	-.49	3.36	.07	.02
CB	.08	.11	.73	.07
S	.03	.07	.79	.19
N	-.07	.44	.51	.21
CAxS	.56	4.27	.04	.28
CBxN	.00	.00	.99	.28

MS(reg)=3.03, MS(res)=1.74, Overall $F(6,121)=1.73$, $p=.119$

CA = condition (control = 0; penalty = 0; reward = 1)
CB = condition (control = 0; reward = 0; penalty = 1)
N = 128

TABLE 3.16

Stepwise Multiple Regression Analyses with LOGNOG, Number of Optional Games using as Covariate, Interest Rating of Initial Game (Rt) (Brooklyn College)

Extraversion

Variable	Beta	F	p	Multiple R
Rt	.23	6.68	.01	.22
CA	-.15	.23	.63	.22
CB	-.26	1.15	.28	.26
E	.15	1.93	.17	.30
N	.10	.86	.36	.32
CAxE	.04	.01	.90	.32
CBxN	.08	.10	.75	.32

MS(reg)=.60, MS(res)=.31, Overall F(7,120)=1.97, p=.065

Impulsivity

Variable	Beta	F	p	Multiple R
Rt	.22	6.63	.01	.22
CA	-.05	.04	.85	.22
CB	-.30	1.57	.21	.26
I	.20	2.98	.09	.32
N	.04	.12	.73	.33
CAxI	-.06	.06	.80	.33
CBxN	.12	.23	.63	.33

MS(reg)=.65, MS(res)=.30, Overall F(7,120)=2.13, p=.045

Sociability

Variable	Beta	F	p	Multiple R
Rt	.22	6.14	.01	.22
CA	-.23	.94	.33	.25
CB	-.19	.46	.50	.26
S	.03	.06	.80	.26
N	.09	.67	.41	.28
CAxS	.08	.08	.77	.28
CBxN	.07	.09	.77	.28

MS(reg)=.47, MS(res)=.31, Overall F(7,120)=1.52, p=.167

CA = condition (control = 0; penalty = 0; reward = 1)
CB = condition (control = 0; reward = 0; penalty = 1)
N = 128

TABLE 3.17

Stepwise Multiple Regression Analyses with SOMOV, Number of Optional Moves using as Covariate, Interest Rating of Initial Game (Rt) (Brooklyn College)

Extraversion

Variable	Beta	F	p	Multiple R
Rt	.21	5.72	.02	.21
CA	-.18	.32	.57	.21
CB	-.23	.93	.34	.25
E	.12	1.32	.25	.28
N	.07	.45	.50	.29
CAxE	.23	.11	.74	.29
CBxN	.11	.09	.77	.30

MS(reg)=17.26, MS(res)=10.50, Overall F(7,120)=1.64, p=.130

Impulsivity

Variable	Beta	F	p	Multiple R
Rt	.21	5.68	.02	.21
CA	-.16	.42	.52	.21
CB	-.26	1.20	.28	.25
I	.13	1.29	.26	.30
N	.02	.04	.84	.30
CAxI	.10	.17	.68	.30
CBxN	.10	.18	.67	.30

MS(reg)=18.27, MS(res)=10.44, Overall F(7,120)=1.75, p=.104

Sociability

Variable	Beta	F	p	Multiple R
Rt	.21	5.52	.02	.21
CA	-.23	.86	.35	.24
CB	-.12	.20	.65	.25
S	.02	.05	.82	.25
N	.06	.24	.62	.26
CAxS	.05	.03	.85	.26
CBxN	.08	.10	.75	.26

MS(reg)=13.32, MS(res)=10.73, Overall F(7,120)=1.24, p=.285

CA = condition (control = 0; penalty = 0; reward = 1)
CB = condition (control = 0; reward = 0; penalty = 1)
N = 128

TABLE 3.18

Stepwise Multiple Regression Analyses with SOTIM, Amount of Option Time using as Covariate, Interest Rating of Initial Game (Rt) (Brooklyn College)

Extraversion

Variable	Beta	F	p	Multiple R
Rt	.21	6.05	.01	.21
CA	-.18	.32	.57	.22
CB	-.19	.68	.41	.27
E	.09	.70	.40	.29
N	.08	.53	.47	.30
CAxE	.13	.16	.69	.30
CBxN	.00	.00	.98	.30

MS(reg)=1,907, MS(res)=1,142, Overall $F(7,120)=1.67$, $p=.123$

Impulsivity

Variable	Beta	F	p	Multiple R
Rt	.22	6.15	.01	.21
CA	-.09	.15	.70	.22
CB	-.23	.93	.34	.27
I	.12	1.00	.32	.30
N	.03	.10	.76	.30
CAxI	.05	.04	.83	.30
CBxN	.04	.02	.88	.30

MS(reg)=1,966, MS(res)=1,138, Overall $F(7,120)=1.73$, $p=.109$

Sociability

Variable	Beta	F	p	Multiple R
Rt	.22	5.82	.01	.21
CA	-.19	.60	.44	.26
CB	-.15	.31	.58	.27
S	-.00	.00	.93	.27
N	.06	.31	.58	.27
CAxS	.10	.14	.71	.27
CBxN	.00	.00	.98	.27

MS(reg)=1,628, MS(res)=1,158, Overall $F(7,120)=1.40$, $p=.209$

CA = condition (control = 0; penalty = 0; reward = 1)
CB = condition (control = 0; reward = 0; penalty = 1)
N = 128

TABLE 3.19

Stepwise Multiple Regression Analyses with AVINT, Average Interest Rating of Optional Games using as Covariate, Interest Rating of Initial Game (Rt) (Brooklyn College)

Extraversion

Variable	Beta	F	p	Multiple R
Rt	.69	85.69	.00	.67
CA	.63	5.62	.02	.68
CB	.09	.18	.67	.68
E	.09	.97	.33	.68
N	-.05	.26	.61	.68
CAxE	-.51	3.59	.06	.70
CBxN	-.08	.13	.71	.70

MS(reg)=17.47, MS(res)=1.35, Overall F(7,94)=12.93, p=.000

Impulsivity

Variable	Beta	F	p	Multiple R
Rt	.67	80.02	.00	.67
CA	.27	1.74	.19	.68
CB	.14	.48	.49	.68
I	.03	.09	.77	.68
N	-.02	.03	.86	.68
CAxI	-.14	.41	.52	.68
CBxN	-.13	.40	.53	.69

MS(reg)=16.86, MS(res)=1.40, Overall F(7,94)=12.08,p=.000

Sociability

Variable	Beta	F	p	Multiple R
Rt	.71	88.66	.00	.67
CA	.66	8.42	.00	.68
CB	.06	.08	.77	.68
S	.13	1.92	.17	.68
N	-.05	.26	.61	.68
CAxS	-.56	5.79	.02	.70
CBxN	-.05	.05	.82	.70

MS(reg)=17.87, MS(res)=1.32, Overall F(7,94)=13.53, p=.000

CA = condition (control = 0; penalty = 0; reward = 1)
CB = condition (control = 0; reward = 0; penalty = 1)
N = 102

TABLE 3.20

Stepwise Multiple Regression Analyses with RATE, Overall Interest Rating of the Game using as Covariate, Interest Rating of Initial Game (Rt) (Brooklyn College)

Extraversion

Variable	Beta	F	p	Multiple R
Rt	.85	362.67	.00	.86
CA	-.04	.07	.79	.86
CB	.09	.51	.47	.86
E	.08	2.36	.13	.87
N	-.07	1.52	.22	.87
CAxE	.06	.13	.72	.87
CBxN	-.08	.43	.51	.87

MS(reg)=25.16, MS(res)=.45, Overall F(7,120)=56.21, p=.000

Impulsivity

Variable	Beta	F	p	Multiple R
Rt	.85	369.47	.00	.86
CA	.04	.13	.72	.86
CB	.06	.26	.61	.86
I	.11	3.46	.06	.87
N	-.11	3.83	.05	.87
CAxI	-.03	.05	.83	.88
CBxN	-.06	.21	.65	.88

MS(reg)=25.19, MS(res)=.45, Overall F(7,120)=56.46, p=.000

Sociability

Variable	Beta	F	p	Multiple R
Rt	.85	341.82	.00	.86
CA	-.04	.07	.79	.86
CB	.10	.59	.44	.86
S	.05	.79	.38	.87
N	-.06	1.21	.27	.87
CAxS	.05	.14	.71	.87
CBxN	-.08	.44	.51	.87

MS(reg)=24.98, MS(res)=.46, Overall F(7,120)=54.50, p=.000

CA = condition (control = 0; penalty = 0; reward = 1)
CB = condition (control = 0; reward = 0; penalty = 1)
N = 128

TABLE 3.21

Stepwise Multiple Regression Analyses with LOGNOG, Check of Directionality of Interaction Terms (Brooklyn College)

Extraversion				
Variable	Beta	F	p	Multiple R
CA	-.37	1.23	.27	.02
CB	-.53	2.16	.14	.13
E	.02	.01	.90	.19
CAxE	.29	.72	.40	.20
CBxE	.40	1.13	.29	.22

MS(reg)=.38, MS(res)=.31, Overall F(5,122)=1.22, p=.300

Impulsivity				
Variable	Beta	F	p	Multiple R
CA	-.18	.47	.49	.02
CB	-.47	2.34	.13	.13
I	.10	.48	.48	.23
CAxI	.09	.13	.72	.23
CBxI	.33	1.02	.32	.25

MS(reg)=.50, MS(res)=.31, Overall F(5,122)=1.65, p=.151

Sociability				
Variable	Beta	F	p	Multiple R
CA	-.38	1.67	.20	.02
CB	-.37	1.53	.22	.13
S	.08	.36	.55	.14
CAxS	.30	1.03	.31	.15
CBxS	.25	.62	.43	.17

MS(reg)=.22, MS(res)=.32, Overall F(5,122)=.70, p=.623

CA = condition (control = 0; penalty = 0; reward = 1)
CB = condition (control = 0; reward = 0; penalty = 1)
N = 128

TABLE 3.22

Stepwise Multiple Regression Analyses with AVINT, Check of Directionality of Interaction Terms (Brooklyn College)

Extraversion

Variable	Beta	F	p	Multiple R
CA	.17	.21	.65	.12
CB	-.12	.09	.76	.14
E	-.01	.01	.94	.14
CAxE	-.01	.00	.96	.14
CBxE	.20	.22	.63	.15

MS(reg)=1.12, MS(res)=2.54, Overall F(5,96)=.44, p=.817

Impulsivity

Variable	Beta	F	p	Multiple R
CA	.14	.20	.65	.12
CB	.01	.00	.97	.14
I	-.00	.00	.98	.14
CAxI	-.02	.00	.95	.14
CBxI	-.06	.03	.87	.14

MS(reg)=.98, MS(res)=2.55, Overall F(5,96)=.38, p=.858

Sociability

Variable	Beta	F	p	Multiple R
CA	.20	.38	.79	.12
CB	-.08	.06	.44	.14
S	.07	.22	.38	.17
CAxS	-.05	.02	.71	.17
CBxS	.16	.20	.51	.18

MS(reg)=1.58, MS(res)=2.51, Overall F(5,96)=.63, p=.678

CA = condition (control = 0; penalty = 0; reward = 1)
CB = condition (control = 0; reward = 0; penalty = 1)
N = 102

TABLE 3.23

Stepwise Multiple Regression Analyses with LOGNOG, Number of Optional Games Using as Covariate, Interest Rating of Initial Game (Rt), with Paid Conditions Collapsed (Brooklyn College)

Extraversion

Variable	Beta	F	p	Multiple R
Rt	.21	6.07	.01	.22
CA	-.33	1.35	.25	.26
E	.06	.16	.69	.29
CAxE	.22	.50	.48	.30

MS(reg)=.90, MS(res)=.30, Overall F(4,123)=2.98, p=.022

Impulsivity

Variable	Beta	F	p	Multiple R
Rt	.22	6.31	.01	.22
CA	-.24	1.03	.31	.26
I	.12	.64	.42	.31
CAxI	.12	.21	.65	.31

MS(reg)=1.02, MS(res)=.30, Overall F(4,123)=3.38, p=.011

Sociability

Variable	Beta	F	p	Multiple R
Rt	.22	6.00	.01	.22
CA	-.27	1.20	.27	.26
S	.06	.17	.68	.26
CAxS	.16	.35	.55	.26

MS(reg)=.71, MS(res)=.31, Overall F(4,123)=2.30, p=.062

CA = condition (control = 0; penalty = 1; reward = 1)
N = 128

TABLE 3.24

Stepwise Multiple Regression Analyses with SOMOV, Number of Optional Moves Using as Covariate, Interest Rating of Initial Game (Rt), with Paid Conditions Collapsed (Brooklyn College)

Extraversion				
Variable	Beta	F	p	Multiple R
Rt	.20	5.27	.02	.21
CA	-.35	1.50	.22	.24
E	-.03	.05	.83	.26
CAxE	-.27	.74	.39	.27

MS(reg)=26.92, MS(res)=10.35, Overall F(4,123)=2.60, p=.039

Impulsivity				
Variable	Beta	F	p	Multiple R
Rt	.20	5.44	.02	.21
CA	-.34	2.01	.16	.24
I	.03	.04	.85	.28
CAxI	.27	.99	.32	.29

MS(reg)=30.06, MS(res)=10.25, Overall F(4,123)=2.93, p=.023

Sociability				
Variable	Beta	F	p	Multiple R
Rt	.21	5.41	.02	.21
CA	-.21	.73	.39	.24
S	-.04	.08	.78	.24
CAxS	.12	.19	.56	.24

MS(reg)=20.09, MS(res)=10.57, Overall F(4,123)=1.90, p=.114

CA = condition (control = 0; penalty = 1; reward = 1)
N = 128

TABLE 3.25

Stepwise Multiple Regression Analyses with SOTIM, Amount of Optional Time Using as Covariate, Interest Rating of Initial Game (Rt), with Paid Conditions Collapsed (Brooklyn College)

Extraversion

Variable	Beta	F	p	Multiple R
Rt	.20	5.36	.02	.21
CA	-.39	1.83	.17	.24
E	-.01	.01	.91	.26
CAxE	.31	.97	.33	.27

MS(reg)=2813, MS(res)=1131, Overall F(4,123)=2.49, p=.047

Impulsivity

Variable	Beta	F	p	Multiple R
Rt	.20	5.66	.02	.21
CA	-.31	1.67	.20	.24
I	-.01	.00	.94	.27
CAxI	.24	.73	.39	.28

MS(reg)=2918, MS(res)=1128, Overall F(4,123)=2.58, p=.040

Sociability

Variable	Beta	F	p	Multiple R
Rt	.21	5.54	.02	.21
CA	-.25	1.07	.30	.24
S	-.07	.31	.57	.24
CAxS	.16	.38	.54	.25

MS(reg)=2318, MS(res)=1147, Overall F(4,123)=2.02, p=.096

CA = condition (control = 0; penalty = 1; reward = 1)
N = 128

TABLE 3.26

Stepwise Multiple Regression Analyses with AVINT, Average Interest Rating of Optional Games Using as Covariate, Interest Rating of Initial Game (Rt), with Paid Conditions Collapsed (Brooklyn College)

Extraversion

Variable	Beta	F	p	Multiple R
Rt	.67	80.08	.00	.67
CA	.31	1.53	.21	.67
E	.08	.40	.53	.67
CAxE	-.25	.85	.36	.68

MS(reg)=28.64, MS(res)=1.39, Overall F(4,97)=20.63, p=.000

Impulsivity

Variable	Beta	F	p	Multiple R
Rt	.67	79.36	.00	.67
CA	.19	.81	.37	.67
I	.02	.03	.86	.67
CAxI	-.12	.25	.62	.68

MS(reg)=28.49, MS(res)=1.39, Overall F(4,97)=20.42, p=.000

Sociability

Variable	Beta	F	p	Multiple R
Rt	.68	80.23	.00	.67
CA	.34	2.68	.10	.67
S	.14	1.38	.24	.67
CAxS	-.30	1.70	.19	.68

MS(reg)=28.95, MS(res)=1.37, Overall F(4,97)=21.04, p=.000

CA = condition (control = 0; penalty = 1; reward = 1)
N = 102

TABLE 3.27

Stepwise Multiple Regression Analyses with RATE, Overall Interest Rating of the Game Using as Covariate, Interest Rating of Initial Game (Rt), with Paid Conditions Collapsed (Brooklyn College)

Extraversion

Variable	Beta	F	p	Multiple R
Rt	.85	363.54	.00	.86
CA	-.11	.60	.44	.86
E	.06	.72	.40	.87
CAxE	.14	.73	.40	.87

MS(reg)=43.61, MS(res)=.45, Overall F(4,97)=96.77, p=.000

Impulsivity

Variable	Beta	F	p	Multiple R
Rt	.86	362.65	.00	.86
CA	-.03	.08	.78	.86
I	.06	.62	.43	.87
CAxI	.05	.14	.71	.87

MS(reg)=43.28, MS(res)=.46, Overall F(4,97)=93.77, p=.000

Sociability

Variable	Beta	F	p	Multiple R
Rt	.84	343.20	.00	.86
CA	-.13	1.08	.30	.86
S	.02	.10	.75	.87
CAxS	.16	1.39	.24	.87

MS(reg)=43.47, MS(res)=.46, Overall F(4,97)=95.19, p=.000

CA = condition (control = 0; penalty = 1; reward = 1)
N = 128

TABLE 3.28

Stepwise Multiple Regression Analyses with LOGNOG, Number of Optional Games Using as Covariate, Interest Rating of Initial Game (Rt), with Paid Conditions Collapsed, Reduced Model (Brooklyn College)

Extraversion

Variable	Beta	F	p	Multiple R
Rt	.22	6.73	.01	.22
CA	-.14	2.66	.10	.26
E	.13	2.40	.12	.29

MS(reg)=1.16, MS(res)=.30, Overall $F(3,124)=3.82$, $p=.011$

Impulsivity

Variable	Beta	F	p	Multiple R
Rt	.21	6.54	.01	.22
CA	-.14	2.70	.10	.26
I	.17	4.22	.04	.31

MS(reg)=1.33, MS(res)=.30, Overall $F(3,124)=4.47$, $p=.000$

Sociability

Variable	Beta	F	p	Multiple R
Rt	.23	6.75	.01	.22
CA	-.13	2.30	.13	.26
S	.00	.01	.93	.26

MS(reg)=.92, MS(res)=.31, Overall $F(3,124)=2.96$, $p=.035$

CA = condition (control = 0; penalty = 1; reward = 1)
N = 128

TABLE 3.29

Stepwise Multiple Regression Analyses with SOMOV, Number of Optional Moves Using as Covariate, Interest Rating of Initial Game (Rt), with Paid Conditions Collapsed, Reduced Model (Brooklyn College)

Extraversion				
Variable	Beta	F	p	Multiple R
Rt	.21	5.97	.01	.21
CA	-.12	1.82	.18	.24
E	-.13	2.11	.15	.26

MS(reg)=33.37, MS(res)=10.33, Overall F(3,124)=3.23, p=.025

Impulsivity				
Variable	Beta	F	p	Multiple R
Rt	.21	5.81	.02	.21
CA	-.12	1.82	.18	.24
I	.15	3.10	.08	.28

MS(reg)=36.66, MS(res)=10.25, Overall F(3,124)=3.58, p=.016

Sociability				
Variable	Beta	F	p	Multiple R
Rt	.21	5.99	.02	.21
CA	-.11	1.56	.21	.24
S	.00	.01	.92	.24

MS(reg)=26.11, MS(res)=10.50, Overall F(3,124)=2.48, p=.064

CA = condition (control = 0; penalty = 1; reward = 1)
N = 128

TABLE 3.30

Stepwise Multiple Regression Analyses with SOTIM, Amount of Optional Time Using as Covariate, Interest Rating of Initial Game (Rt), with Paid Conditions Collapsed, Reduced Model (Brooklyn College)

Extraversion

Variable	Beta	F	p	Multiple R
Rt	.21	6.13	.01	.21
CA	-.12	1.89	.17	.24
E	.09	1.18	.28	.26

MS(reg)=3384, MS(res)=1131, Overall F(3,124)=2.99, p=.034

Impulsivity

Variable	Beta	F	p	Multiple R
Rt	.21	6.00	.01	.21
CA	-.12	1.89	.17	.24
I	.12	1.80	.18	.27

MS(reg)=3616, MS(res)=1125, Overall F(3,124)=3.21, p=.025

Sociability

Variable	Beta	F	p	Multiple R
Rt	.21	6.27	.01	.21
CA	-.11	1.66	.20	.24
S	-.01	.02	.89	.24

MS(reg)=2947, MS(res)=1141, Overall F(3,124)=2.58,p=.056

CA = condition (control = 0; penalty = 1; reward = 1)
N = 128

TABLE 3.31

Stepwise Multiple Regression Analyses with AVINT, Average Interest Rating of Optional Games Using as Covariate, Interest Rating of Initial Game (Rt), with Paid Conditions Collapsed, Reduced Model (Brooklyn College)

Extraversion

Variable	Beta	*F*	*p*	Multiple R
Rt	.67	79.46	.00	.67
CA	.09	1.43	.23	.67
E	-.01	.02	.88	.67

MS(reg)=37.80, MS(res)=1.39, Overall $F(3,98)=27.27$, $p=.000$

Impulsivity

Variable	Beta	*F*	*p*	Multiple R
Rt	.67	79.74	.00	.67
CA	.09	1.46	.23	.67
I	-.03	.17	.68	.67

MS(reg)=37.87, MS(res)=1.38, Overall $F(3,98)=27.36$, $p=.000$

Sociability

Variable	Beta	*F*	*p*	Multiple R
Rt	.66	78.03	.00	.67
CA	.09	1.37	.24	.67
S	-.02	.07	.80	.67

MS(reg)=37.82, MS(res)=1.38, Overall $F(3,98)=27.29$, $p=.000$

CA = condition (control = 0; penalty = 1; reward = 1)
N = 102

TABLE 3.32

Stepwise Multiple Regression Analyses with RATE, Overall Interest Rating of the Game Using as Covariate, Interest Rating of Initial Game (Rt), with Paid Conditions Collapsed, Reduced Model (Brooklyn College)

Extraversion

Variable	Beta	F	p	Multiple R
Rt	.86	376.23	.00	.86
CA	.00	.02	.89	.86
E	.11	6.01	.01	.87

MS(reg)=58.04, MS(res)=.45, Overall F(3,124)=129.07, p=.000

Impulsivity

Variable	Beta	F	p	Multiple R
Rt	.86	368.08	.00	.86
CA	.00	.04	.84	.86
I	.09	3.66	.06	.87

MS(reg)=57.68, MS(res)=.46, Overall F(3,124)=125.85, p=.000

Sociability

Variable	Beta	F	p	Multiple R
Rt	.85	360.62	.00	.86
CA	.00	.03	.86	.86
S	.09	3.82	.05	.87

MS(reg)=126.06, MS(res)=.46, Overall F(3,124)=126.06, p=.000

CA = condition (control = 0; penalty = 1; reward = 1)
N = 128

TABLE 3.33

Stepwise Multiple Regression Analyses with Initial Paid/Unpaid Game Score, G, with Paid Conditions Collapsed (Brooklyn College)

Extraversion				
Variable	Beta	F	p	Multiple R
CA	-.20	5.28	.02	.19
SX	.16	3.58	.06	.25
E	.20	5.60	.02	.32

MS(reg)=81.11, MS(res)=16.76, Overall $F(3,124)=4.84$, $p=.003$

Impulsivity				
Variable	Beta	F	p	Multiple R
CA	-.19	5.09	.03	.19
SX	.15	3.20	.08	.25
I	.19	5.03	.03	.32

MS(reg)=78.01, MS(res)=16.83, Overall $F(3,124)=4.63$, $p=.004$

Sociability				
Variable	Beta	F	p	Multiple R
CA	-.20	5.37	.02	.19
SX	.16	3.54	.07	.25
S	.22	6.52	.02	.33

MS(reg)=85.96, MS(res)=16.64, Overall $F(3,124)=5.16$, $p=.002$

CA = Condition (control = 0; penalty = 1; reward = 1)
SX = Sex (male = 0; female = 1)
G = Number of frogs remaining (As level of performance increases, G decreases)
N = 128

CHAPTER 4

COMPARISON OF THE TWO STUDIES

This chapter presents additional analyses intended to clarify the findings of the Hunter College and Brooklyn College studies. The methods of analysis will be, first, to compare means of variables that differ between studies; second, to combine data from both studies into the same analyses; and third, to summarize in terms of correlations what the regressions have shown. Prior to presenting these additional analyses, the findings of these studies are reviewed.

At Hunter College paid subjects played significantly fewer optional games than unpaid subjects, and, when initial interest rating of the game was controlled for, paid subjects rated the optional games as less interesting. Payment reduced intrinsic motivation.

The interactions of the various personality scales with paid/unpaid experimental condition were not significant; and therefore, the hypothesis that high impulsives and/or extraverts should be more affected by the addition of reward than low impulsives or introverts was not supported.

In addition, subjects with high scores on extraversion and sociability played significantly more optional games than those with low scores, and when controlling for initial interest, subjects high on extraversion and impulsivity rated their optional play as significantly less interesting than those with low scores.

Finally, the initial paid/unpaid game score, (G), was positively related to the behavioral dependent measures and served as a good covariate, while interest rating of this game, (Rt), served as a good covariate for the rating dependent measure.

The results of the Brooklyn College study showed that the withdrawal of reward manipulation did not produce the expected result. Because subjects in this condition apparently did not perceive the payment differently from subjects in the reward (payment) condition, the payment conditions were collapsed. In addition, payment did not produce a clear reduction in intrinsic motivation. Although the subjects in the payment condition played fewer optional games than unpaid subjects, the difference in amount of play was not significant. There were also no significant differences in interest ratings of optional games between paid and unpaid groups.

The interactions of paid/unpaid condition with the various personality scales were not significant indicating that, once again, the main hypothesis of the study was not confirmed.

Unexpected main effects for personality measures were found once more. Extraverts and impulsives played more than introverts or low impulsives. Controlling for interest rating of initial play, extraverts rated the game as more interesting on RATE, one of the two rating variables. Finally, the covariate (G) was unrelated to the dependent variables in this study; however, the covariate (Rt) was significantly related to both behavioral and rating dependent measures.

When the findings between studies are compared, we see that sociability is the underlying component of extraversion which is most associated with persistence in the Hunter College data while impulsivity plays a similar role in the Brooklyn data. In the Hunter data, average interest rating of optional play (AVINT) is significantly and negatively related to extraversion after controlling for initial interest. In the Brooklyn data, AVINT is unrelated to personality variables, but overall interest rating of the game (RATE) is significantly and positively related to extraversion after controlling for initial interest. Because RATE was not present in the first study, there is no basis for direct comparison. Nevertheless, an interest rating variable in each study is significantly related to extraversion. The relationship is negative in the Hunter College data, positive in the Brooklyn College data.

Two questions come to mind: What variable or variables accounts for the differences in the results of the two studies? What variable or variables might account for the lack of findings if the hypotheses underlying this research are true?

To answer these questions, I combined the data from both studies and performed *t* tests on all variables for which this statistic is appropriate. These *t* tests compared the means of the Hunter College sample population with the means of the Brooklyn College population. Table 4.1 shows those variables on which there were significant differences. *F* tests of equality of variances are provided only in those cases where unequal variances were found.

Three findings from Table 4.1 suggest a pattern of differences which may explain why the payment manipulation resulted in reduced intrinsic motivation at Hunter College but not at Brooklyn. The Brooklyn College subjects were almost three years younger, performed better on the first game leaving almost three frogs less per game, and rated the initial play of the game more interesting. Therefore, if the relative magnitude of intrinsic motivation is greater for the Brooklyn College subjects, then one can postulate that the magnitude of extrinsic motivation must be increased by an equal proportion to produce the same effect. Increasing extrinsic motivation would mean increasing payment. Since it was not increased, paid subjects experienced less reduction in intrinsic motivation.

Additionally, extraversion, impulsivity, sociability, and neuroticism scores were not significantly different between the populations ruling out the possibility that differences in these variables between the college populations can be used to explain the differences in the findings between experiments. However, this finding leaves unanswered the question of why the subscales did not perform in the same manner. I will return to this issue in the discussion section.

The next behavior I will examine is the decision to play optional games. Did impulsivity or sociability play a greater role in this process? Does the proportion of subjects who opt to continue change across studies? To answer these questions stepwise logistic regressions were computed using the BMDP statistical package (Dixon, 1983), program LR. In each of these regressions, the programs were started with all terms in the model. Terms were allowed a single movement which means that once removed, they could not be reentered. In all cases two terms were not allowed to be removed from the model. In the first three regressions these terms were condition and the first personality variable entered. In the last model these terms were study and condition. All the regressions were computed twice: first using PLAYAGAN (Yes/No) as the dichotomous dependent variable and second, using PLAYTWO (Yes/No) as the dependent variable. For PLAYAGAN the variable, number of optional games (NOG), was dichotomized as yes, one or more optional games and no, zero optional games. For PLAYTWO, NOG was dichotomized as yes, two or more optional games, and no, zero or one optional game. Regressions using each of these dependent variables produced similar effects. However, the effects are larger for PLAYTWO and these are presented in the four regressions. The first regression (Table 4.2) employs extraversion as one of the independent variables; the second regression (Table 4.3) replaces extraversion and the interaction term of extraversion and condition with sociability and impulsivity; the third regression (Table 4.4) reverses the order of sociability and impulsivity; and the fourth regression (Table 4.5) employs three terms, (study, condition, and an interaction term for study with condition.) The interaction term in this last regression tests the null hypothesis of no differences between studies in the proportion of subjects choosing to play optional games.

Table 4.2 shows the logistic regression which uses extraversion as an independent variable. The first part of the table shows the first step of the regression with all terms in the model; the second part of the table shows the history of the regression, namely the term removed at each step and the likelihood chi-square value for each step; the third part of the table shows the final model and the significance value of the terms remaining. However, for each term the column marked coefficient/S.E. indicates the importance of any given variable in the model. If this number is 2 or larger, the regression coefficient is significant ($p < .05$). In Table 4.2 we noted that the final model contains two terms, condition and extraversion. Both of these terms are constrained to remain in the model. The coefficient/S.E. and the significance level indicate that condition is significant but extraversion is not. In Table 4.3 we note again that only two terms, condition and sociability, remain in the model and only condition is significant. Finally, in Table 4.4 we see that condition and impulsivity are both significant in the final model. These findings seem to suggest that impulsivity and not sociability is the personality variable most associated with the decision to play optional games. However, these findings may be due to the relatively larger number of subjects in the combined sample from the Brooklyn population and thus the regression appears more like the findings from the Brooklyn data than those from the Hunter data.

Table 4.5 shows that the impact of payment on the proportion of subjects choosing to play optional games was not significantly different between populations. This can be seen by examining the interaction term of study with condition.

Table 4.6 shows the relationships of all the major independent variables in both studies with all the dependent variables. Since none of the interaction terms were significant, this table clearly shows the important relationships in the data from both studies. The second part of the table shows the effect of the various conditions used in both studies while the first part shows the effect of personality variables. The differences in the relative relationships of impulsivity and sociability to each of the behavioral dependent variables for each of the studies are evident. The correlations of extraversion and sociability with optional play are largest in the Hunter sample while in the Brooklyn sample extraversion and impulsivity are largest. With regard to ratings at Hunter, the correlation of AVINT with impulsivity approaches significance while the equivalent correlation with sociability is much smaller and does not approach significance. In the Brooklyn data we see a reversal in direction of the correlation of sociability with AVINT, and no relation at all between AVINT and impulsivity. RATE in the Brooklyn data shows a clear positive relationship with both impulsivity and sociability. Table 4.7 shows the intercorrelations of sociability and impulsivity with each of the dependent variables with the alternative scale partialled out. Thus, we see the correlations of sociability with the dependent variables with impulsivity partialled out and the correlations of impulsivity with the dependent variables with sociability partialled out. These correlations look fairly similar to those of the prior table suggesting that the effects found in each of the two studies seem to be due to the relatively independent operation of each of the subscales.

With this review of the findings of each of the studies we can now move on to consider their significance.

TABLE 4.1

Comparison of Sample Means Where the Difference Between Hunter and Brooklyn College Means Approached Significance.

Variable	School	N	M	SD	t	df	p	F	p
G	H	55	9.38	7.41	2.75*	69	.007	3.01	.000
	B	128	6.44	4.27					
Rt	H	55	6.89	1.93	-1.71*	78	.091	1.99	.002
	B	128	7.38	1.37					
L	H	55	3.52	1.54	2.16	181	.032		
	B	128	3.00	1.45	2.16				
SQTIM	H	55	64.50	37.46	1.93	181	.055		
	B	128	53.50	34.42					
AGE	H	55	25.51	6.67	2.51	181	.013		
	B	128	22.82	6.62					

*Indicates t test for unequal variances. F test for equality of variances is included only when variances are not equal.

TABLE 4.2

Variable: PLAYTWO: Play Two or More Optional Games (Yes/No)

LOGISTIC REGRESSION
(N=183)

Independent Variables	b	Standard Error	Coeff/S.E.
Study	.16	.17	.96
Condition	1.12	.72	1.56
Extraversion	-.07	.04	-1.71
Neuroticism	-.51	.04	-1.42
C*E	-.06	.43	-1.31
C*N	.00	.04	-.02
Constant	1.33	.71	1.87

Step	Term Removed	Improvement Chi-Square	p
1	C*N	.00	.98
2	Study	.92	.34
3	C*E	1.51	.22
4	Neuroticism	1.77	.18

Independent Variables	b	Standard Error	Coeff/S.E.	p
Condition	.42	.16	2.63	.00
Extraversion	-.07	.40	-1.73	.08
Constant	.78	.53	1.49	.13

TABLE 4.3

Variable: PLAYTWO: Play Two or More Play Optional Games (Yes/No)

LOGISTIC REGRESSION
(N=183)

Independent Variables	b	Standard Error	Coeff/S.E.
Study	.18	.17	1.03
Condition	1.18	.72	1.66
Sociability	-.02	.07	-.32
Impulsivity	-.17	.11	-1.53
Neuroticism	-.03	.04	-.85
C*S	-.11	.71	-1.59
C*I	.55	.11	.48
C*N	-.02	.04	-.48
Constant	1.15	.71	1.62

Step	Term Removed	Improvement Chi-Square	p
1	C*N	.23	.63
2	C*I	.12	.73
3	Study	.94	.33
4	Neuroticism	1.29	.26
5	C*S	1.68	.19
6	Impulsivity	3.33	.07

Independent Variables	b	Standard Error	Coeff/S.E.	p
Condition	.41	.16	2.62	.00
Sociability	-.51	.06	-.90	.37
Constant	.28	.43	.64	.52

TABLE 4.4

Variable: PLAYTWO: Play Two or More Play Optional Games (Yes/No)

LOGISTIC REGRESSION
(N=183)

Independent Variables	b	Standard Error	Coeff/S.E.
Study	.18	.17	1.03
Condition	1.85	.72	1.66
Impulsivity	-.02	.11	-1.53
Sociability	-.03	.07	-.32
Neuroticism	-.03	.04	-.85
C*I	-.05	.11	-.48
C*S	-.11	.07	-1.59
C*N	.02	.04	-.48
Constant	1.15	.71	1.62

Step	Term Removed	Improvement Chi-Square	p
1	C*N	.23	.63
2	C*I	.12	.73
3	Study	.94	.33
4	Neuroticism	1.29	.26
5	C*S	1.68	.19
6	Sociability	.02	.89

Independent Variables	b	Standard Error	Coeff/S.E.	p
Condition	.43	.16	2.68	.00
Impulsivity	-.18	.09	-2.01	.04
Constant	-.71	.43	1.67	.09

TABLE 4.5

Variable: PLAYTWO: Play Two or More Play Optional Games (Yes/No)

LOGISTIC REGRESSION
(N=183)

Independent Variables	b	Standard Error	Coeff/S.E.
Study	.18	.17	1.03
Condition	1.18	.72	1.66
S*C	-.02	.07	-.32
Constant	1.15	.71	1.62

Step	Term Removed	Improvement Chi-Square	p
1	S*C	.75	.39

Independent Variables	b	Standard Error	Coeff/S.E.	p
Study	.41	.16	2.62	.00
Condition	-.51	.06	-.90	.37
Constant	.28	.43	.64	.52

TABLE 4.6

Correlations Between Main Dependent and Independent Variables In Both Studies, Hunter and Brooklyn Colleges

Var	Schl	G	Rt	LOGNOG	SOMOV	SOTIM	AVINT	RATE
E	H	.08 (.27)	.03 (.40)	.34 (.00)	.31 (.01)	.33 (.10)	-.18 (.11)	.--
	B	.19 (.01)	.04 (.34)	.13 (.08)	.12 (.08)	.09 (.14)	.01 (.42)	.14 (.07)
I	H	.07 (.28)	.09 (.24)	.17 (.10)	.16 (.11)	.14 (.15)	-.23 (.06)	.--
	B	.19 (.01)	.05 (.27)	.18 (.02)	.15 (.03)	.12 (.09)	.01 (.46)	.13 (.07)
S	H	.11 (.20)	-.04 (.38)	.30 (.01)	.28 (.02)	.31 (.01)	-.10 (.25)	.--
	B	.20) (.00)	.11 (.10)	.02 (.40)	.02 (.40)	.00 (.48)	.10 (.16)	.18 (.02)
N	H	.17 (.11)	-.27 (.02)	.06 (.34)	.07 (.30)	.09 (.25)	-.21 (.08)	.--
	B	-.02 (.42)	-.05 (.30)	.07 (.21)	.04 (.31)	.04 (.34)	-.06 (.26)	-.14 (.05)
L	H	.06 (.34)	.06 (.33)	-.19 (.08)	-.18 (.09)	-.08 (.27)	.00 (.49)	.--
	B	-.05 (.29)	.02 (.38)	-.06 (.23)	-.05 (.27)	.00 (.49)	.01 (.47)	.04 (.33)

Parentheses indicate significance levels. Dashes are entered where correlations either cannot be computed or would be repetitive.

Continued on next page.

TABLE 4.6 (Continued)

Correlations Between Main Dependent and Independent Variables In Both Studies, Hunter and Brooklyn Colleges

Var	Schl	G	Rt	LOGNOG	SQMOV	SQTIM	AVINT	RATE
CA[a]	H	-.09	.06	-.37	-.31	-.40	-.16	.--
		(.24)	(.32)	(.00)	(.01)	(.00)	(.13)	
	B	-.14	-.02	-.03	-.00	.03	.12	-.01
		(.06)	(.40)	(.38)	(.49)	(.35)	(.11)	(.41)
CB[b]	H	.--	.--	.--	.--	.--	.--	.--
	B	-.05	.06	-.09	-.09	-.14	-.01	.07
		(28)	(.25)	(.14)	(.13)	(.06)	(.46)	(.23)
CAB[c]	H	-.09	.06	-.37	-.31	-.40	-.16	.--
		(.24)	(.32)	(.00)	(.01)	(.00)	(.13)	
	B	-.19	.04	.12	-.10	-.10	.11	.05
		(.02)	(.34)	(.08)	(.13)	(.12)	(.13)	(.30)
G	H	.--	-.34	.34	.29	.35	.01	.--
			(.00)	(.00)	(.01)	(.00)	(.46)	
	B	.--	.02	.13	.09	.11	.10	.09
			(.38)	(.06)	(.15)	(.11)	(.16)	(.14)
Rt	H	.--	.--	.02	-.10	.10	.63	.--
				(.44)	(.22)	(.22)	(.00)	(.--)
	B			.22	.21	.21	.67	.86
				(.00)	(.00)	(.00)	(.00)	(.00)

Parentheses indicate significance levels. Dashes are entered where correlations either cannot be computed or would be repetitive.

[a]Indicates dummy variable coded 0 if control or (paid) withdrawal of reward conditions, and 1 if (paid) reward condition.

[b]Indicates dummy variable coded 0 if control or (paid) reward conditions, and 1 if (paid) withdrawal of reward condition.

[c]Indicates dummy variable coded 0 if control condition, and 1 if either (paid) reward or withdrawal of reward, in other words both payment conditions combined.

TABLE 4.7

Partial Correlations of Main Dependent Variables with Impulsivity Controlling for Sociability Variables and with Sociability Controlling for Impulsivity in Both Studies, Hunter and Brooklyn Colleges

Var	Schl	G	Rt	LOGNOG	SOMOV	SOTIM	AVINT	RATE
S	H	.09	-.07	.26	.25	.28	-.04	.--
		(.24)	(.30)	(.03)	(.03)	(.02)	(.39)	
	B	.14	.09	-.06	-.05	-.05	.10	.14
		(.05)	(.13)	(.25)	(.30)	(.28)	(.15)	(.05)
I	H	.05	.11	.10	.09	.06	-.21)	.--
		(.35)	(.21)	(.22)	(.25)	(.32)	(.08)	
	B	.12	.01	.19	.16	.13	-.03	.06
		(.09)	(.47)	(.02)	(.03)	(.07)	(.36)	(.25)

Parentheses indicate significance levels. Dashes are entered where correlations cannot be computed.

CHAPTER 5
DISCUSSION

My research has tested two main hypotheses. First, that introducing extrinsic rewards and later withdrawing them should reduce subsequent intrinsic motivation after the reward is withdrawn. Second, that individuals should be differentially sensitive to the introduction and later removal of reward. Extraverts and high impulsives should have shown the greatest sensitivity to reward and the greatest subsequent losses in intrinsic motivation. The first hypothesis received modest support, the second none. This final chapter examines the theoretical significance of my research findings.

In Chapter 2 I noted that the first hypothesis was supported by fewer paid subjects playing optional games and by paid subjects playing fewer optional games. In Chapter 3, I noted that statistical effects in the same direction were found in the Brooklyn College experiment although these differences were not significant. I also noted that the Brooklyn College subjects were initially more interested and more skilled at the game than the Hunter subjects and thus possibly less susceptible to reduced intrinsic motivation when offered extrinsic rewards. Therefore, while the differences in the means between paid and unpaid groups in the second experiment were not significant on behavioral measures of intrinsic motivation, the means were ordered in the appropriate direction.

In both studies, the final interest ratings of the game were not materially different between paid and unpaid groups. Small significant effects were found with the use of covariates; however, the same effects were not found in both studies. This was apparently due to the fact that while there were no significant differences between studies in the final interest ratings, there were significant differences between studies in the scores used as covariates (viz., initial game score and initial interest rating).

Why were the interest ratings less responsive to the manipulation than the behavior? Measurement error may account for some of the differences. Behavioral and rating variables may have different sources of measurement error reducing correlations between them. Regarding behavior, subjects who feel their performance is substandard may keep playing to improve it, even though they no longer enjoy the game. Regarding ratings, subjects who find the game uninteresting, perhaps in the payment condition, may think it impolite to admit it.

However, intrinsic motivation probably is not a unidimensional construct. On a behavioral level, changes may occur in intrinsic motivation before the subject is aware of them on a conscious or rating level. Also, rating a task's interest value is a self-conscious act while intrinsic motivation has often been characterized by a lack of self-consciousness. In addition, persistence or the amount of optional behavior is a process variable, recorded during the ongoing behavior. Ratings, however, which are either recorded after the process or require a disruption of the process, are not process variables.

Other researchers have noted a lack of consistency between behavioral and rating variables similar to the findings of this work. Deci (1971) reported significantly lower free-time performance means for a paid versus a control group, but a rating measure of task-liking showed no difference. Smith (1974) reported in Condry (1977) found significant behavioral differences but no significant differences in interest ratings. Harackiewicz (1979) found that three measures of task-liking, willingness to volunteer, and free-time performance all loaded on the same factor. However, she reported an average intercorrelation for the measures of only .51. Additionally, recall of tasks, either completed or not completed, did not load on this factor in her study. Many of the other studies, as noted by Condry (1977), used only a single dependent variable.

The data did not support the second major hypothesis of this study, that extraverts and/or high impulsives should have experienced the greatest losses in intrinsic motivation following a payment condition. Instead, I found an unexpected main effect for extraversion. Because themore extraverted subjects played longer, whether paid or unpaid, one might conclude that extraverts were more intrinsically motivated. It is possible, however, that these results reflect a stylistic difference. Brebner and Cooper (1974) have suggested that in free response situations introverts are geared to inspect while extraverts are geared to respond. Perhaps in this study, the same level of understanding or experience was achieved by introverts through cognitive analysis and by extraverts through behavior. In this regard, it is noteworthy that the differences between extraverts and introverts cannot be conclusively ascribed to impulsivity. This finding is important because one definition of impulsivity is the notion of behavior with relatively little forethought.

I have not presented in this report many characteristics of play behavior that I analyzed. I wanted to demonstrate a consistent pattern of behavior indicating that the overall style of response of extraverts differed from that of introverts. Among the variables analyzed were number of errors, speed of play, best score, and length of play before and after asymptotic performance. However, there were no clear differences between extraverts and introverts or between high and low scorers on the other personality scales.

What can be said for Gray's Theory in the light of the null findings of the present research? There are five possibilities.

First, the task may have been inappropriate for testing Gray's theory. The computer game which the subjects played was not a task where increased effort would be immediately manifested in clear increments in performance. Reward usually increases learning or performance in operant tasks by increasing effort and perhaps by focusing the subject's attention on the desired aspect of the task. Playing "Frogs'n'Puddles" was interesting enough to keep subjects attentive without reward, and increased effort was unlikely to produce immediate higher levels of performance. In fact subjects reported that when they tried to increase concentration on the task, they tended to focus on a problem solution and were unable to break set. This breaking of set, or shifting to different problem solving strategies, appeared necessary to produce higher scores. Therefore, Gray's statement that extraverts are "more sensitive to reward" might possibly be restated to say that extraverts exert greater effort than introverts for the same reward. Such a difference would be more likely to show up experimentally in tasks that more closely link effort and performance.

My second point about Gray's theory and this research is that the confirmation of the first hypothesis (or at least the reasoning underlying it) was a precondition of the second hypothesis: Extrinsic payment must reduce subsequent intrinsic motivation for it to do so differentially for extraverts and introverts (or high and low impulsives.) This confirmation could have taken several statistical forms, the simplest being a main effect for groups. A more complex but equally important finding would have been no main effect but a clear reduction in intrinsic motivation for extraverts only. Assuming that there are errors of measurement at all stages, it may be in any case that a fairly large reduction in intrinsic motivation is needed to find differences in this reduction across different levels of extraversion or impulsivity,

My third point is that sensitivity to reward and punishment may characterize extreme scorers on extraversion and impulsivity. The present research used a selection procedure that produced a full range of scores on each of the major personality scales. This range of scores approximated a normal distribution. An alternative strategy would have been to select extreme extraverts and/or impulsives and extreme introverts and/or low impulsives. I rejected a selection procedure that would produce extreme scores for two reasons. First, any finding produced from a study using extreme scores is less likely to replicate than one which uses the full range of scores because of a statistical effect known as regression to the mean. Second, the use of extreme scorers allows no statements about how subjects whose scores fall close to the mean might have behaved if they had been included in the sample. The selection of extreme groups creates a psychology of extreme groups where it is not known how less extreme scorers might have behaved. However, there is a trade-off in using the full range of scores. Those effects which increase proportionally with extremity of score are most likely found in extreme scorers. Therefore, the failure to find the expected effects may be due to too inclusive a selection procedure.

The fourth possibility concerns a variable not yet mentioned in this research: The time of day. Revelle et al. (1980) have suggested that level of arousal is linked to time of day and personality. Their research supports the notion that introverts become more aroused earlier in the day than extraverts and consequently achieve their optimal level of performance on various tests earlier in the day. These differences between extraverts and introverts were found to be largely due to the impulsivity component of the EPI. Subjects in the two studies I have reported were run as early as 9 a.m. and as late as 10 p.m., and it is unknown how this may have affected the findings. Subjects played when their schedules permitted. Had I run all the subjects in the morning or in the afternoon, my findings might have been more consistent.

The final possibility is that Gray's theory is untrue. Although the null findings presented in this report cannot prove Gray's theory is wrong, they can lead to speculation as to other causes that may have produced the positive findings for the theory. A careful examination of these research reports does not suggest any obvious answers.

More research is clearly needed to answer many of the questions raised in these two studies.

APPENDIX A

SCORING GUIDE

Number of frogs removed	Number of frogs remaining	Rating
31	1	GENIUS
30	2	MASTER
29	3	VERY GOOD
28	4	GOOD
27	5	FAIR
26	6	NEEDS IMPROVEMENT

Hunter College scoring guide used for both paid and unpaid groups.

APPENDIX B

		X	X	X		
		X	X	X		
X	X	X	X	X	X	X
X	X	X	O	X	X	X
X	X	X	X	X	X	X
		X	X	X		
		X	X	X		

MOVE WHICH FROG?

TO WHICH PUDDLE?

APPENDIX C

SCORING GUIDE

Number of frogs removed	Number of frogs remaining	Rating
31	1	GENIUS
30	2	MASTER
29	3	VERY GOOD
28 - 27	4 - 5	GOOD
26 - 25	6 - 7	FAIR
24	8	NEEDS IMPROVEMENT

Brooklyn College scoring guide used for the unpaid group.

APPENDIX D

SCORING GUIDE

Number of frogs removed	Number of frogs remaining	Rating	You Win	You Lose
31	1	GENIUS	$7.75	$.00
30	2	MASTER	7.50	.25
29	3	VERY GOOD	7.25	.50
28 - 27	4 - 5	GOOD	7.00 - 6.75	.75 - 1.50
26 - 25	6 - 7	FAIR	6.50 - 6.25	1.25 - 1.50
24	8	NEEDS IMPROVEMENT	6.00	1.75

Brooklyn College scoring guide used for both paid groups.

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