## ABSTRACT

## THE EFFECTS OF EXTERNAL REWARDS ON INTRINSIC MOTIVATION

### by Nathan Dumford

This paper reports on an experiment designed to test the effects of external rewards on intrinsic motivation. The study involved giving rewards to four participants for doing high interest tasks through four different conditions. Specific conditions included expected non-contingent, expected contingent, unexpected non-contingent, and unexpected contingent rewards. Motivation was measured by task persistence, task performance, and a free-period choice. Results were analyzed via visual inspection of performance data in graphical representation. Across all conditions and participants detrimental effects of rewards were not found. Limitations with the study and directions for future research are discussed.

## THE EFFECTS OF EXTERNAL REWARDS ON INTRINSIC MOTIVATION

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#### Literature Review

One explanation for the detrimental effects of rewards comes from a large body of research focused on a cognitive evaluation theory approach. Cognitive evaluation theory has been built upon early work done by DeCharms (1968), Heider (1958), and Festinger (1957) that suggested interfering effects external rewards might have on intrinsic motivation (Deci, 1971; Deci, 1975; Deci, Koestner, & Ryan, 1999; Cameron & Pierce, 2002; Eisenberger & Cameron, 1996). Cognitive evaluation theory (CET) first proposes that the detrimental effect can be accounted for by a change in the perceived locus of causality (Deci, 1975). Deci (1975) writes that intrinsic motivation can be affected by a change in perceived locus of causality from internal motivation to external motivation, which will cause a decrease in intrinsic motivation and will occur when someone receives external motivation for an already intrinsically motivated activity.

CET also asserts that intrinsic motivation is affected by changes in feelings of competence and self-determination (Eisenberger & Cameron, 1996). Competence and self-determination (i.e., autonomy) are hypothesized as two innate psychological needs that are fundamental to intrinsic motivation (Deci, Koestner, & Ryan, 1999). If a person's competence and self-determination needs are not satisfied then their intrinsic motivation will decrease, because that person perceives a loss in competence and personal freedom (Cameron & Pierce, 2002). Therefore, rewards are predicted to lead to a more external perceived locus of causality, or depress the need for competence and self-determination, and undermine intrinsic motivation (Deci, Koestner, & Ryan, 1999).

Another theory known as the overjustification effect has been used to explain the negative effects rewards can have on individuals (Cameron & Pierce, 2002; Cameron & Pierce, 1994; Deci, Koestner, & Ryan, 1999; Eisenberger & Cameron, 1996; Greene & Lepper, 1974; Tang & Hall, 1995). Simply stated, when a person engages in an activity initially without a reward (self-initiated), then that person will become less likely to perform the activity for no reward after being externally rewarded (Tang & Hall, 1995). Put another way, the individual's account for the behavior involves too many reasons (justifications) for performing the activity and ultimately intrinsic motivation is discounted (Cameron & Pierce, 2002).

The theoretical basis for overjustification effect comes out of both attribution and selfperception theories (Cameron & Pierce, 1994). Originally, the overjustification hypothesis was suggested by self-perception theory (Lepper, Greene, & Nisbett, 1973). Self-perception theory states that individuals infer their feelings and attitudes from an analysis of their behaviors and situations. When internal cues are weak, the individual becomes similar to an observer and must rely on external cues to infer their feelings (Bem, 1972). Thus, when individuals analyze that their behavior is caused by an external cue, they do not attribute the behavior to their feelings and attitudes (Cameron & Pierce, 2002).

Attribution theory involves the information people use to answer causal questions. According to discounting attribution principle or subtraction rule, people discount a potential cause of behavior to the extent that other potential causes also exist (Cameron & Pierce, 2002). An example will better help illustrate how these two theories combined account for the overjustification hypothesis; if Sally enjoys reading (self-initiated and intrinsic interest for reading) and her mother decides to give her a dollar for every chapter she reads in a book (causing internal cues of reason for behavior to become salient), Sally will analyze her behavior (which involves multiple justifications) and reduce (discounting principle) the cause of her reading from intrinsic interest to the external reward, resulting in a detrimental effect of intrinsic interest in the activity. Two theories that have repeatedly advocated for the use of rewards and reinforcements are the social learning theory and behavioral theory. Both theories are very different; however both have many similarities in the use of rewards and reinforcements.

In general, the social learning theory focuses on the cognitive mediators of behavior; whereas, behavioral theory emphasizes the response contingencies of behaviors (Cameron & Pierce, 1994, 2004). Social learning theory asserts that the rewards given have an informative aspect that influences the individual's thoughts and feelings (Cameron & Pierce, 2002). For instance, during a task an individual self evaluates and determines they have a low self-efficacy for doing the task, a reward is seen as elevating the self-efficacy, which produces essential parts of self-regulation and in turn heightens the intrinsic motivation. Much of the social learning theory and behavioral theory involves the how and when the reward is given, along with the consequences of the behavior. Yet, social learning theory views the beliefs about the self (self-efficacy, personal standards of performance, and self evaluation) as an essential part of human behavior and motivation.

When discussing rewards and motivation from a behavioral perspective it is first important to discuss the difference between a reward and reinforcement. Many researchers have called their reward procedures a reinforcement procedure (Cameron and Pierce, 1994, 2004). By definition, reinforcement increases the frequency of a behavior it follows; a reward does not (Cameron & Pierce, 1994, 2004). In behavior theory, actions are viewed as lawful and predictable, successful behaviors become frequent, unsuccessful behaviors decrease to extinction (Eisenberger & Cameron, 1996). When using reinforcement the behavior will increase. When using rewards the behavior does not necessarily have to increase; however, many behaviorists view rewards as basically helpful (Cameron, 2001).

Behavioral theorist's means of understanding the effects of rewards is through the threeterm contingency (Cameron & Pierce, 1994). The three-term contingency allows for the researcher to evaluate the discriminative stimulus, the response, and the reinforcement. Flora (1990) suggests results from much of the rewards literature can be accounted for by evaluating the reward contingency as the discriminative stimulus. For example in Deci's 1971 study, the subjects were told they would be receiving a reward prior to engaging in the designated task. The condition was presented prior to the behavior and consequence. Therefore, behavioral theory accounts for decreases in free-choice periods as dependent upon the contingency conditions set for the reward.

In 1971, Deci tested the CET hypothesis in a study conducted at the University of Rochester. In this initial study, Deci (1971) used a between groups design involving 24 undergraduate psychology students participating for course credit. The participants were equally divided into an experimental group and control group. They were asked to complete soma puzzles over 3 one-hour sessions. During each session the participants in the experimental group received one dollar for every puzzle they completed. They were paid prior to the third session. The control group did not receive money. In the middle of each session the experimenter would leave for eight minutes. The participants were informed to do what they wanted during the eight minutes (free-choice period). They could choose what ever they wanted during those eight minutes with the choice of the soma puzzle, three magazines, and an ashtray. The experimenter would watch the participant during the break through a one-way glass to record the amount of time the participant spent on the soma puzzle. The amount of time on task was one measure of intrinsic motivation; the second measure was a self-reported interest toward the soma puzzle. Deci (1971) reported that the reward group spent statistically significant less time on the task and the self-report measure resulted in no significant differences between the groups.

Lepper, Greene, and Nisbett first introduced overjustification effect research in a study conducted with primary school children in 1973 (Tang & Hall, 1995). Lepper and colleagues hypothesized that by using the discounting rule to predict the overjustification effect, they could study whether extrinsic rewards would turn a play activity into a work activity (Greene & Lepper, 1974). Lepper, Greene, and Nisbett used a between groups design that began by observing the children during a free choice play period and recording the amount of time each child spent on the target activity (drawing) to determine initial task interest. The children that spent the most time on the drawing activity were chosen for the study, because the elevated time on the target task indicated a higher interest for the activity. Those children were then randomly divided into three groups, expected reward group, unexpected reward group, and a control group that did not receive a reward. Children were brought into the experimental setting individually and asked to draw pictures for the experimenter. During the experimental setting subjects in the expected reward group were told prior to initiating the drawing task that if there pictures were done well they would receive a reward, indicating a high performance level was needed, and then the experimenter would show the good player award to the child. After the child completed the session, the experimenter would give the subject the award. In the unexpected reward group, the children were not told of the good player award and received the reward after completing the session with the experimenter. The control group subjects were asked to come into the experimental setting to draw pictures for the observer. Then they were allowed to go back to the classroom. Following the experimental sessions, Lepper and colleagues did a final observation of the free play period to record the amount of time the subjects engaged in the target activity.

Lepper and colleagues (1973) concluded that the expected reward group spent statistically significant less time on the target activity after the experimental session than the other groups. Moreover, the expected reward group spent significantly less time on the target activity in the post-reward free choice play session than the pre-reward free choice play session. The unexpected reward group and control group did not yield any significant differences.

These studies are seen by many as the cornerstone of the subsequent 30 years of research that has followed. Many confirmatory and exploratory research studies have culminated into several meta-analyses on the impact of external rewards on intrinsic motivation.

In 1988, Rummel and Feinberg conducted the first meta-analysis assessing the cognitive evaluation theory. The researchers used forty-five studies that involved participants who received rewards for doing tasks and were defined as controlling rewards by the researchers. The meta-analysis matched the reward groups with the non-reward groups or control groups of each study. Intrinsic motivation was measured by both free time on task and self-reports of task interest (Cameron & Pierce, 2002; Eisenberger & Cameron, 1996). Rummel and Feinberg concluded that extrinsic rewards did have detrimental effects or controlling factors on intrinsic motivation, adding support for CET.

Tang and Hall in 1995 published a meta-analysis evaluating specifically the overjustification effect. Tang and Hall reviewed 50 published studies including 256 effect sizes (Deci et al., 1999). This meta-analysis tested several hypotheses that support the overjustification effect, specifically that negative effects would occur if the reward was an expected tangible, the task was of high interest, and the reward conditions were for task contingent and performance contingent (Tang & Hall, 1995). They also hypothesized that negative effects would not be found for verbal rewards, low interest tasks, unexpected rewards,

and non-contingent rewards (Cameron & Pierce, 2002). The researchers included six different measures of intrinsic motivation for the meta-analysis (Deci et al., 1999). Those measures include free time on task, task enjoyment ratings, quantity of performance during the reward phase, quality of performance during the reward phase, ratings by others, and time waited to initiate the task (Deci et al., 1999; Tang & Hall, 1995).

The results yielded much of what was hypothesized originally. Tang and Hall (1995) concluded that expected tangible rewards decreased intrinsic motivation on high interest tasks when the rewards were given as task contingent and performance contingent. Task non-contingent rewards did not provide any affects on intrinsic motivation measures. Unlike what the overjustification hypothesis predicts, unexpected rewards led to an increase on a few of the intrinsic motivation measures, while verbal rewards led to decreases in the intrinsic motivation measures (Cameron & Pierce, 2002; Tang & Hall, 1995). Generally, however, Tang and Hall present the results as confirmatory to the overjustification effect.

Cameron and Pierce (1994) conducted a much larger meta-analysis specifically evaluating between-group designs used in assessing the detrimental effects of rewards. The researchers used ninety-six studies comparing rewarded and non-rewarded subjects. The moderating variables were identified as the reward type (tangible or verbal), expectancy of the reward (unexpected or expected), and contingency of the reward (performance contingent or engagement contingent). The effects were analyzed by free-time periods and self-report measures of task interest. Cameron and Pierce reported that verbal rewards did not have any negative effects on intrinsic motivation and had results indicating increases in self-report measures. Tangible unexpected rewards did not have any detrimental effects on both measures. Tangible expected rewards did not have any negative effects and had increases in self-report measures of task interest. Tangible expected non-contingent rewards did produce detrimental effects in the free-choice period measure, but the self-report measure did not have any decreases. Cameron and Pierce (1994) reported that overall the rewards did not negatively effect intrinsic motivation. In 1996 Eisenberger and Cameron added an additional analysis of the same studies that reported the same results as the 1994 meta-analysis.

In 1999, after several articles and meta-analysis had been conducted producing evidence contrary to the CET findings, Deci, Koestner, and Ryan presented what they termed a new hierarchical meta-analysis. Deci and colleagues used 128 studies that included experiments of rewards and intrinsic motivation. The meta-analysis focused on reward effects of high interest tasks; if conditions within a study were measured or defined as uninteresting tasks those studies were excluded (Cameron & Pierce, 2002). The effect of rewards was measured by self-reported interest and free choice time on task after the reward was removed. If a study did not report free time measures, task persistence was used as a measurement for free choice time on task.

Deci, Koestner, and Ryan (1999) reported results of verbal rewards as increasing motivation during both measures and tangible rewards as overall significant negative effects on motivation. They further divided tangible rewards into unexpected rewards and expected rewards. Unexpected rewards produced no reliable effects; however, expected rewards were reported as having several significant negative effects. Expected rewards were split into task-non-contingent, engagement-contingent, completion-contingent, and performance-contingent categories for evaluation. All, except task-non-contingent yielded significant negative effects on motivation. Engagement-contingent, according to Deci and colleagues, produced the highest levels of significant effects in both free choice and self-reported motivation for high interest

tasks. Deci, Koestner, and Ryan (1999) used the results from this meta-analysis to further illustrate and solidify the predictions of CET.

A number of reasons have been speculated as to the cause of the variability in the results for this research. Some assert that studies are conducted and categorized specifically to find or not to find negative effects, as seen in the prior theoretical reviews (Deci et al., 2001; Cameron and Pierce, 1994; Cameron, 2001; Cameron and Pierce, 2002). Some point to the many layers of reward expectancies and reward contingencies as potential causes of mixed results. Others identify the cause of conflicting results to the difficulty in the operationalization of intrinsic motivation (Calder & Straw, 1975; Wiersma, 1992).

In addressing the reward expectancies and contingencies it is first important to identify the types of rewards used. Throughout the literature, rewards used are either tangible or verbal (Ryan, Mims, & Koestner, 1983). The expectancies of these rewards are often split into either an expected reward or unexpected reward (Ryan et al., 1983). For instance, a part of a condition for a study could be a tangible expected or unexpected reward, or a verbal expected or unexpected reward.

Reward contingencies for this field of research can most effectively be understood by addressing each theory. The cognitive evaluation theory and overjustification theory adhere to similar contingencies for the rewards given. Ryan and colleagues, in 1983, published an article identifying task non-contingent (reward for participation), task-contingent (reward for doing or completing the target activity), and performance contingent (reward for performance of activity at a certain level) as adhering to the CET paradigm. Deci and colleagues re-categorized the contingencies in 1999 as task non-contingent, completion contingent (reward for completing the task), engagement contingent (reward for engaging in the task at a certain level), and performance contingent. CET and overjustification theorists view completion contingent, engagement contingent, and performance contingent as controlling contingencies (Cameron & Pierce, 2002).

From the behavioral perspective, contingencies are considered immediate, intermittent, or delayed (Cameron & Pierce, 2002). Each contingency is predicted to have different behavioral outcomes, depending on the expectancy and type of reward. Essentially, several different combinations are available and effectiveness can only be assessed individually (Cameron & Pierce, 1994, 2002).

Measurements of intrinsic motivation are seen as dependent upon the theoretical orientations of the researchers (Wiersma, 1992). For example, most CET and overjustification researchers use free-choice measures along with self-report measures. The typical types of measurements for intrinsic motivation in the literature are time on task during a free-choice period (Lepper, Greene, & Nisbett, 1973), performance of task during free-choice period (Deci, 1971, 1972), questionnaire of task interest or self report (Deci, 1971, 1972; Lepper, Greene, & Nisbett, 1973), and finally participants' willingness to volunteer for future studies (Cameron and Pierce, 2002). Some researchers that have not found detrimental effects have used task-persistence, time on task during the target activity, and other performance measures (Weaver & Watson, 2004; Wiersma, 1992).

Over the years several studies have consistently not found detrimental effects of rewards, specifically in studies using single subject designs. Feingold and Mahoney (1975) used a single subject design with a dot to dot or etch a sketch task and found no differences in motivation and no negative effects of reinforcement. Mawhinney, Dickson, and Taylor (1989) measured the effects of money rewards for playing a video game. The researchers reported no detrimental

effects for the contingent reward group and limited effects for the non-contingent reward group. Vasta, Andrews, McLaughlin, Stirpe, and Comfort (1978) found no evidence of detrimental effects of intrinsic motivation using reinforcement in an analog classroom setting. Furthermore, Vasta and Stirpe (1979) used a single subject design to measure the effects of rewards on children's math tasks. Again, the researchers reported no effects, with some increases on intrinsic interest. In 1994 Cameron and Pierce conducted a meta-analysis of all single subject design studies measuring effects of intrinsic motivation. This analysis used five studies that had been published prior to the meta-analysis and resulted in no undermining effects.

A majority of the studies, especially the meta-analysis, have identified several conditions that do seem to deplete specific motivational measurements. First, the subject is to be engaged in a high interest task (Cameron & Pierce, 1994, 2002; Deci, 1999). In the early Deci experiments, the subjects worked on soma puzzles, at that time a very popular game. Lepper and colleagues had their subjects engage in drawing tasks, a fun task for five-year-old children. Second, the reward must be tangible (Cameron & Pierce, 1994, 2002; Deci, 1971; Greene & Lepper, 1974). Deci and other researchers have frequently found verbal rewards to increase or sustain task interest. Most tangible rewards have been money, awards, and sweets. Third, participants must expect the reward (Cameron & Pierce, 1994, 2002). Much of the literature has found very conflicting results for unexpected rewards. Lepper and colleagues in 1973 reported no detrimental effects, whereas in their 1974 study they reported slight decreases. Fourth, the reward is given non-contingently (Cameron & Pierce, 2002). Most research, that gives participants rewards for attaining a specific level of performance, has not resulted in negative effects. Finally, intrinsic motivation must be measured by a free-choice measure and a selfreport measure following the withdrawal of the reward (Cameron & Pierce, 2002; Wiersma, 1992). Cameron and Pierce (2002) conclude that motivation measured in the reward phase does not result in negative effects. The reasons for the effect, the sustainability of the effect, the measurements of intrinsic motivation, and the practicality of the conditions in the real world are much of the conflict of this literature, but most researchers agree under these conditions using these measurements the results will indicate a detrimental effect.

The conditions and measurements identified as resulting in the detrimental effects have been studied by between-groups design for a majority of the research in this field. The CET and overjustification researchers have typically utilized the between-groups design. From a behavioral approach, idiosyncratic differences of effects of rewards are only available through single subject designs (Cameron & Pierce, 1994, 2002). Only a handful of studies concerning rewards effects on intrinsic motivation have used single subject designs and most involve dull or boring tasks that measure intrinsic motivation by assessing task persistence and time on task during the reward phase. Few have incorporated the conditions, identified above, that are typically used in the between-groups design. Feingold and Mahoney (1975) used a high interest task (dot-to-dot or etch-a-sketch) along with tangible rewards (prizes) and measured intrinsic motivation by a free-choice period in a single subject design. However, the contingency for the reward was performance based. The subjects were awarded by the amount of dot-to-dot connections. Mawhinney and colleagues (1989) also included a high interest task (video games) with tangible rewards (money) and measurements from a free choice period (trigger pulls between video games) in a single subject design. Still, the contingency was performance based. The subjects received the reward for the amount of trigger pulls between each video game.

To date, no other study has incorporated the conditions necessary to produce a detrimental effect of rewards in a repeated measures design. This study will use contingent and

non-contingent tangible rewards in expected and unexpected conditions while the subject is engaging in idiosyncratic high interest tasks. Single subject designs have not resulted in producing negative effects; however, combining these conditions used in between-groups design allows for a greater probability of manufacturing the negative effect so often found. The purpose of this study is to assess the impact of rewards on intrinsic motivation when all contingencies and schedules are designed to produce a negative effect.

- Hypothesis 1: Rewards given to subjects in the unexpected contingent and noncontingent and the expected contingent conditions will lead to an increase in intrinsic motivation measures.
- Hypothesis 2: Rewards given to subjects in the expected non-contingent condition will lead to decreases in the free-choice activity, while task persistence and performance stay the same over time.

#### Method

#### *Participants*

Two university-aged students and two high school aged students served as participants in this study. The university-aged subjects were at a medium sized University in southwest Ohio. The two high school aged participants were recruited from a medium sized high school in southwest Ohio.

Stipulations for inclusion included age of the subject and voluntary consent for participation. The age sample for the study is consistent with original experiments conducted by Deci (1971, 1972). Deci (1971) specified that external rewards for children in past research typically involved verbal reinforcement and social approval, which are not considered external rewards that will control behavior and initiate a cognitive reevaluation. Tangible rewards used with adolescent age subjects are seen to have more behavior control and cognitive reevaluation. Gender preferences are not considered, which are consistent with Cameron and Pierce (1994) meta-analysis that concluded no significant results between genders. *Setting* 

The research project was conducted in a isolated room reserved for each session. The room included standard tables and chairs, along with a video recorder in some sessions. The video recorder was rented through a university library at a medium sized university in southeast, Ohio.

#### Independent Variable

The independent variables for this study are how the reward is given and why the reward is given. Aligning with past research the reward was either offered before (expected) the subjects engaged in the target task or the reward was not offered before (unexpected) engaging in the target task. In conjunction, the subjects received the reward contingently or non-contingently.

The first condition is the non-contingent reward offered before the target activity. Participants in this condition are informed of the non-contingent nature of the reward. The second condition is that a non-contingent reward is unexpected to the subjects before the target activity. Participants are instructed to engage in the activity without any knowledge of a reward or schedule of the reward given, receiving the reward regardless of activity. The third condition is a contingent reward offered before the target activity. Subjects were told if they adhere to a specific performance of an activity they will receive the reward. The fourth condition is a contingent reward that is unexpected to the participants before engaging in the desired activity. Participants in this condition are unaware of the specification to receive the reward. *Dependent Variable* 

Task persistence, task performance, and time on task during free-choice selections are the three dependent variables for this study. Task persistence is the on-task percentage for a target activity during the free-choice period. The Behavior Observation System (BOS) was used to collect persistence data, specifically coding for on and off task behaviors in ten second intervals.

Task performance is the percentage completed correctly in the allotted time for a target activity. This percentage was calculated by adhering to each activity's scoring rules for incorrect and correct answers.

The last dependent variable is the activity each participant engages in during the free choice period. During a free-choice period at the end of each condition the participants are not required to engage in a specific activity, therefore participants are free to do alternate tasks other than the target activity.

#### Materials

The two university aged participants gave signed adult consent (See Appendix A). Parent consent forms were signed for all participants under the age of 18 years old. A parent letter was given informing parents of the nature, purpose, confidentiality, and rights (see Appendix B). Finally, an assent form was read and signed by all participants (see Appendix C).

The Behavior Observation System (BOS) is used by the researchers to assess time on task for the persistence measure during the free-choice period (see Appendix C). The BOS is a direct observation procedure to measure on-task engagement in 10-second intervals. The on-task engagement is defined as the absence of motor, verbal or off-task behaviors during the 10-s interval. The BOS score is calculated as the percentage of intervals containing on-task behaviors.

The tasks that were available for participants to engage in are sudoku, rubiks cube, jigsaw puzzles, crossword puzzles, word find puzzles, wordoku, mystery crossword puzzles, and coded crossword puzzles. Sudoku puzzles are a type of logic puzzle where the objective is to place numerals 1 through 9 in a 9 x 9 grid so that each row, each column, and each 3 x 3 grid contains each number one time. Sudoku puzzles used in this study are published by Puzzle Express and paid for and downloaded from <u>www.puzzelexpress.com</u>.

Rubiks cubes are puzzles that require physical manipulation and logic to align six sides of a block with nine squares of the same color. This multi-dimensional puzzle is intended for ages eight through adult. Milton Bradley produces Rubik's cubes.

Jigsaw puzzles are puzzle that require physical manipulation to correctly connect pieces together to form a picture or design. The puzzled used for the study is a Thomas Kinkade 300 piece oversized puzzle. Ceaco and Thomas Kinkade produce this puzzle.

Crossword puzzles are word puzzles that give clues to the correct words needed to solve the puzzle. The crossword puzzles used in this study are come from a book titled Easy Crossword Express, published by Penny Press in 2007.

Word find puzzles involve searching for specific words with in a block of letters. The word find puzzles used in the study come from a book titled Family Favorites Word Seek Puzzles, published by Penny Press in 2007.

Mystery Crosswords are 9 x 9 crossword puzzles that also have a hidden word that runs from the top left to the bottom right of the puzzle. The mystery word is revealed when the puzzle is solved correctly. The Puzzles used in this study are published by Puzzle Express and paid for and downloaded from www.puzzelexpress.com.

Wordoku is constructed similarly to sudoku puzzles, but rather than solving the puzzle with numbers the puzzle uses 9 letter words. If the puzzle is correctly completed a word will be spelled out across the center. The Puzzles used in this study are published by Puzzle Express and paid for and downloaded from <u>www.puzzelexpress.com</u>.

Coded crosswords are a variation of traditional crossword puzzles. Instead of clues, each letter is represented by a number, 1 through 26. The objective is to substitute letters for numbers to complete the crossword. The Puzzles used in this study are published by Puzzle Express and paid for and downloaded from <u>www.puzzelexpress.com</u>.

All scoring guidelines for each task are displayed in the scoring rules grid. The scoring rules grid displays the formulas for calculating percentage correct for tasks. Moreover, the grid also highlights the necessary correct number of items for the coupon delivery (see Appendix E).

The coupons delivered were exchanged for certain tangible rewards. The first reward that could have been attained is a journal. The journals available were produced by Better Office Products. Another reward available was a package of pens. The pens available were retractable medium width ballpoint pens produced by Pilot. The third reward available was three ring binders. The binder's available, range in size from 1" to 2" in width. All binders are produced by Cardinal Brands, Inc. A fourth reward available to participants was packages of pencils. The mechanical pencils came in a package of five and are produced by MMIV BiC. The last rewards available were all gift certificates to Starbucks, Subway, the Mall, Olive Garden, and Barnes and Nobles Bookstore. All gift certificates for each establishment ranged in price from five dollars, ten dollars, and twenty dollars.

Researchers adhered to a table of randomized conditions to avoid sequencing effects and allow for participants to receive the conditions in the same order (see Appendix F). A script and checklist was used for all conditions (see Appendix G.1-G.5). The script and checklist for the start of the experiment contained all information for task choice, coupon exchange, and guidelines for participation. The condition checklists and scripts provided the proper wording for each condition and documentation for coupon delivery. *Design and Analysis* 

A within-subject alternating treatment design was used, in which the participants were instructed to complete high interest tasks for tangible rewards. Participants were informed of the reward in both contingent and non-contingent conditions. Additionally, participants were unaware of the reward in both contingent and non-contingent conditions. All conditions encompassed a free-choice period.

Intrinsic motivation was measured by task performance and task persistence in contingency conditions, and the free-choice period. Task performance was measured by the percentage correctly completed on the target task by the participants. Task persistence was measured by the percentage of whole intervals spent on-task during each condition. The free-choice period was measured by a percentage of times the participants chose the target task during the free-choice period after each contingency condition. Moreover, persistence and performance measurements were collected when the participant chose the target task during the free-choice period. Motivation measures were collected during all four conditions.

All four conditions were randomly sequenced during the sessions for each participant. Tasks and rewards were chosen by the participants; therefore, each participant's tasks and rewards were specific to their preferences. For all conditions and procedures the researchers followed script and checklist guidelines to insure standardization. Treatment integrity was maintained and percentages of adherence to fidelity checklists were calculated.

Visual inspection was used to analyze the data collected through out the study. Visual inspection allows for assessing treatment effects of single participant data. Data points on graphs include percentages of correctly completed tasks (task performance) during the contingency conditions and percentages of task performance of the target activities during the free-choice period. This data represents the changes of motivation measures across time in each condition. *Procedures* 

Participants were selected based on criteria for inclusion in the study. Participants selected were informed of the research schedule and times for participation. Informed consent, parent consent, and participant assent for the experiment and videotape was attained from the subjects prior to the start of the first session (see Appendix A, B, C).

Prior to the start of the study a research assistant was trained on the procedures of the study using the scripts and fidelity checklists for each condition. Training lasted 30 minutes two days a week for one week prior to the start of the first participant.

For three participants the experiment consisted of twelve 30 minute sessions. For one participant the experiment consisted of seven 30 minute sessions. For every session with the participants the order of conditions was randomized to prevent sequencing effects. The experimenter adhered to a table of randomized conditions prior to each session (see Appendix F). During the 30-minute sessions each condition lasted six minutes.

During the six-minute intervals participants engaged in a specific task receiving a specific reward, depending on the condition, for three minutes, while the experimenter collected task performance data. The remaining three minutes for each condition was a free-choice period where the subject's engaged in any task, while the researcher collects task persistence and performance data.

The study was conducted in one-on-one sessions. The researcher activated the video recorder prior to the start of session for inter-observer agreement during task persistence data collection. Upon starting the recorder the experimenter indicated the session number and participant code, to inform second observers of the randomized conditions and subject.

At the start of the study the subject's were required to select a task to engage for the length of the whole experiment (see Appendix G.1). Subjects collected coupons throughout the sessions to exchange for various rewards at the end of each session or participants were allowed to save coupons to exchange for larger rewards (see Appendix E). The amount of coupons needed varied for each reward. The researcher indicated which task was chosen on the fidelity checklist. The task chosen by the participant is the same task used throughout the experiment. This ensured the same measurements for all conditions for the entire experiment.

The first condition required that the participants were aware of the non-contingent reward. During this condition the experimenter read the script to the participants informing them that the reward (coupon) is given every minute, regardless of task completion or engagement (see Appendix G.2). The experimenter indicated to the subject to begin and used a stopwatch to consistently administer the reward every minute. After the three minutes had elapsed the researcher read the free-choice period script and started the timer for three minutes. The experimenter documented the tasks chosen by the participant and only collected task persistence and task performance measures when the participants were engaging in the target activity.

After the free-choice period the experimenter immediately began the next condition (as

all conditions are randomized during the study the order of conditions is not limited to this current order). In this condition participants were not informed of the non-contingent reward. The researcher read the script where subjects were simply asked to begin the task, without any other instructions (see Appendix G.3). A timer was used to consistently give the reward in one-minute intervals to the subject. The experimenter stopped the timer after three minutes and began the script and timer for the free choice period.

During the third condition the subjects were informed of the contingent reward. The experimenter read the condition script that includes the performance requirements to attain the reward (see Appendix G.4). While the subjects are engaging in the activity during the condition the experimenter gave the reward immediately upon subjects completing the necessary requirements. After three minutes the free-choice script was read and the timer was started.

The fourth condition is similar in that the reward is given on a performance contingency, except the participants were not aware of the task completion requirements prior to engaging in the task. The researcher read the condition script that asks participants to simply begin the task (see Appendix G.5). Once the experimenter instructed participants to begin, the timer was started. The researcher gave the reward immediately upon participants achieving the required performance criteria. The free-choice period script is administered and the timer was started for the last three minutes.

At the end of the last condition the experimenter stopped the video recorder and returned all materials to the specific participant's folders. Prior to each participant leaving the experimental setting the researcher confirmed the next session and answered any immediate questions about the study.

#### Results

The present study examined the relationship between external rewards and intrinsic motivation utilizing an alternating treatment design. Specifically, this study sought to determine if intrinsic motivation increased or decreased in any of the experimental conditions: a) the unexpected non-contingent (UNC) reward condition, b) the unexpected contingent (UC) reward condition, c) the expected contingent (EC) reward condition, and d) the expected non-contingent reward condition (ENC). Based on previous research, it was hypothesized that intrinsic motivation measures would be positively impacted in the unexpected non-contingent, expected contingent, and unexpected contingent conditions; additionally, in the expected non-contingent condition the free-choice measure would be negatively impacted, while no changes would be seen in the persistence (on-task percentage) and performance measures (percentage correct of target task).





Figure 1. University Participant 1 task performance shown as percentage correct of the target task chosen (Word Find) across the unexpected non-contingent (UNC), expected non-contingent (ENC), expected contingent (EC), and unexpected contingent (UC) reward conditions.

Task performance for university participant 1 is shown in Figure 1. Across all experimental conditions, the percentage correct on the target task showed either a slight increase or no change across the 7 sessions. Additionally, no divergence was noted between the four experimental conditions. Specifically, percentages correct for the unexpected non-contingent reward condition yielded a slight upward trend. The data in Table 1 show the participant initially received a score of 27.7 % correct in session 1 and ended with 36.1% correct in session 7. In the expected non-contingent reward condition percentages correct maintained across the 7 sessions. The initial percentage correct was 28.6% and ended with 18.4%. Overall, measurements were varied, with percentages correct ranging from 37.1% to 16%.

Task performance data for the expected contingent reward condition resulted in an upward trend, beginning with 14% correct in session 1 and ending with 28.5% correct in session 7. Performance measurements for the unexpected contingent reward condition showed an upward trend. The only decrease in percentage correct after the first session was in session 2 resulting in a score of 2.4% correct.

Task persistence percentages across all conditions were 100%. During each condition the participant was engaged in the task 100% of the interval observed.

Task persistence and free-choice measurements resulted in 0% across all conditions. Regardless of experimental condition the participant did not choose the target task in any of the 7 sessions during the free choice period. Subsequently, task persistence measurements resulted in 0% due to the participant choosing alternative tasks during the free-choice period. Alternative tasks chosen by the participant during the free-choice period varied between two alternatives; a) doing nothing and sitting quietly for the three minute free-choice period, or b) reading the words on the target task, looking at the word find available during the free-choice period, but not completing the task with a pencil.

# Table 1

	_Experimental Conditions_					
	UNC	ENC	EC	UC		
Session 1	27.7%	28.6%	14%	17%		
Session 2	17.9%	22.2%	27.5%	2.4%		
Session 3	31.8%	37.1%	41%	36.3%		
Session 4	26.3%	16.2%	28.9%	22.8%		
Session 5	30.7%	27.1%	17.1%	23.1%		
Session 6	13.1%	33.3%	38.8%	20%		
Session 7	36.1%	18.4%	28.5%	26.4%		

# University Participant 1 Performance Percentages across Conditions





*Figure 2.* University participant 2 task performance shown as percentage correct of the target task chosen (Word Find) across the unexpected non-contingent (UNC), expected non-contingent (ENC), expected contingent (EC), and unexpected contingent (UC) reward conditions.

Task performance for university participant 2 is shown in Figure 2. Across all conditions, the percentage correct showed either a slight upward trend or no change with no divergence noted between the conditions. Task performance percentages for each session and condition can be seen in Table 2. In the unexpected non-contingent reward condition, there is an increasing trend, beginning with 16% and ending with 22.2% in session 12. There is an upward trend in percentage correct between sessions 1 through 8 and a decrease in percentage correct between sessions 8 and 10. Percentage correct in sessions 11 and 12 began to level out within the 20% correct range. In the expected non-contingent reward condition, measures of percentage correct were shown as having an upward trend, starting with 17.6% correct in session 1 to 32.3% correct in session 12. A large increase is seen in session 7 (43.2%); however, sessions 8 through 12 resumed gradual increases (22.2% to 32.2%).

In the expected contingent reward condition, measures of task performance showed an upward trend, beginning with 17.6% in session 1 and ending with 19% in session 12. An increase in percentage correct was seen between session 1 at 17.6% and session 6 at 38.4%. Performance measures in sessions 7 at 26.6% and 8 at 44.4% showed shifts in performance which began to maintain between sessions 9 (18%) and 12 (19%). Task performance measures in the unexpected contingent reward condition showed a slight downward trend, starting with 34.2% in session 1 and ending with 25.8% in session 12. Although the performance measurements for this condition appear to be at a slight decrease, there were no divergent trends between the other three conditions. Percentage correct measurements between sessions 1 through 8 showed a decrease in performance from 34.2% to 7.5%. In session 9, the percentage correct increased to 37.5% and remained between 35% and 25% through session 12.

# Table 2

	_Experimental Conditions_					
	UNC	ENC	EC	UC		
Session 1	16%	17.6%	10%	34.2%		
Session 2	18.9%	18.9%	10.5%	18.9%		
Session 3	26%	29%	20.5%	23.5%		
Session 4	33%	28.5%	27.5%	11%		
Session 5	31.5%	18.4%	27.5%	23.6%		
Session 6	26.3%	25%	38.4%	20%		
Session 7	28.5%	43.2%	26.3%	14.2%		
Session 8	40%	22.2%	44.4%	7.5%		
Session 9	17.9%	26.3%	18.7%	37.5%		
Session 10	30.5%	19.4%	17.1%	25.7%		
Session 11	20.5%	30.7%	23.8%	35.1%		
Session 12	25.8%	32.3%	25.8%	25.8%		

University Participant 2 Performance Percentages across Conditions



Figure 3. Task performance of free-choice period across the unexpected non-contingent (UNC), expected non-contingent (ENC), expected contingent (EC), and unexpected contingent (UC) reward conditions.

Task performance during the free-choice period for university participant 2 is shown in Figure 3. For all conditions and all sessions, the participant chose the target task (word find) during the 3-minute free choice period resulting in 100% choice of target task. Additionally, task persistence measures for each free-choice period were 100%. The participant was on-task for the target task during 100% of the intervals observed of the free-choice period.

Task performance during the free-choice period showed increases in percentage correct across all conditions. In the free-choice period after the unexpected non-contingent reward condition, percentage correct of target task showed an increase in production across the 12 sessions, starting with 8.3% and ending with 25% in session 12. In the free-choice period after the expected non-contingent reward condition, performance measures showed an increase beginning with 10.2% in session 1 and ending with 31.1% in session 12. The free-choice period after the expected contingent reward condition resulted in increases from 7.6% in session 1 to 22.2% in session 12. Performance measures in the free-choice period after the unexpected contingent reward condition showed a slight increase across the 12 sessions, beginning with 26.3% and ending with 27.7%. There were no divergent trends in any of the free-choice performance measurements across the 12 sessions.



Figure 4. Task performance shown as percentage correct of the target task chosen (Crossword Puzzle) across the unexpected non-contingent (UNC), expected non-contingent (ECA), expected contingent (EC), and unexpected contingent (UC) reward conditions.

Task performance measurements for high school participant 1 can be seen in Figure 4. Performance percentages for each session and condition can be seen in Table 3. Overall, performance decreased in three of the conditions over the 12 sessions. However, it is important to note that the three conditions - unexpected non-contingent reward, unexpected contingent reward, and expected contingent reward - that showed decreases overall produced high initial performance scores in session 1 that proved to be inconsistent with the participant's performance between sessions 2 and 12 for all three conditions.

For the unexpected non-contingent rewards condition, the participant scored 34.2% correct in session 1, whereas performance measurements for session 2 through 12 maintained between 10% and 20% correct. Moreover, the same pattern is evident in the expected contingent reward condition, beginning with a performance score of 33% correct. Then, for sessions 2 through 12, percentage correct maintained between 10% and 20%. Task performance for the unexpected contingent reward condition began at 38.4% and maintained between 5% and 20% correct from sessions 2 through 12. Task performance measures for the expected non-contingent reward condition remained consistent, between 10% and 20%, across all 12 sessions.

Largely, all conditions performance measures were stable across sessions 2 through 12 remaining in the 10% to 20% correct region. No divergent trends were evident and no changes in performance scores were evident, except for the initial data from session 1 for the unexpected non-contingent reward, unexpected contingent reward, and expected contingent reward conditions.

# Table 3

	_Experimental Conditions_					
	UNC	ENC	EC	UC		
Session 1	34.2%	13.1%	33%	38.4%		
Session 2	20.2%	22.9%	17.3%	18%		
Session 3	11.3%	15.7%	23.1%	9.7%		
Session 4	15.6%	15.3%	19.3%	15.8%		
Session 5	13.8%	17.6%	14%	4.4%		
Session 6	17%	9.4%	15.2%	5.2%		
Session 7	11.9%	14.4%	10.2%	7.3%		
Session 8	18%	11.4%	17.6%	20.7%		
Session 9	26.2%	21.4%	19.5%	11.5%		
Session 10	12.9%	25.1%	17.7%	11.8%		
Session 11	16.2%	21.8%	18.3%	11.1%		
Session 12	21.8%	20.4%	19%	14%		

High School Participant 1 Performance Percentages across Conditions



Figure 5. Task performance of free-choice period across the unexpected non-contingent (UNC), expected non-contingent (ENC), expected contingent (EC), and unexpected contingent (UC) reward conditions.

Task performance during the free-choice period for high school participant 1 is shown in Figure 5. Across all conditions and sessions, this participant chose the target task 56% of the available free-choice periods. Across all conditions and sessions, the alternative task (word find puzzle) was chosen 44% of the available free-choice periods.

Task persistence data for the target task during the free-choice period was 100% of the intervals observed.

In the free-choice period following the unexpected non-contingent reward condition, the participant chose the target task 42% of the 12 free-choice periods. Specific performance measures were erratic, ranging in percentage correct from 6% to 21%. In the last session, the participant chose the target task as an upward trend was beginning. In the following six sessions, the participant chose the alternative task.

The participant chose the target task 67% of the 12 sessions in the free-choice period following the expected non-contingent reward condition. The participant chose an alternative task in the last 4 sessions of the study. Performance measures during the free-choice period ranged between 30% correct and 35% correct in the first two sessions. Performance measurements stayed between 5% correct and 10% correct between the third and sixth sessions. During the last two sessions in which the participant chose the target task, percentage correct was 20% and 21%.

In the free-choice period after the expected contingent reward condition, the participant chose the target task 50% of the 12 sessions. Performance measurements were inconsistent across the 6 sessions that the participant chose the target task. Additionally, the participant did not present any patterns for choosing the target task. Specifically, the participant chose the target task in sessions 2, 3, 4, 5, 10, and 11. Performance measures in those sessions ranged between 2.9% correct and 26% correct.

In the free-choice period after the unexpected contingent reward condition the participant chose the target task 67% of the 12 sessions. Performance measures of the sessions that the

participant chose the target task were largely consistent ranging between 5% and 15%. There were not trends upward or downward.

*High School Participant 2* 



Figure 6. Task performance shown as percentage correct of the target task chosen (Word Find) across the unexpected non-contingent (UNC), expected non-contingent (ENC), expected contingent (EC), and unexpected contingent (UC) reward conditions.

Task performance measurements for high school participant 2 are shown in Figure 6. Performance percentages for each session and condition can be seen in Table 4. Across all conditions and sessions, the percentage correct on the word find puzzle did not show any divergent trends. Slight increasing trends were seen in both the expected non-contingent reward condition and expected contingent reward condition. In the unexpected non-contingent reward condition and the unexpected contingent reward condition performance measures were consistent across the 12 sessions.

Performance measures in the unexpected non-contingent reward condition were consistently between 5% correct and 25% correct across the 12 sessions. Performance measures in the expected non-contingent reward condition showed a gradual increase starting with 9% correct and ending with 18.2% correct. Only one measurement was below the initial percentage correct and that was in session nine with 8.5% correct.

Percentage correct in the expected contingent reward condition showed a slight increase from sessions 2 through 12. The percentage correct in session 1 was 9.7% and decreased to 3.2% in session 2. However, session 3 had a percentage correct of 9.6% and gradually increased through session 12 ending at 20% correct. Performance measures in the unexpected contingent reward condition maintained between 5% and 25% correct alternating across sessions until session 10. In session 10, the performance measure increased to 30% and began to decrease in the last two sessions to 12.5%.

# Table 4

	_Experimental Conditions_					
	UNC	ENC	EC	UC		
Session 1	18.1%	9%	9.7%	21.2%		
Session 2	16.1%	13.7%	3.2%	13.3%		
Session 3	25%	10%	9%	9%		
Session 4	3.5%	9.6%	13.7%	13.7%		
Session 5	13.3%	14.2%	7.1%	7.1%		
Session 6	22.5%	10.3%	23.3%	23.3%		
Session 7	24.1%	12%	22.2%	22.2%		
Session 8	3.2%	16.7%	20%	20%		
Session 9	10%	8.5%	8.3%	8.3%		
Session 10	7.4%	17.8%	33.3%	33.3%		
Session 11	6.6%	18.5%	22.7%	22.7%		
Session 12	12.1%	18.2%	20%	12.5%		

# High School Participant 2 Performance Percentages across Conditions



Figure 7. Task performance of free-choice period across the unexpected non-contingent (UNC), expected non-contingent (ENC), expected contingent (EC), and unexpected contingent (UC) reward conditions.

Task performance of the free-choice period for high school participant 2 is shown in Figure 7. For all free-choice periods after all conditions, the participant chose the target task 100% of the 12 sessions. Subsequently, task persistence data across all free-choice periods resulted in 100% of the intervals observed.

Task performance measures in the free-choice period after the expected non-contingent reward, expected contingent reward, and unexpected contingent reward conditions all showed a slight upward trend. Percentages correct in the free-choice period after the unexpected non-contingent reward condition maintained across all 12 sessions.

The free-choice period performance after the unexpected non-contingent reward condition remained between 5% and the 25% correct range. Performance scores between sessions 6 and 11 showed a downward trend; however, in session 12 percentage correct returned slightly above the initial measurement in session 1. The free-choice period performance after the expected non-contingent reward condition began with a score of 9% correct and ended with a score of 18.2% correct. The free-choice period performance after the expected contingent reward condition started with 12.9% and ended with 13.3% correct. The free-choice period performance after the unexpected contingent reward condition started with 9.6% and ended with 12.1% correct. Variability within the data for the three free-choice period performance measures that showed increase was minimal and largely maintained consistent patterns across the 12 sessions. All conditions were implemented with 100% integrity by researchers conducting the study.

#### Discussion

Critics of the use of rewards contend that not only will negative effects be detected across most types of reward conditions, but also across most tasks participants are required to do. In this study, we used several conditions and specific measurements identified through past meta-analyses that are ideal situations to produce negative effects on intrinsic motivation: a) the task must be of high interest, b) the reward is tangible, c) participants expect the reward, d) the

reward contingency is non-contingent, and e) intrinsic motivation is measured by a free-choice period.

Performance measure results for the unexpected non-contingent reward condition for all four participants showed half of the participants having a slight increase in performance and half of the participant's performance measures resulting in no change across sessions. Performance measures in the unexpected contingent reward condition provided evidence of being the weakest condition to increase performance, with only one participant's data showing a slight increase and three participant's performance measures resulting in no change across sessions. Performance measures in the expected contingent and expected non-contingent reward condition resulted in three participant's data having an upward trend and one participant's data resulting in no change across sessions. The impact of the rewards given in different contingencies did not yield results consistent with adverse effects on any of the performance data across all participants.

Across all sessions and participants, three of the participants chose the target task more than 50% of the sessions available, whereas one participant did not choose the target task during the free choice periods. Specifically, two of the participants chose the target task in every free-choice period resulting in 100% choice of target task. One participant did not choose the target task in any free-choice periods, resulting in 0% choice of the target task. One participant intermittently chose the target task during the free-choice periods, resulting in 56% choice of the target task across sessions. Performance measures in the free-choice period across all conditions resulted in upward trends for 2 participants and trends of maintaining across conditions and sessions for 1 participant.

Consistent with the performance data outcomes, the free-choice period data outcomes for three of the participants did not provide evidence of rewards undermining intrinsic motivation for the high interest task. Negative outcomes were not seen in the free-choice period due to the participants being reinforced by the reward for their performance of the target task, resulting in generalization during the free-choice periods.

Free-choice period results for the participant that did not choose the target task in any of the sessions indicated that target task was not more interesting then the other activities or that the reward did not reinforce engagement of the target activity. The activities the participant chose were either doing nothing or doing the target task without writing down any of the answers for data collection purposes. The participant did not choose any of the alternative tasks available.

Task persistence measures during the free-choice period were also not adversely affected by the contingency conditions. Across all participants and conditions, when the target task was chosen the participants stayed on-task 100% of the intervals observed.

There are no definitive statements of which condition produced the best outcomes due to a lack of divergence within the data and some of the participants data neither increased nor decreased. However, it is evident that there were no adverse effects of external rewards on intrinsic motivation for completing high interest tasks across all intrinsic motivation measures and reward conditions. The implications of this study provide more evidence for the productive and useful nature of using rewards to reinforce behaviors. Additionally, outcomes of this study give counter evidence towards conditions that are reported to produce negative outcomes, specifically, that the reward is non-contingent, tangible, and expected.

Due to the unique features of this study and incongruence with past research, it is difficult to explain the inconsistency with some of the outcomes from past research. Perhaps one reason is that prior studies have typically utilized between-groups designs (e.g., Deci, 1971, 1972; Lepper, Greene, & Nisbett, 1973); whereas only a handful have implemented single subject

designs. Many of the studies using between-groups designs have reported adverse effects on intrinsic motivation using free-choice period choice, self-report, and performance as dependent variables. As highlighted before, other studies using between-groups designs have reported limited negative effects and some increases using the same measures of intrinsic motivation (e.g, Cameron & Pierce, 1994, 2002). Past studies using single subject designs have reported results indicating that the effects of external rewards have not produced adverse outcomes on intrinsic motivation (Cameron & Pierce, 1994; Feingold & Mahoney, 1975; Mawhinney, Dickenson, & Taylor, 1989; Vasta & Strip, 1979; Weaver & Watson, 2004); which are consistent with the outcomes of this study. Specifically, the studies cited above used the expected contingent reward condition (which is the most frequently used contingency in behavior plans) using performance and persistence data as measurements of intrinsic motivation. The outcomes in this study for the expected reward condition resulted in similar performance and persistence data.

A majority of the single subject designs studies in past literature have implemented reward contingencies for participants while doing dull or mundane tasks (e.g., math fact fluency, reading fluency, classroom setting). Criticisms of such designs in past CET literature contend that negative outcomes are only evident in high interest tasks (games, puzzles, drawing). Finding consistencies with the present study (high interest tasks) and past single participant designs studies (low interest tasks) are difficult to conclude due to the nature of the task in the present study.

One study conducted by Mawhinney and colleagues (1989) used a high interest task (videogame) and gave money for the amount of trigger pulls produced by the participants during both contingent and non-contingent conditions. Results for the Mawhinney study for the contingent conditions are similar to the present study in that no detrimental effects for the contingent condition were found. However, results for the non-contingent condition differ from each other. Mawhinney et al. concluded that limited effects were seen in the non-contingent condition, whereas the non-contingent conditions in this study resulted in increases of performance and limited effects on persistence and free choice measures. Differences in outcomes may be due to that the present study including both expected and unexpected rewards for the non-contingent contingency and three measures of intrinsic motivation. Mawhinney only used the unexpected expectancy of the reward contingency and only used the performance measure for intrinsic motivation. Overall, both studies are generally consistent in that no detrimental effects are evident when providing rewards for high interest tasks. *Limitations* 

One limitation is that it was difficult to assess the relationship between the participant's estimates of task enjoyment and their performance on the tasks. The research design utilized in this study did not implement a traditional baseline period to use for comparison of task performance. Furthermore, task performance during the baseline period could have been used for estimations of task enjoyment prior to the treatment phases of the study. Additionally, other extraneous variables were not controlled for, such as, multiple exposures to the same task, setting of the experiment, and the presence of the video camera. Participants may have become better at the target task due to simply having repeated attempts.

As in all single subject designs, generalization is very difficult due to the small sample size. Furthermore, it would be difficult to generalize the results of the participants to the specific age groups used in this study. Other participants may have very different outcomes due to the choice of task to engage in and the rewards they have received. Additionally, reward conditions impact on participant's intrinsic motivation performance measures may vary from participant to

participant due to prior experiences with the different types of contingencies. Little is known about consistent reinforcement patterns on performance across much of the population for high interest tasks.

The present study's outcomes may have also been influenced by exposing participants to multiple treatments in each session. However, the design of the present study included randomized selection of each treatment given to the participants in all sessions. Because of the design it is difficult to generalize the current outcomes of each condition to a situation in which each condition was administered independently.

Future research could build upon the present study in several ways. Specifically, more research using single-participant designs for high interest tasks could be beneficial in better understanding the impact rewards have on persistence and free-choice measurements. Future research could examine the impact of the expected non-contingent reward contingency for further understanding, due to the inconsistent outcomes this study produced compared to past research in between-groups designs. It would be very interesting to see outcomes specific to this reward contingency across several populations, tasks, and rewards. Furthermore, little research has been done using the self-report measures in a single participant design for high interest tasks. Although there are large amounts of research on this topic, little has been conducted that take into consideration the impact of individual differences. Additional research can focus on the possible consistencies across larger populations; but, more importantly future research should take into account the abundance of individual differences and the impact those differences have on intrinsic motivation.

#### References

- Bem, D. J. (1972). Self-perception theory. In L. Berkowitz (Ed.), Advances in experimental social psychology (Vol. 6) (pp. 2-62). New York: Academic Press.
- Calder, B. J., & Straw, B. M. (1975). Self-perception of intrinsic and extrinsic motivation. *Journal of Personality and Social Psychology*, 31, 599-605.
- Cameron, J. (2001). Negative effects of reward on intrinsic motivation-A limited phenomenon: Comment on Deci, Koestner, and Ryan (2001). *Review of Educational Research*, 71, 29-42.
- Cameron, J., & Pierce, D. W. (1994). Reinforcement, reward, and intrinsic motivation: A metaanalysis. *Review of Educational Research*. 64, 3.
- Cameron, J., Pierce, D. W. (2002). Rewards and intrinsic motivation. Westport, CT: Bergin and Garvey.
- DeCharms, R. (1968). Personal causation. New York: Academic Press.
- Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology*. 18, 105-115.
- Deci, E. L. (1972). Intrinsic motivation, extrinsic reinforcement, and inequity. *Journal of Personality and Social Psychology*. 22, 113-120.
- Deci, E. L. (1972). The effects of contingent and noncontingent rewards and controls on intrinsic motivation. *Organizational Behavior and Human Performance*, 8, 217-229.
- Deci, E. L. (1975). Intrinsic motivation. New York, NY: Plenum Press.
- Deci, E. L., Ryan, R. M., & Koestner, R. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin*. 125, 627-668.
- Deci, E. L., Ryan, R. M., & Koestner, R. (2001). The pervasive negative effects of rewards on intrinsic motivation: Response to Cameron (2001). *Review of Educational Research*, 71, 43-51.
- Eisenberger, R., & Cameron, J. (1996). The detrimental effects of rewards: Myth or reality? *American Psychologist*, 51, 1153-1166.
- Feingold, B. D., & Mahoney, M. J. (1975). Reinforcment effects on intrinsic interest: Undermining the overjustification hypothesis. *Behavior therapy*, 6, 357-377.
- Festinger, L. (1957). A theory of cognitive dissonance. Evanston, II: Row, Peterson.
- Flora, S. R. (1990). Undermining intrinsic interest from the standpoint of a behaviorist. *The Psychological Record*, 40, 323-346.
- Greene, D., & Lepper, M. R. (1974). Effects of extrinsic rewards on children's subsequent intrinsic interest. *Child Development*. 45, 1141-1145.
- Heider, F. (1958). The psychology of interpersonal relations. New York: John Wiley & Sons.
- Kohne, A. (1993). Punished by rewards. Boston: Houghton Mifflin.
- Lepper, M. R., Greene, D., Nissbett, R. E. (1973). Undermining children's intrinsic interest with extrinsic reward: A test of the "overjustification" hypothesis. *Journal of Personality and Social Psychology*, 28, 129-137.
- Mawhinney, T. C., Dickinson, A. M., & Taylor, L. A. (1989). The use of concurrent schedules to evaluate the effects of extrinsic rewards on "intrinsic motivation." *Journal of Organizational Behavior Management*, 11, 175-191.
- Ryan, R. M., Mims, B., & Koestner, R. (1983). Relation of reward contingency and interpersonal context to intrinsic motivation: A review and test using cognitive evaluation theory. *Journal of Personality and Social Psychology*, 45, 736-750.

- Rummel, A., & Feinberg, R. (1988). Cognitive evaluation theory: A meta-analytic review of the literature. *Social Behavior and Personality*, 16, 147-164.
- Tang, S. H., & Hall, V. C., (1995). The overjustification effect: A meta-analysis. *Applied Cognitive Psychology*, 9, 365-404.
- Vasta, R., Andrews, D. E., McLaughlin, A. M., Stirpe, L. A., & Comfort, C. (1978). Reinforcement effects on intrinsic interest: A classroom analog. *Journal of School Psychology*, 16, 161-168.
- Vasta, R., & Stirpe, L.A. (1979). Reinforcement effects on three measures of children interest in math. *Behavior Modification*. 3, 223-244.
- Weaver, A. D., & Watson, T. S. (2004). An idiographic investigation of the effects of ability and effort based praise on math performance and persistence. *The Behavior Analyst Today*. 5, 381-389.
- Wiersma, U. J. (1992). The effects of extrinsic rewards in intrinsic motivation: A meta-anlaysis. *The Journal of Psychology*, 124, 75-86.

### APPENDIX A Adult Consent for Own Participation

The researchers would like you to participate in a research study titled "The Effects of Extrinsic Rewards on Intrinsic Motivation." The purpose of this study is to better understand the positive and negative relationship between rewards, reinforcements, and intrinsic motivation. If you decide to participate in this study, your involvement will consist of twelve 30 minute sessions. Scheduling of sessions will be flexible to accommodate to your schedule. Participation in the study will include engaging in tasks that are intrinsically motivating to you for a period of time. While you are doing the tasks you will receive rewards at different intervals throughout the sessions. Additionally, the study will include observations that will evaluate the reliability of the research implementation and participant observations through video recordings. All sessions will be video recorded and destroyed after observations are completed.

Your participation is entirely voluntary and you will be free to refuse or stop at any time without penalty. You grades or class standing will not be affected in anyway if you decide to stop. All identifying information will be coded and strictly confidential. Furthermore, all video recordings will be stored in a locked filling cabinet and office. After the video observations have been completed all taped sessions will be destroyed. Your identity will not be revealed without your written consent.

Do you have any questions? If you have any questions later, please feel free to contact us.

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Please read the following paragraph, and, if you agree to participate sign below.

I understand that all identifying information about me collected from this research will be kept strictly confidential. I do understand that I will be video recorded for observation purposes and all recordings will be destroyed after reviewed. I understand all of the potential risks and benefits of this study and agree to participate.

Signature	Date
Investigator	Date

#### APPENDIX B Parent Consent for Son or Daughter to Participate

Dear Parent or Guardian:

We would like to ask your permission for your son or daughter to participate in a research project that involves outcomes of rewards and reinforcements on intrinsic motivation. This study, titled "The Effects of Extrinsic Rewards on Intrinsic Motivation", will aid in understanding the positive and negative uses of rewards and reinforcements in many various fields of interest.

*What is involved?* Teenagers who participate will be asked to spend 30 minutes over 12 sessions engaging in various intrinsically motivating tasks, such as crossword puzzles and word finds. During the sessions the participants will be given rewards in the form of coupons on several different schedules. Participant's will be asked to exchange their coupon's for a tangible reward, such as journals, packages of pens, food items, or gift certificates to various establishments. Additionally, the study will include observations that will evaluate the reliability of the research implementation and participant observations through video recordings. All sessions will be video recorded and destroyed after observations are completed. Outcomes of the research will be used to evaluate positive and negative uses of rewards.

*Potential Benefits and Concerns.* Although we will arrange sessions to take place after school hours to not interfere with important lessons, he or she may have to make up work that would be typically completed during this time. During the study your son and daughter will be involved in many different reward schedules for engaging in tasks to investigate their influence on motivation. Negative motivation outcomes may occur for some of the tasks. However, all tasks the participants will be asked to engage in are of high interest and not academic in nature. Benefits of the current study include improved understanding of rewards and reinforcements and their impact on individual intrinsic motivation.

*Participation is voluntary.* Your son or daughter's participation in the study is completely voluntary. At any time they will be free to refuse to participate or stop at any time without penalty. Their grades and class standing will not be affected in anyway if they decide to stop. Furthermore, there will be no penalty if you do not wish your son or daughter to be in this study.

*Information is confidential.* All information will be held as confidential as is legally possible. Only the researchers will see the study protocols and videotaped sessions. All names on documents will be replaced with numbers and coded. All videotapes and recorded materials will be held in a locked cabinet and locked office on the Miami University campus. After reviewing the videotaped sessions all recordings will be destroyed.

*Questions?* If you have any questions please feel free to contact Nathan Dumford (513-337-9667) or Thomas S. Watson (513-529-0173). Please keep the attached copy of the cover letter and permission slip for your records. If you would like to meet with

### **APPENDIX B (CON"T)**

either researcher prior to the project start or for questions feel free to contact at the phone numbers or emails below.

Thank you for you consideration.

Sincerely,

Nathan M. Dumford, MS Educational Psychology Department Miami University Phone: 513-337-9667 Email: <u>NMDumford@gmail.com</u> Thomas S. Watson, PhD Educational Psychology Department Miami University Phone: 513-529-0173 Email: <u>WatsonTS@muohio.edu</u>

Please check the appropriate boxes and send this form back to school with your son or daughter:

I have read and I understand the permission letter. I give consent for my teenager

to participate in this study.

I have received a copy of the project letter and permission form.

I have read and I understand that my son or daughter will be videotaped during

the sessions for observation and project implementation integrity and give my

permission for my teenager to participate.

I would like more information before giving my consent for my teenager to participate. Call me at \_\_\_\_\_.

I do not wish my son or daughter to participate in this study.

Parent's Signature/Date \_\_\_\_\_

Son or Daughter's name

### APPENDIX C Subject Assent Form

Study Title: The Effects of Rewards on Intrinsic Motivation Investigators: Nathan M. Dumford, MA (513-337-9667) Thomas S. Watson, PhD (513-529-0173)

I am being asked to participate in a study that involves doing tasks that are enjoyable and being rewarded for doing them. The main goal of this study is to examine the effects of rewards on intrinsic motivation.

If I decide to participate I will be asked to meet for twelve 30 minute sessions. During the sessions I will complete tasks as asked and receive coupons that I can exchange for certain tangible rewards. Further more, I understand that all the sessions will be videotaped and reviewed at a later time. After each session is reviewed the recording will be destroyed.

The sessions will take place after school hours and I may have to complete homework at other times than I normally would. I also understand that this study may have an impact on the tasks that I am engaging in and a debriefing will occur at the end of the study or at my termination.

This project has been explained to me and I have been allowed to ask questions about it. I am aware that I do not have to participate in the study and may at any time decide to stop participating. If I do choose to not participate in the study I will not have any affects on my grades and class standing. I have read this form, understand the project, and agree to participate.

Student	Date
Investigator	Date

# **APPENDIX D**

#### Behavior Observation System

Name of student:	Date: Observer	
Target Behavior(s) t1 =	t2=	
Setting:		

		Peer			Peer			Peer
1 on off	2 on off	3 on off	4 on off	5 on off	6 on off	7 on off	8 on off	9 on off
t1 t2								
T T- T+								
P C- C+								
10 on off	11 on off	12 on off	13 on off	14 on off	15 on off	16 on off	17 on off	18 on off
t1 t2								
T T- T+								
P C- C+								
19 on off	20 on off	21 on off	22 on off	23 on off	24 on off	25 on off	26 on off	27 on off
t1 t2								
T T- T+								
P C- C+								
28 on off	29 on off	30 on off	31 on off	32 on off	33 on off	34 on off	35 on off	36 on off
t1 t2								
T T- T+								
P C- C+								
37 on off	38 on off	39 on off	40 on off	41 on off	42 on off	43 on off	44 on off	45 on off
t1 t2								
T T- T+								
P C- C+								
46 on off	47 on off	48 on off	49 on off	50 on off	51 on off	52 on off	53 on off	54 on off
t1 t2								
T T- T+								
P C- C+	P C-C+							

# **APPENDIX E**

Task	Scoring Rules						
1. Suduku Puzzles	% Correct = # correct small squares / Total # of available squares 1 Coupon = Every 2 correct small squares						
2. Rubik's Cube	% Correct = # correct colored squares / 54 #Correct Colored Squares: Same colored squares adjacent to each other on one of the six sides.						
	1 Coupon = 3 same colored squares adjacent to each other 2 Coupons = 4 same colored squares adjacent to each other 3 Coupons = 5 same colored squares adjacent to each other 4 Coupons = 6 same colored squares adjacent to each other 5 Coupons = 7 same colored squares adjacent to each other 6 Coupons = 8 same colored squares adjacent to each other 7 Coupons = 9 same colored squares adjacent to each other						
3. Jigsaw Puzzles	% Correct = # correctly connected pieces / Total amount of pieces 1 Coupon = Ever 2 pieces correctly connected						
4. Crossword Puzzles	% Correct = # Correctly filled in squares / Total # of empty squares 1 Coupon = Every 2 correctly filled in squares						
5. Word Find Puzzles	% Correct = # correctly found words / Total words available 1 Coupon = Every 5 words found correctly						
6. Worduku Puzzles	% Correct = # correct small squares / Total # of available squares 1 Coupon = Every 2 correct small squares						
7. Mystery Crossword Puzzles	% Correct = # Correctly filled in squares / Total # of empty squares 1 Coupon = Every 2 correctly filled in squares						
8. Coded Crossword Puzzles	% Correct = # Correctly filled in squares / Total # of empty squares 1 Coupon = Every 2 correctly filled in squares						

## **APPENDIX F**

## **Randomized Conditions**

Sessions											
1	2	3	4	5	6	7	8	9	10	11	12
EC	UC	EC	UNC	ENC	EC	UNC	ENC	EC	UC	ENC	UNC
ENC	ENC	UC	EC	UNC	ENC	UC	UC	UNC	EC	UC	EC
UNC	EC	ENC	UC	UC	UNC	ENC	EC	ENC	UNC	UNC	UC
UC	UNC	UNC	ENC	EC	UC	EC	UNC	UC	ENC	EC	ENC

ENC: Expected Non-Contingent reward

UNC: Unexpected Non-Contingent reward

EC: Expected Contingent reward

UC: Unexpected Contingent reward

# APPENDIX G.1 General Instructions

\* Please complete all self-checks prior to first condition.

- 1. Start by speaking into the video camera indicating which session and subject number you are beginning. *Example: This is session 1 for subject 1*.
- 2. Present three tasks for the subject to choose to engage in throughout the experiment.

This will only occur on the first session to start the experiment. The following

sessions throughout the experiment will use this same task for every condition.

Task Chosen By Subject:

\*Please write the task on the following 12 general instructions pages.

- Explain to the subject the quantity of coupons needed to receive the reinforcement.
  Say: You can attain these items (point to the items) in exchange for coupons awarded to you throughout the experiment. Each item has a different amount of coupons needed to receive them (explain the different amounts).
- 5. Begin the Session with the first condition indicated on the randomized table.

### APPENDIX G.2 NCA

- \* Please complete all self-checks.
- \* When giving instructions to the subject use the bold text.
- $\Box$  1. Select the appropriate task for the participant and place in front of them.
  - Say: For the next few minutes please work on this task (point to the task).

You will be receiving this item (show the reinforcement).

When I say begin you may start.

- 2. **Ready begin.** Start stopwatch for 3 minutes.
- 3. Coupon Checklist
  - \_\_\_\_\_1<sup>st</sup> one minute coupon delivered.
  - \_\_\_\_\_2<sup>nd</sup> one minute coupon delivered.

\_\_\_\_\_3<sup>rd</sup> one minute coupon delivered.

- $\Box$  4. After 3 minutes say: **Stop.**
- $\Box$  5. Record number of completed tasks.

# of completed tasks: \_\_\_\_\_

## **Free Choice Period**

- 1. You are free to do what ever you please. I have some paperwork to complete and then we will move on.
- $\Box$  2. Reset stopwatch to zero and start for 3 minutes.
- 3. After 3 minutes stop and move on to the next condition.

### APPENDIX G.3 NCB

- \* Please complete all self-checks.
- \* When giving instructions to the subject use the bold text.
- $\Box$  1. Select the appropriate task for the participant and place in front of them.
  - Say: For the next few minutes please work on this task (point to the task).

## When I say begin you may start.

- 2. Say: **Ready begin.** Start stopwatch for 3 minutes.
- 3. Coupon Checklist

\_\_\_\_\_1<sup>st</sup> one minute coupon delivered.

 $2^{nd}$  one minute coupon delivered.

\_\_\_\_\_\_3<sup>rd</sup> one minute coupon delivered.

- $\Box$  4. After 3 minutes say: **Stop.**
- $\Box$  5. Record number of completed tasks.

# of completed tasks: \_\_\_\_\_

## **Free Choice Period**

- 1. You are free to do what ever you please. I have some paperwork to complete and then we will move on.
- $\Box$  2. Reset stopwatch to zero and start for 3 minutes.
- 3. After 3 minutes stop and move on to the next condition.

#### APPENDIX G.4 CA

\* Please complete all self-checks.

\* When giving instructions to the subject use the bold text.

- $\Box$  1. Select the appropriate task for the participant and place in front of them.
  - Say: For the next few minutes please work on this task (point to the task).

For every (adhere to scoring rules for each task) \_\_\_\_\_ correct \_\_\_\_\_

## you will receive one coupon. When I say begin you may start.

- 2. Say: **Ready begin.** Start stopwatch for 3 minutes.
- 3. Coupon Checklist

\_\_\_\_ Coupon Delivered

Time:

\_\_\_\_ Coupon Delivered

Time: \_\_\_\_\_

\_\_\_\_ Coupon Delivered

Time: \_\_\_\_\_

 $\Box$  4. After 3 minutes say: **Stop.** 

 $\Box$  5. Record number of completed tasks.

# of completed tasks: \_\_\_\_\_

% correct of completed task: \_\_\_\_\_

## **Free Choice Period**

- 1. You are free to do what ever you please. I have some paperwork to complete and then we will move on.
- $\Box$  2. Reset stopwatch to zero and start for 3 minutes.
- 3. After 3 minutes stop and move on to the next condition.

Time:

Coupon Delivered

\_\_\_\_\_ Coupon Delivered

Time: \_\_\_\_\_

Coupon Delivered

Time:

#### APPENDIX G.5 CB

\* Please complete all self-checks.

\* When giving instructions to the subject use the bold text.

 $\Box$  1. Select the appropriate task for the participant and place in front of them.

Say: For the next few minutes please work on this task (point to the task).

### When I say begin you may start.

- 2. Say: **Ready begin.** Start stopwatch for 3 minutes.
- 3. Coupon Checklist

Coupon Delivered Coupon Delivered

Time: \_\_\_\_\_

Coupon Delivered

Time: \_\_\_\_\_

Coupon Delivered

Time:

Time: \_\_\_\_\_

Coupon Delivered

Time:

Coupon Delivered

Time:

- $\Box$  4. After 3 minutes say: **Stop.**
- $\Box$  5. Record number of completed tasks.

# of completed tasks: \_\_\_\_\_

% correct of completed task: \_\_\_\_\_

## Free Choice Period

1. You are free to do what ever you please. I have some paperwork to complete and then we will move on.

- $\Box$  2. Reset stopwatch to zero and start for 3 minutes.
- 3. After 3 minutes stop and move on to the next condition.