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The Effects of Feedback Sequence on Cognitive Performance

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THE EFFECTS OF FEEDBACK SEQUENCE

ON COGNITIVE PERFORMANCE

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by

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ABSTRACT

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The current study tested the effects of feedback sequence on performance on a visual-spatial task. Twenty-three female participants were randomly assigned to one of five feedback sequence conditions which occurred after two consecutive trials of a hole-punch task. The five feedback sequence conditions consisted of positive-positive (i.e., positive feedback followed by positive feedback), positive-negative, negative-positive, negative-negative, and a no-feedback control group. Positive feedback was presented as a 80%-90% accuracy range whereas negative feedback was a 30%-40% accuracy range. Third trial accuracy and completion time were measured as was locus of control via the Internal Control Index (ICI) survey. Analyses revealed an effect of feedback sequence on accuracy, but not on completion time. The no-feedback control group performed with lower accuracy than the negative-negative and positive-positive groups. Locus of control had no effect on performance, either by itself or as an interaction with feedback sequence. Differences in accuracy in the no-feedback group may have occurred due to heightened performance ambiguity in that condition.

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CHAPTER I

INTRODUCTION

Despite a robust amount of scientific literature on the topic, the effects of feedback on performance are not definitively understood. A large meta-study performed by Kluger and DeNisi (1996) that included 607 effect size measures from 131 separate studies found a surprisingly variable effect of feedback. Overall, feedback tended to improve performance but the authors reported that, in 38% of the effects examined, feedback actually decreased performance. Clearly, there is a more complex interaction between feedback and performance than a simple linear relationship.

One of the factors that likely impacts the way that feedback affects performance is the feedback type, typically distinguished as positive and negative. For the purpose of this review, positive feedback will be defined as feedback indicating successfully completing a task or the meeting of a particular goal, while negative feedback will be defined as feedback indicating the failure to accomplish a task or meet a specific goal. While it may seem initially as though positive feedback would automatically lead to better performance due to confidence-boosting effects, in reality, both positive and negative feedback provide vital information to someone who is performing a task. Feedback provides the basis for performance adjustment. Positive feedback enables those receiving feedback to know what they are doing well and that they do not need to adjust their performance, whereas negative feedback enables those receiving feedback to know what they are not doing well, and informs them of what aspects of their performance to focus on altering. If both positive and negative feedback serve important functions toward assessing and improving performance, they might be expected to affect performance in roughly equal ways. Instead, a consistent effect of positive or negative feedback has failed to emerge from the literature, and there are various theories that attempt to explain the different ways in which feedback affects performance.

CHAPTER II

LITERATURE REVIEW

Feedback Intervention Theory (FIT)

One of the most significant and influential theories of how feedback affects cognitive performance is Feedback Intervention Theory (FIT), as proposed by Kluger and DeNisi (1996). The FIT is a hierarchical model of attention, based on the concept of a finite amount of attention and mental resources that can be used during any particular point in time. Normally, the focal point of attention lies in the middle of the hierarchy, at the task-focus level. Based on mental comparison between task performance and task feedback, the focal point of attention can shift to other areas of the hierarchy. The high end of the hierarchy contains the self-focus level, and the low end of the hierarchy contains the learning-focus level. Using this model, negative feedback will often shift the focal point of attention toward the self-focus level, particularly when criticism has an effect on the self-concept, such as when people do poorly on a task at which they expect to succeed. The FIT model is fairly complex, and attentional focus as well as the amount of effort put toward a task can be predicted based on variables in the model.

The FIT model can be viewed in some ways as a protective mechanism for self-concept and self-esteem. This view may actually be required for understanding what happens during negative feedback. FIT predicts that negative feedback at the self-focus level (i.e., the top of the hierarchy) will result in a reduction of effort if the task is deemed to be important to a person's self-concept (Kluger & DeNisi, 1996). From a logical point of view, this resultant decrease in effort could be viewed as a somewhat counterintuitive result, as putting less effort into a task at which one is struggling will likely result in a poorer outcome. But this is where the protective factor of the FIT model comes into effect. As the focus of attention at the top of the hierarchy is on the self, not the task, protecting the self-concept takes priority over task performance. A reduction in effort can eliminate the cognitive dissonance experienced when not living up to expectation. Rather than failing because they are not good enough, individuals perceive themselves as failing because they are not putting in the required effort, which is less of a blow to the ego. Thus, individuals are able to maintain their self-concept despite poor performance (Kluger & DeNisi, 1996). The protective aspect of this attentional shift is similar to the model of excuses put forth by Snyder, Higgins, and Stucky (1983) who theorized that excuses serve a protective function to the ego.

Kluger and DeNisi's (1996) previously mentioned meta-analysis also examined specific aspects of feedback-related studies to determine if the findings were consistent with the FIT model. One of the more significant variables examined was the information that was conveyed in the feedback that was given. When the feedback gave information relevant to the task-focus or learning-focus levels, such as showing the correct solution for a task, the feedback tended to enhance performance. When the feedback tended to result in an attentional shift to the self-focus level, especially when the feedback was discouraging or a threat to self-concept, performance suffered. These findings match the predictions made by the FIT model. Other important variables that were observed in the meta-analysis included how often feedback was given, and how quickly that feedback was received. Both of these variables correlated with performance, which corresponds to the FIT model, as frequent and timely feedback likely helps to keep attention attuned to the task-focus level. Other studies have found support for particular aspects of FIT, including support for the concept that attentional shifts following feedback can directly impact goal-setting (Krenn, Würth, & Hergovich, 2013b), and evidence of hostile negative feedback leading to an attentional shift toward the self-focus level which then negatively affects performance (Raver, Jensen, Lee, & O'Reilly, 2012).

Feedback Factors

Other factors, such as cognitive resources, have been identified as having as an impact on how feedback affects performance. Detailed by Kanfer and Ackerman (1989), there is a finite amount of mental resources available at any given time, similar but separate from the more familiar concept of the attention span. Later, Kanfer (1996) differentiated between resource-sensitive tasks, which are complex tasks that require a larger amount of cognitive resources, versus resource-insensitive tasks, which are simpler tasks that require a smaller amount of cognitive resources. Because resource-insensitive tasks require fewer cognitive resources, Kanfer (1996) hypothesized that resource-insensitive tasks are less prone to variability in performance than are resource-sensitive tasks.

Based on the idea of cognitive resources, as well as the aforementioned FIT model, Vancouver and Tischner (2004) predicted that performance on resource-sensitive tasks would be more responsive to the effects of feedback than would resource-insensitive tasks. Cognitive resources in Vancouver and Tischner's study were manipulated via the complexity of rules in an arithmetic task, with the more complex rules corresponding to the resource-sensitive condition. While their study also included an intervention element designed to reduce the threats to self-concept that result from attentional focus on the self (i.e., top of the attentional hierarchy), a direct effect of feedback was also reported. When no intervention was present, negative feedback decreased performance on the resource-sensitive task whereas positive feedback increased performance. In the other experimental conditions (i.e., resource-sensitive with intervention, resource-insensitive with intervention, and resource-insensitive without intervention), there was a significant but weak feedback effect. In those conditions, positive feedback decreased but negative feedback increased performance (Vancouver & Tischner, 2004). These results imply that without the specific self-concept intervention, performance on resource-sensitive tasks are highly influenced by the effects of feedback, while performance on resource-insensitive tasks are more resistant to the effects of feedback. This implication is consistent with the FIT model, in that when attention and resources move to the self-focus level, there is less attention and resources available for the current task. For resource-insensitive tasks, this may not be a problem, because there still may be enough mental power available for the task. In contrast, for resource-sensitive tasks, the loss of the requisite mental power to devote to the task may result in a decline in performance.

Another of the factors that influences how feedback affects performance appears to be the task goal as perceived by those who are engaging in the task. In particular, variation appears based on whether a task is deemed as having a promotion goal or a prevention goal. The categorization of these goals is determined by regulatory focus, as theorized by Higgins (1997). For Higgins, promotion goals tend to be motivated by pleasure seeking and usually involve more creativity, while prevention goals are motivated more by pain avoidance and often involve more attention to detail. Promotion goals and prevention goals are usually both oriented toward success, but the motivation to achieve success is different. Promotion goals are set to achieve success to gain something desired, such as money or status, whereas prevention goals are set to achieve success in order to avoid losing something desired. The manner in which the goal of a task is perceived affects a person's motivation to succeed and the effort that the individual puts forth.

Regulatory focus, defined as whether a task is deemed by the individual to have a promotion goal versus a prevention goal, has been demonstrated to significantly influence the effect of feedback. Van-Dijk and Kluger (2004) found that the regulatory focus of an individual toward a task moderated the effect of feedback on the individual's motivation. An interesting crossover effect was observed in that study in that, for the promotion goals, positive feedback increased motivation and negative feedback decreased motivation, whereas the opposite occurred for the prevention goals, with negative feedback increasing motivation and positive feedback decreasing motivation. To manipulate regulatory focus in their experiment, participants were assigned hypothetical occupational situations that were deemed to be oriented either toward promotion goals (e.g., a project dealing with career development) or prevention goals (e.g., a project dealing with safety), and were then surveyed about their motivation to exert effort.

In addition to the effect on motivation, regulatory focus has also been shown to moderate the effect of feedback on performance. Van-Dijk and Kluger (2011) found that positive feedback increased performance for promotion goals while negative feedback decreased performance. The results were reversed for prevention goals in that negative feedback increased and positive feedback decreased performance. For the Van-Kijk and Kluger (2011) study, the task used for the promotion goal was an idea generation task, where participants were instructed to generate as many uses for a given item as they could. For the prevention goal, the task used was error detection in a list of completed arithmetic calculations. Regulatory focus can be difficult to experimentally manipulate because it involves personal goals and motivation, and the type of task by itself may not be enough to alter regulatory focus. While tasks that emphasize creativity or attention to detail can orient someone towards having a promotion goal or a prevention goal, personal factors such as personality and experience likely have a large impact on how someone views the goal of a task.

Another factor that has been shown to influence the effect of feedback is goal orientation, specifically the difference between those with a learning goal and those with a performance goal. Differences were found on feedback effects for goal orientation on a series of reading comprehension and analogy tasks (Cianci, Schaubroeck, & McGill, 2010). In that study, goal orientation was manipulated via specified instructions to the participants that their explicit goal was either to perform as well as possible or to learn. Participants in the learning goal orientation condition had higher performance on the analogy and reading comprehension questions when given negative feedback than when given positive feedback. The reverse was shown in the performance goal orientation condition, where positive feedback resulted in significantly higher performance than negative feedback. Ultimately, factors such as goal orientation help explain some of the variance in the way that feedback affects performance, though certain elements remain unexplained.

Feedback Sequence

While the effects of feedback on performance have been previously investigated, such effects have been quite variable and prone to moderating effects of other factors such as cognitive resources and regulatory focus. However, feedback effects are most commonly presented as single-instance scenarios by presenting either positive or negative feedback and, then, measuring performance. Fewer studies have tested the effects of multiple iterations of feedback or the feedback sequence over multiple trials. If there are potential cumulative or prolonged lingering effects of feedback, it would be important to identify those effects. Feedback sequence has not often been examined in the scientific literature, and instances where the sequence itself is the focal point of an experiment have been almost non-existent. However, several studies have included feedback sequences within their design.

An incremental increasing/decreasing feedback design was used in a National Aeronautics and Space Administration system-monitoring computer simulation task (Venables & Fairclough, 2009). After initial feedback was given as 50% accuracy regardless of actual performance on the task, those in the positive feedback group had their performance feedback accuracy increase in each of three additional trials, while those in the negative feedback group had their feedback accuracy decrease in each of the next three trials. This study had a greater focus on motivational and physiological measures than performance, but a lack of effect on performance was mentioned, which went against the stated hypothesis. In contrast, there was an observed effect of feedback on affect, where the successive positive feedback led to positive affect, and vice versa. It is surprising that this type of sequence did not show an effect on performance, though it is possible that the task used in the experiment was actually so complex that the effect of feedback on performance was too small to detect.

A more complex combination of positive and negative feedback occurred in a four-group feedback-sequence design implemented in a study involving a visual perception and memory task (Krenn, Würth, & Hergovich, 2013b). That task consisted of three trials, and feedback was presented as either positive or negative following the first and second trials, and involved the ability of the participants to raise the difficulty level of the task. The four groups consisted of positive-positive (i.e., positive feedback after the first trial and positive feedback after the second trial), positive-negative, negative-positive, and negative-negative. This particular study focused on an additional difficulty-raising/maintaining element and, unfortunately, neglected to report the effects of only the feedback-sequence conditions on task performance. There was, however, a reported effect of feedback sequence on difficulty-raising, as those in the positive-positive and negative-positive conditions chose to raise the difficulty level for the final trial, while those in the negative-negative and positive-negative conditions chose to maintain the difficulty level.

A logical feedback sequence to study would be simultaneous presentation of positive and negative feedback, in which certain aspects of a performance are given positive feedback, and other aspects negative feedback. This would provide something akin to a pros and cons list of a task performance. However, this type of sequence does not seem to have been used in many, if any, studies of cognitive performance. One of the reasons for a lack of studies involving this type of sequence may be due to the complexity that the experimental task would require, as the task used would need to have several viable aspects about which the participants could be given feedback, as well as each of those aspects being individually measurable. Were this type of sequence used in a study, it would seem likely, using FIT as a model, that presenting positive feedback with negative feedback would at least dampen the self-concept threat presented by negative feedback by itself. However, other factors could also influence the result, such as the ratio of positive to negative feedback, and the particular aspects of the task performance that were given which feedback type.

Task Type

The type of cognitive tasks that have been used in prior studies on the effects of feedback have been surprisingly varied, although the task type has often been chosen to accommodate certain specific aspects of these individual studies. More traditional cognitive tasks used in previous research have included tests of reading comprehension and analogies (Cianci et al., 2010), anagrams (Feather, 1966; Feather & Saville, 1967), mathematics (Vancouver & Tischner, 2004), and tests of logic and reasoning (Jung et al., 2014). Less traditional tasks tend to be utilized when other experimental variables are introduced into the study. Recent studies focusing on attention have frequently used computer simulation programs due to the high level of multitasking and attentional shifts that are required to achieve maximum performance. Simulation programs used in the literature include air traffic control (Yeo & Neal, 2004), forest enterprise management (Spering, Wagener, & Funke, 2005), and a program designed by the National Aeronautics and Space Administration involving system monitoring and resource management (Venables & Fairclough, 2009). A more creative task is often used when measuring regulatory focus, to coincide with promotion goals, which tend to involve creativity. A list of creation tasks used in the literature contains those that consist of generating different possible uses for objects (Spieker & Hinsz, 2004; Van Dijk & Kluger, 2011), creating a list of words that fit a specific criteria (Podsakoff & Farh, 1989), and a novel visual task that involves categorizing three-dimensional models based upon specific criteria; models that, at least according to the authors, bear a resemblance to aliens (DePasquer Swanson, & Tricomi, 2014).

An important aspect of a task when it comes to feedback effects is the ambiguity of the correct way to complete the task. Manipulated feedback is more convincing if the actual task performance is relatively difficult for the participants to assess themselves (Raftery & Bizer, 2009). This can be achieved through task difficulty, as well as rapid shifts of attention. But perhaps one of the best ways to present performance ambiguity is to use a novel and ambiguous task. Spatial tasks, such as the mental rotation task (Stoeber, Schneider, Hussain, & Matthews, 2014), are used in part due to the limited modality of the information available to the participant, as only visual information is presented. Another visual-spatial task used in this capacity is the Kohs block design test (Singh & Misra, 1985), which involves displaying a block pattern on a card, and having the participants use colored cubes to recreate the pattern shown on the card. On other occasions, novelty can result in ambiguity, such as in the aforementioned aliens task (DePasque Swanson, & Tricomi, 2014), or in the hole-punch task (Raftery & Bizer, 2009). The hole-punch task may very well be the strongest combination of limited modality and novelty, being purely visual in nature and being an unusual and novel task, involving mentally folding and unfolding paper; only those well-schooled in the art of origami will have a large amount of familiarity with the task.

Locus of Control

Locus of control describes how individuals perceive the amount of control they have over events in their life and is represented by two ends of a continuum. On one end is the internal locus of control, in which people believe that they have control and are responsible for the events and outcomes that occur in their lives. On the opposite end of the continuum lies the external locus of control, where people attribute the control over events in their life to external circumstances or random chance. The concept of locus of control was defined by Rotter (1954), has since been included in several studies of personality, and was included as one of the four dimensions in Judge, Locke, and Durham's (1997) core self-evaluations model.

Examination of the impact of internal versus external locus of control on feedback has been limited, but a small number of relevant observations have been made. Baron, Cowan, Ganz, and McDonald (1974) found a difference in performance on a shape discrimination task between those with an internal versus external locus of control, as measured by Rotter's Internal-External scale (Rotter, 1966), based on the type of feedback presented. However, rather than investigating positive versus negative feedback, Baron et al. (1974) measured intrinsic versus extrinsic feedback, defined as self-discovered feedback (i.e., intrinsic) and feedback given by the experimenter (i.e., extrinsic). Their findings were that participants with an internal locus of control performed better when receiving intrinsic feedback, while those with an external locus of control had better performance when given extrinsic feedback.

A study by Krenn, Wuerth, and Hergovich (2013a) measured the impact of the core self-evaluations, which consist of locus of control, self-efficacy, self-esteem, and neuroticism, on performance following feedback. As one of the core self-evaluations, locus of control was one of the traits that was analyzed in the study, as measured by the Questionnaire for Competence and Control Orientations (Krampen, 1991). The task used to measure performance involved counting the number of people appearing in short video clips. The experiment, however, did not observe an effect of locus of control or the core self-evaluations, as a whole, on performance. Overall, while locus of control has been theorized to impact the effects of feedback on performance, the results have been mixed, with some studies finding evidence of an effect (e.g., Baron et al., 1974), and other studies failing to find an effect (e.g., Krenn, Wuerth, & Hergovich, 2013a).

Hypotheses

The current study investigated the effects of feedback sequence on performance on a visual-spatial task. Specifically, a similar feedback sequence grouping to that of Krenn, Würth, and Hergovich (2013b) was utilized but with an added no-feedback control group. Based upon previous literature, with an emphasis placed on FIT, there are two primary hypotheses that were to be investigated in the current study. The first hypothesis was that feedback sequence would affect cognitive performance on a visual-spatial task. Consistent with the FIT theory, it was proposed that attentional focus following negative feedback would result in a lower level of cognitive performance. Therefore, it was expected that the feedback sequences ending in positive feedback (i.e., the positive-positive and negative-positive sequences) would result in superior cognitive performance than sequences ending in negative feedback (i.e., the negative-negative and positive-negative sequences). It was also predicted that the positive-positive sequence would result in the highest level of performance on the visual-spatial task, while the negative-negative sequence would produce the lowest level of actual performance. The no-feedback control condition was expected to yield performance in the middle of the five groups. The second hypothesis was that locus of control would mediate the effects of feedback sequence on performance. It was expected that participants with an internal locus of control would be more resistant to feedback effects, while those with an external locus of control would be more affected by feedback. In particular, it was hypothesized that the performance of participants with an external locus of control would be at a lower level than those with an internal locus of control when receiving feedback sequences that ended with negative feedback.

CHAPTER III

METHOD

Participants

A total of 23 females ranging from ages 18 to 38 years (*M* = 20.17, *SD* = 4.13), and four males ranging from ages 19 to 22 years (*M* = 20.00, *SD* = 1.41), participated in the study. All participants were students from Central Washington University recruited through the department's online research participation board. Participants were incentivized with extra credit for the eligible psychology class of their choice, and were also entered into a drawing to win a gift card worth $10.00. Demographic information on age, sex, class standing, and college major were collected from all participants. Of the female participants, 43% self-reported their class standing as first-year, 13% as second-year, 17% as third-year, and 26% as fourth-year or later. Of the male participants, 50% self-reported their class standing as first-year, and 50% as third-year. For female participants, 39% self-identified as psychology majors, while 61% self-identified as majors in fields other than psychology. For males, 25% self-identified as psychology majors, while 75% self-identified as non-psychology majors. All procedures were approved by the university's Human Subjects Review Council (HSRC) prior to data collection.

Materials

Cognitive Task. The cognitive task used in this experiment was the hole-punch task with items similar to those on the Perceptual Ability section of the Dental Admission Test used as admission criteria for dental school programs throughout the United States. The hole-punch task had also been used previously in measures of feedback effects on cognitive ability (Raftery & Bizer, 2009). The task is a test of spatial perception similar to other measures of spatial ability such as the mental rotation task most famously used by Shepard and Metzler (1971). The hole-punch task involves showing two-dimensional drawings of a single sheet of paper being folded in unique patterns and, then, determining the effects of one or more holes being punched on a specific location of the folded pattern. The participant's task is to mentally unfold the sheet of paper and determine all the locations in which holes would appear. All of the patterns that were used in the current experiment have holes that appear cleanly along a 4 x 4 grid.

When the hole-punch task had been used previously in measures of feedback effects, participants were provided with five multiple choice answers of the ensuing pattern of holes (Raftery & Bizer, 2009). The current experiment did not involve multiple choice answers. Instead, participants were given a blank 4 x 4 grid and asked to mark the squares in the grid in which the holes would appear, and which squares would appear blank. This modification was implemented to increase the cognitive complexity of the task, which is an important factor in measuring the effects of feedback (Vancouver & Tischner, 2004), and also to provide a larger amount of useable data, as each square in the grid was used as a data point, in contrast to the binary correct/incorrect nature of a multiple choice selection. Specifically, each individual hole-punch item included 16 data points and four hole-punch items were included in each trial. Therefore, each of the three trials provided 64 data points, in contrast to the four data points that would have been generated by multiple choice selections. Having a larger set of data points made it more likely to detect differences between groups. To complete the hole-punch tasks, participants were provided with blank grids on paper, and filled them in using a pencil (see Appendix A for the hole-punch items).

Locus of Control Survey. To assess a participant's locus of control as internal versus external, participants completed the Internal Control Index (ICI), a 28-item questionnaire developed by Duttweiler (1984). The ICI involves the participant reading a statement with a blank in it (e.g., "When faced with a problem I ___ try to forget it.") and then filling in the blank with one of five options: Rarely, occasionally, sometimes, frequently, and usually. The possible score on the ICI ranges from 28 to 140 and each item has a range of 1 (*rarely*) to 5 (*usually*). Some items are reverse scored. A high overall score represents an internal locus of control, and a low overall score represents an external locus of control. In a population of junior college students, the ICI was measured as having a Cronbach's alpha reliability of .84 (Duttweiler, 1984), as well as having a significant negative correlation with Rotter's Internal-External scale, which also measures internal versus external control, albeit scaled in the opposite direction (Duttweiler, 1984). Thus, a high ICI score represents an internal locus of control, whereas a high score on Rotter's scale represents an external locus of control. In the current experiment, the ICI had a Cronbach's alpha of .81. See Appendix B for the full ICI scale.

Manipulation Check. The manipulation check included two items asking participants if they believed the feedback they were given during the experiment and how the participants evaluated their own performance on the task. These questions were presented after all other data collection was complete and can be found in Appendix C.

Procedure

Participants initially completed the demographic questions and the ICI scale. Then, participants took part in a short practice session of the hole-punch task, which was intended to familiarize them with the hole-punch task and how to fill out the provided grids. The participants were presented with two practice items in succession, with a criterion of 50% accuracy on one of the two items required to continue with the experiment. Those that did not achieve the 50% criterion on either of the first two practice items were presented with the first practice item again. If the 50% criterion was still not reached following the repeated item, the participant would have been excused from the study. None of the participants in the study failed to reach this criterion.

The experiment consisted of three trials, each including four hole-punch items. Each set of four items in each trial was held constant throughout the experiment, in order to equalize the difficulty level. There was a 5-minute time limit implemented for each of the three trials. Following each of the first and second trials, the participants' completed grids were collected and taken into another room to be "scored." Participants were then presented with pre-determined feedback, which consisted of either a high score (i.e., positive feedback), a low score (i.e., negative feedback), or no feedback (i.e., control). After the pre-determined feedback was presented, the next trial began. Following the third trial, rather than receiving feedback, participants were instead given the two-item manipulation check to measure whether they believed the feedback they were given during the course of the experiment. The participants were then debriefed with regard to the purpose of the experiment and the deceptive feedback they received. Informed consent was then reacquired.

There were five groups in the experiment, one for each of five feedback-sequence conditions. The feedback sequences consisted of: (a) positive-positive (i.e., positive feedback after trial 1 and positive feedback after trial 2); (b) positive-negative (i.e., positive feedback after trial 1 and negative feedback after trial 2); (c) negative-negative; (d) negative-positive; and (e) a no-feedback control condition. Pre-determined levels of positive and negative feedback were presented as the percentage of correct squares on the grid, and consisted of values in a particular range provided by a random number generator. By utilizing a random number generator set to specific parameters, the percentage value for the feedback varied between trials, even for groups that received the same feedback for both trials (i.e., the positive-positive and negative-negative groups). In addition, receiving a range of percentage values likely made the feedback given to the participants more believable. The range for the positive feedback was 80 to 90%, while the range for the negative feedback was 30 to 40%. The participants were also given a manipulated comparison of the average score from previous participants from the study, which were given a range of 50 to 60%. See Appendix D for the pre-determined feedback script that individual participants received.

The completion time for each trial was also recorded. While there was a 5-minute time limit for each trial, it was possible for participants to finish each trial in under 5 minutes. In these instances, participants were told to signal that the trial was complete by raising their hands. Time to completion was also tracked for a secondary purpose. Participants that completed any of the three trials in less than 1 minute were to be removed from the study, due to the likelihood that the participant was filling out the grids at random and not putting their full effort into the task. A similar cutoff was used by Raftery and Bizer (2009) due to participants not taking the task seriously, although those authors used a standardized z-score cutoff. None of the participants in the current study were excluded for this reason, as none of the participants completed any of the three trials in less than 1 minute. Time to completion was tracked via a stopwatch.

Statistical Analyses

The following data were collected from each participant: (a) the ICI score (range 28 to 140); (b) the score of the first hole-punch trial (range 0 to 16 for each of four items, range 0 to 64 for the entire trial); (c) the time to completion of the first trial; (d) the score of the second hole-punch trial; (e) the time to completion of the second trial; (f) the score of the third hole-punch trial; (g) the time to completion of the third trial; (h) demographic information; and (i) the results of the manipulation check. Each individual hole-punch item was scored as the number of correctly marked squares out of 16, and each trial which consisted of four items was scored out of 64, and then converted to a percentage. The score used for analysis was the percentage for each trial. Although data for all three trials were collected, only the data for the third trial were analyzed, as only the third trial data represented the effect of the entire feedback sequence, which was the focus of this experiment. Missing data were not possible for the hole-punch task, as leaving squares of the grid blank was expected to be common and was required for a high score. As well, no missing data on the ICI occurred for any of the participants in the present study.

Data on accuracy and time to completion on the third trial were to be analyzed using separate analyses of covariance (ANCOVA), with feedback sequence as the independent variable and locus of control score as the covariate in each analysis. If the assumptions were not met for the covariate portion of the ANCOVA test, two separate 5 (i.e., feedback-sequence) x 2 (i.e., internal versus external locus of control split) analyses of variance (ANOVA) were to be used instead. Post-hoc analyses for differences between groups was conducted using Tukey's HSD.

It was anticipated that there would be a significant difference between feedback sequence groups, with the positive-positive and negative-positive groups scoring highest on the hole-punch task, and the negative-negative and positive-negative groups scoring the lowest. It was also expected that locus of control score would mediate the effects of feedback sequence, as those who scored lower on the ICI would be more affected by the feedback sequence than those with higher ICI scores, especially for the positive-negative and negative-negative conditions.

CHAPTER IV

RESULTS

The current study was designed to examine the effects of feedback sequence on the cognitive performance of both males and females. However, only four males participated, resulting in males not being represented in all five conditions. Due to the scarcity of male participants as well as a well-documented sex difference in visual-spatial ability between males and females (Reilly & Neumann, 2013), data from male participants were excluded from statistical analysis. Visual inspection of the data for accuracy on the third trial showed that males ($M = 91.80$, $SD = 6.51$) had higher accuracy than females ($M = 84.85$, $SD = 9.83$) and, although this difference was not statistically significant in a preliminary *t*-test assessing potential sex differences in performance, the decision was made to exclude males as they were not present in all five conditions.

Performance

Data on accuracy on the third trial were originally intended to by analyzed using a one-way ANCOVA for the factor of feedback sequence with ICI score as the covariate. However, ICI scores did not meet the assumptions of an ANCOVA, failing the assumption of homogeneity of regression slopes. As a result and in order to retain ICI scores within the statistical analysis, ICI scores were transformed into a high/low split variable, where the 12 highest scores were designated as high and the 11 lowest scores were designated as low, coded as 1 (*high*) and 2 (*low*), resulting in further analysis via a two-way ANOVA and *n*s per cell ranging from 1 to 4. Levene's test for unequal variance was not significant, $F(9, 13) = 2.10$, $p < .11$. A two-way ANOVA for the factors of feedback sequence (5 conditions: Control, positive-positive, positive-negative, negative-negative, negative-positive) and ICI (2 conditions: High score, low score) revealed a significant main effect for feedback sequence on third trial accuracy, $F(4, 13) = 5.06$, $p < .02$, $n^2 = .55$, indicating that 55% of the variance in the performance of the participants was due to the feedback sequence. There was no main effect of ICI or interaction of the two factors. Post-hoc analysis of the main effect of feedback sequence, using Tukey's HSD, showed that accuracy in the no-feedback control condition (*M* = 71.88, *SD* = 4.42) was significantly lower than the negative-negative condition (*M* = 92.58, *SD* = 6.03, *p* < .009) and the positive-positive condition (*M* = 90.00, *SD* = 5.01, *p* < .02). The same analysis showed a strong trend toward a difference between the control condition and the negative-positive condition (*M* = 85.94, *SD* = 8.70, *p* < .07), as well as between the control condition and the positive-negative condition (*M* = 85.55, *SD* = 10.24, *p* < .10). It should be noted that these trends do not represent statistically significant differences between groups but are presented within this study in order to better address potential underlying factors influencing performance.

Visual inspection of the data show that the means of the two feedback conditions that received consistent feedback (i.e., positive-positive, negative-negative) were higher than the performance means following inconsistent feedback (i.e., negative-positive, positive-negative). Specifically, the negative-negative group scored the highest of all groups (*M* = 92.58, *SD* = 6.03), with the positive-positive group scoring the second highest (*M* = 90.00, *SD* = 5.01). The groups receiving inconsistent feedback, the negative-positive group (*M* = 85.94, *SD* = 8.70) and the positive-negative group (*M* = 85.55, *SD* = 10.24), scored lower and had a higher standard deviation. These differences were not statistically significant, however.

A two-way ANOVA for the factors of feedback sequence and ICI on completion time for the third trial showed no significant main effects or interaction. Levene's test for unequal variance was significant, $F(9, 13) = 4.32$, $p < .01$, suggesting a violation of the ANOVA assumptions. Given previous visual inspection of accuracy scores, it was noted that the negative-negative condition took longer to complete the task ($M = 289.75$, $SD = 12.97$) than did the positive-positive group ($M = 227.80$, $SD = 62.86$). See Table 1 for a summary of performance by feedback sequence group.

Table 1

Hole-Punch Task Performance by Feedback Sequence Group

Feedback Sequence		Third Trial Accuracy		Third Trial Completion Time	
Group	*N*	Mean (Percent)	*SD*	Mean (Seconds)	*SD*
Positive-Positive	5	90.00	5.01	227.80	62.86
Positive-Negative	4	85.55	10.24	264.00	72.00
Negative-Positive	5	85.94	8.70	271.00	47.36
Negative-Negative	4	92.58	6.03	289.75	12.97
No-Feedback	5	71.88	4.42	259.40	70.58
Overall	23	84.85	9.83	261.13	56.46

Correlations

Correlations were calculated between several variables. Significant correlations were found between college major as denoted by psychology versus non-psychology majors, and first trial accuracy, $r(21) = .61$, $p < .003$, second trial accuracy, $r(21) = .54$, $p < .009$, and third trial accuracy, $r(21) = .53$, $p < .01$, with non-psychology majors having higher accuracy scores. This correlation was observed when data from all five conditions were included in the analysis as well as when data from the control condition was excluded to account for their statistically significant difference from the other conditions. After removing those in the control group, the same variables produced equal or greater correlations; college major correlated with first trial accuracy, $r(16) = .71$, $p < .002$, second trial accuracy, $r(16) = .51$, $p < .03$, and third trial accuracy, $r(16) = .54$, $p < .02$. A significant correlation was also found between college major and the second manipulation check item (i.e., "I think the scores I was shown during the hole-punch task were accurate"), which was coded as a 5-point Likert scale of agreement ranging from 1 (*low agreement*) to 5 (*high agreement*), $r(21) = .53$, $p < .03$, indicating that non-psychology majors were more inclined to believe the feedback that they had been presented. One other notable significant correlation was found, which was between second trial completion time and the second manipulation check item, $r(21) = .49$, $p < .04$, where those that had a higher completion time for the second trial tended to agree that the feedback provided to them was accurate. These two variables don't appear to be related conceptually, and the correlation may just be an artifact of the small sample size. See Table 2 for a correlation table for selected variables from the experiment.

The second manipulation check item, which asked participants whether they agreed that the feedback they were presented during the task was accurate, showed a relatively high level of agreement throughout all conditions ($M = 3.83$, $SD = 1.15$). This indicates that the deception aspect of the experiment was likely successful, and that the feedback presented was believed to be accurate by the majority of participants.

Table 2

Correlation Table for Experimental Variables

Variable	Mean	*SD*	1	2	3	4	5	6	7	8	9	10	11
1. Age	20.17	4.13	--										
2. Major	1.61	0.50	.10	--									
3. ICI	104.70	11.78	.04	-.15	--								
4. First Trial Accuracy	86.75	11.17	.25	.61*	-.09	--							
5. First Trial Time	258.09	61.71	.10	.09	-.02	.23	--						
6. Second Trial Accuracy	86.21	9.42	.26	.54*	-.26	.67*	-.06	--					
7. Second Trial Time	239.48	68.99	.21	.17	-.21	.29	.74*	.19	--				
8. Third Trial Accuracy	84.85	9.83	.18	.53*	-.17	.67*	.02	.63*	.02	--			
9. Third Trial Time	261.13	56.46	.02	.23	-.05	.33	.56*	.32	.69*	.21	--		
10. Manipulation Item 1	2.52	1.04	.34	-.20	.19	-.28	-.08	-.32	.04	-.16	-.10	--	
11. Manipulation Item 2	3.83	1.15	.31	.53*	.08	.41	.23	.29	.49*	.25	.45	.24	--

Notes: * $p < .05$

CHAPTER V

DISCUSSION

The current study examined the effect of feedback sequence (i.e., positive-positive, positive-negative, negative-positive, negative-negative, and no-feedback) and locus of control (i.e., high in internal locus of control versus low) on accuracy and completion time on a visual spatial skills task (i.e., the hole-punch task). Feedback sequence had an effect on accuracy, but not on completion time, with the no-feedback condition (i.e., control condition) resulting in lower accuracy than the negative-negative and positive-positive sequences, and trending toward a difference between the no-feedback condition and the negative-positive and positive negative sequences as well. Locus of control did not influence either accuracy or completion time. Lastly, participant major was associated with performance accuracy as well as with the likelihood that the participant reported that they believed the feedback that they were given during the test.

Performance Effects and Ambiguity

The most important finding of the current study was that performance accuracy was influenced by feedback sequence. The most likely explanation for the difference between the performance of the no-feedback control condition and the performance of the four conditions that received feedback is that the ambiguity of performance in the absence of any feedback decreased accuracy in the no-feedback group. The hole-punch task was selected for the current experiment in large part because of its ambiguity and novelty, being a task that the participants had likely never performed before. Furthermore, participants were given only a brief practice session prior to the first trial, which helped maintain the participants' unfamiliarity with the task. Given that participants were unaccustomed to the task, significant doubt about their performance may have impeded performance but only in the condition that lacked any feedback. Thus, feedback, even of the fabricated variety, presents an individual with information on how they are performing and removes ambiguity and confusion. This ambiguity, which likely remained high in the control condition, may have contributed to the impaired visual-spatial task performance of those receiving no feedback.

The performances of the remaining four feedback sequence conditions further support the theory that ambiguity was responsible, at least in part, for the effect of feedback sequence. Although differences in performance among the feedback conditions were not statistically significant, the two feedback sequences with consistent feedback, the negative-negative group and the positive-positive group, had the highest and second-highest accuracy of all the groups. In contrast, those receiving inconsistent feedback, the negative-positive group and the positive-negative group, performed with lower accuracy than the consistent feedback groups, although these two groups still had higher scores than the no-feedback group. The lower performance of the inconsistent feedback groups, combined with the emphatically lower performance of the no-feedback group, strongly suggests that ambiguity and confusion was responsible for the differences in task performance.

The higher the level of ambiguity or confusion, the lower the level of performance. Ambiguity levels during the inconsistent feedback sequence conditions were likely to be high because of the large discrepancy between the instances of positive and negative feedback, which increased from 30-40% to 80-90% in the negative-positive condition, a large, and potentially confusing disparity. The feedback had the same magnitude of change for the positive-negative condition, but in the opposite direction. One method of assessing the degree to which ambiguity and confusion contributed to the performances among the feedback conditions would be to determine if a smaller degree of change between positive and feedback conditions could attenuate differences in performance. Alternatively, a more familiar task might result in a smaller effect, due to less ambiguity about performance, even when no feedback is given.

Previous research on feedback has shown evidence that ambiguity has a negative effect on performance. Schmidt and DeShon (2010) found a negative correlation between level of ambiguity of performance, which was manipulated by either displaying or not displaying the number of possible solutions for a problem, and performance on an anagram task. The performance of participants was worse when ambiguity was present. A similar finding was observed in a study by Darnon, Harackiewicz, Butera, Mugny, and Quiamzade (2007) which found a negative correlation between uncertainty and performance in a reading comprehension test. In that study, uncertainty was simulated by a faux cooperative task where the partner, who was actually predetermined text on a computer screen, would disagree with the answer that the participant gave. Participants in the uncertainty condition performed worse on the reading-comprehension test. Thus, the current study expands the literature indicating that ambiguity of performance has a detrimental effect on cognitive performance in visual-spatial tasks.

An interesting implication of ambiguity being responsible for the poorer performance of the no-feedback group is that fictitious feedback is better than no feedback at all. Such a finding could have practical applications in situations where it would be too costly or time-consuming to actually evaluate and grade the performance of individuals. Instead of failing to provide feedback, giving individuals fake feedback, particularly consistent fake feedback, would appear likely to raise the performance of those individuals on tasks in which their performance is uncertain or ambiguous. There is some research support for this idea. A study by Lipnevich and Smith (2009) measured performance of college students on essay exams for those receiving grades, detailed feedback, and combinations of those variables. The group that received no grades and no detailed feedback performed the worst of all the groups on the final exam, indicating that the mere presence of any type of feedback tended to improve performance, at least in relation to those who do not receive any feedback.

Alternate Theories

While ambiguity seems to be the most likely explanation for differences in performance, there are other alternative explanations that bear consideration. One explanation would be that the type of feedback impacts the level of attention that participants pay toward the task, resulting in differing levels of performance. However, the leading attention-based theory of feedback, the FIT, put forth by Kluger and DeNisi (1996), does not apply to the no-feedback condition, as no feedback was given to increase or decrease the amount of attention the no-feedback group paid to the task. The fact that feedback sequence did not have an effect on completion time in the current study also provides evidence against an attention-based explanation for the difference in performance.

Specifically, if differences in performance had occurred due to increased attention to the task or, in the case of FIT, possible increased attention away from the task, it would be reasonable to expect a difference in completion time based on feedback sequence. This was not the case in the current study, as completion time did not vary significantly among conditions. While it should be mentioned that visual inspection of completion data indicate that the negative-negative group took longer than the positive-positive group to complete the task, this difference in completion time was not reflected with a difference in accuracy between these two groups. In terms of completion time, the no-feedback group had the second-fastest completion time of the five groups, meaning that the no-feedback group did not manifest a notably higher or lower completion time than the other groups. Such a finding suggests that attention-based explanations cannot account for group performance differences on the hole-punch task in the current study.

Another alternative explanation for the difference observed in task performance would be something akin to the Hawthorne effect (Landsberger, 1958) in which performance of individuals tends to increase, at least temporarily, when they know they are being evaluated. It is possible that higher performance was achieved in the four conditions receiving feedback due to those participants being told prior to the start of the first trial that their performance would be scored and compared to the average score of previous participants even though that feedback was ultimately fictitious. In contrast, participants in the no-feedback group were not told that their performance would be scored and compared. The Hawthorne effect could have resulted in increased performance in the groups receiving feedback because of an increased motivation to succeed from the knowledge that their performance was being graded or even because of the social comparison of having their scores compared to the average of other participants.

While such an explanation may possibly have contributed to the difference in performance in the no-feedback controls, it does not appear especially likely given that it is probable that those in the no-feedback group expected their performance to be graded even in the absence of being told so, because most experiments of this type involve evaluation of performance. However, given the potential contribution of the Hawthorne effect to performance, it would be useful for future studies to assess the participants' belief that their performance was being evaluated. Alternatively, the impact of a potential Hawthorne effect could be examined in a modified version of the current experiment by including two no-feedback control groups, one group that would not be told about having their performance being graded, and a second group that would be told that they would be graded and receive feedback after the final trial. In this way, there would be one no-feedback group that did not expect to receive feedback, and one no-feedback group that did expect to receive feedback after completion of the experimental session. If the no-feedback group that expected feedback significantly outperformed the first no-feedback group that did not expect feedback, it could be assumed that the Hawthorne effect contributed, in part, to the differences between groups observed in the current study.

Locus of Control Effects and Correlations

The present study also investigated whether locus of control had an impact on how the feedback sequence affected performance on the hole-punch task. As locus of control describes how much control individuals have over the events that occur in their lives, it was hypothesized that those with a higher internal sense of control and a belief that they could change future outcomes would have a more positive response to negative feedback than would those with a higher external locus of control. The prediction, therefore, was that those with a higher internal sense of control would have higher performances after negative feedback; however, the current study found no performance effects associated with locus of control. There are possible explanations for this. In part, the small sample size resulted in some groups having only one instance of either high locus of control or low locus of control, resulting in little or no variability and substantially limiting the ability to detect such differences using inferential statistics.

Another pertinent observation is that, in the current sample of participants, the overall range of scores on the ICI was fairly limited with few participants scoring in the lower ranges of the ICI. In fact, only one participant actually scored below the middle value of possible scores, which would be interpreted as having an external locus of control. All the other participants had higher scores on the ICI scale, representing an internal locus of control. Thus, in the current sample, there may not have been enough participants with a low ICI score, representing an external locus of control, to truly assess the impact of variability in locus of control on performance. Prior research testing whether locus of control impacts the effects of feedback has found mixed evidence (Baron et al., 1974; Krenn, Wuerth, & Hergovich, 2013a), and the current study's results do little to provide clarity to our muddled understanding of how locus of control impacts feedback effects.

Correlations among variables in the current experiment were also analyzed, in an attempt to better understand the intricacies of feedback effects. Several notable correlations emerged from this analysis, the most interesting being a relationship between college major, which was separated into psychology and non-psychology for the study, and performance. The non-psychology majors had higher accuracy on all three trials of the hole-punch task than did psychology majors. This difference in performance, at least for the third trial, may be confounded with feedback sequence condition, as the low-performing control group had more psychology majors than any other group, lowering the collective score of the psychology majors. However, if feedback sequence grouping were the sole explanation for this difference, first trial performance, which occurred before any feedback had been given should not have differed.

Another relationship was found involving college major, this time with the second manipulation check item, which asked whether the participants agreed with the statement "I think the scores I was shown during the hole-punch task were accurate." This correlation indicated that psychology majors were less likely to agree with the statement than non-psychology majors, possibly as a result of their increased knowledge of psychological experiments, and potentially being more alert to manipulation attempts. There were no correlations found regarding age; even years in college did not strongly correlate with age. The fact that age was not correlated with performance or completion time indicates that the cognitive interference resulting from the level of ambiguity of performance does not appear to be related, or mediated, by age or years in college. Of course, the age range of the participants was, with one exception, between the ages of 18 and 23, which did not offer a great deal of variability in which to detect a difference. A study on a younger age-range might shed light upon a possible developmental difference in the effects of feedback sequence. Alternatively, larger sample sizes in each condition might result in more age variability and, potentially, a better ability to examine any relationship between age and performance.

Study Limitations

There were ultimately several shortcomings of the present study, most paramount being the aforementioned small sample size. As previously noted, the trends for differences between the no-feedback group and the negative-positive and positive-negative feedback groups do not represent statistically significant differences but were presented within this study in order to better address potential underlying factors influencing performance. In particular, the goal in presenting those trends was to minimize the risk of type II error given the small sample size. Furthermore, a power analysis was conducted to determine optimal sample size, and assuming a medium effect size (0.25) and a power of .8, a sufficient sample size of 302 participants was indicated. As noted previously, the sample size was so limited for male participants that only female participants' data were included in the statistical analysis. Visual inspection of performance in males and females suggest that males were more accurate on the task than females, which is expected given the well-established research on sex differences in visual-spatial tasks (Reilly & Neumann, 2013). Ideally, an analysis would include the individual difference variable of sex in order to evaluate potential sex differences in feedback sequence effects. The admittedly very small amount of male data that was gathered during the study suggests there may indeed be a sex difference in feedback sequence effects, as the only participant to score 100% on accuracy during the third trial was actually the sole male in the no-feedback group, a stark contrast to the poor performance of the females in the no-feedback group. Obviously, no meaningful inferences can be drawn from this single example, but it does prove an interesting anecdote and underscores the importance of evaluating sex differences in future iterations of this type of experiment.

While special attention was paid to ensure that all participants received the same instructions on how to perform the hole-punch task, questions from the participants were allowed, and the time spent in the practice session was variable between participants. Most of this variance occurred due to those participants who struggled to grasp the task and tended to ask more questions, resulting in a longer time to master the task during the practice session. An improved design for future studies would include less reliance on verbal instruction, possibly by employing a brief video demonstration of the task being performed or by allowing the participants to physically fold a piece of paper and punch holes for at least one of the practice items. Such measures might help to reduce variability across participants due to potential differences in their understanding of, and subsequent performance on, the task during the practice session.

Another way in which the current study could have been improved is by increasing the time limit for each trial. The 5-minute time limit enforced in the current study did appear to be sufficiently long for the vast majority of participants to complete the task given that 96% of participants marked at least one hole for each item throughout all three trials. However, a longer time limit may have resulted in a greater variance in completion time among the participants, allowing possible effects of condition on completion time to be unmasked. Evidence of this comes from the fact that 52% of the participants used the entire 5-minute period in the third trial and 51% used all 5 minutes throughout all three trials. Several of the participants actually finished with the trial prior to the 5-minute time limit, but visibly used the remaining time to recheck their answers. A longer time limit would likely result in greater variability in completion time, resulting in that measure more accurately reflecting the difficulty some participants had with the task.

Conclusion

Ultimately, the current study found an effect of feedback sequence on cognitive performance. In contrast, locus of control had no effect on performance. The difference in performance based on feedback sequence was due to the low accuracy of the no-feedback group, as compared to the negative-negative and positive-positive groups. This difference is most likely the result of performance ambiguity interfering with cognitive task performance, a theory supported by the rankings of the other feedback-sequence groups on performance during the task. However, the small sample of participants in the current study is a limiting factor, possibly obscuring or attenuating group differences that could have provided a better understanding of feedback sequence effects. The cumulative effect of feedback is still not fully understood, and further research is desired. A long-term goal of this future research should be to establish an ideal ratio of positive to negative feedback that facilitates maximum performance from each individual.

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APPENDIX A

Hole-Punch Task

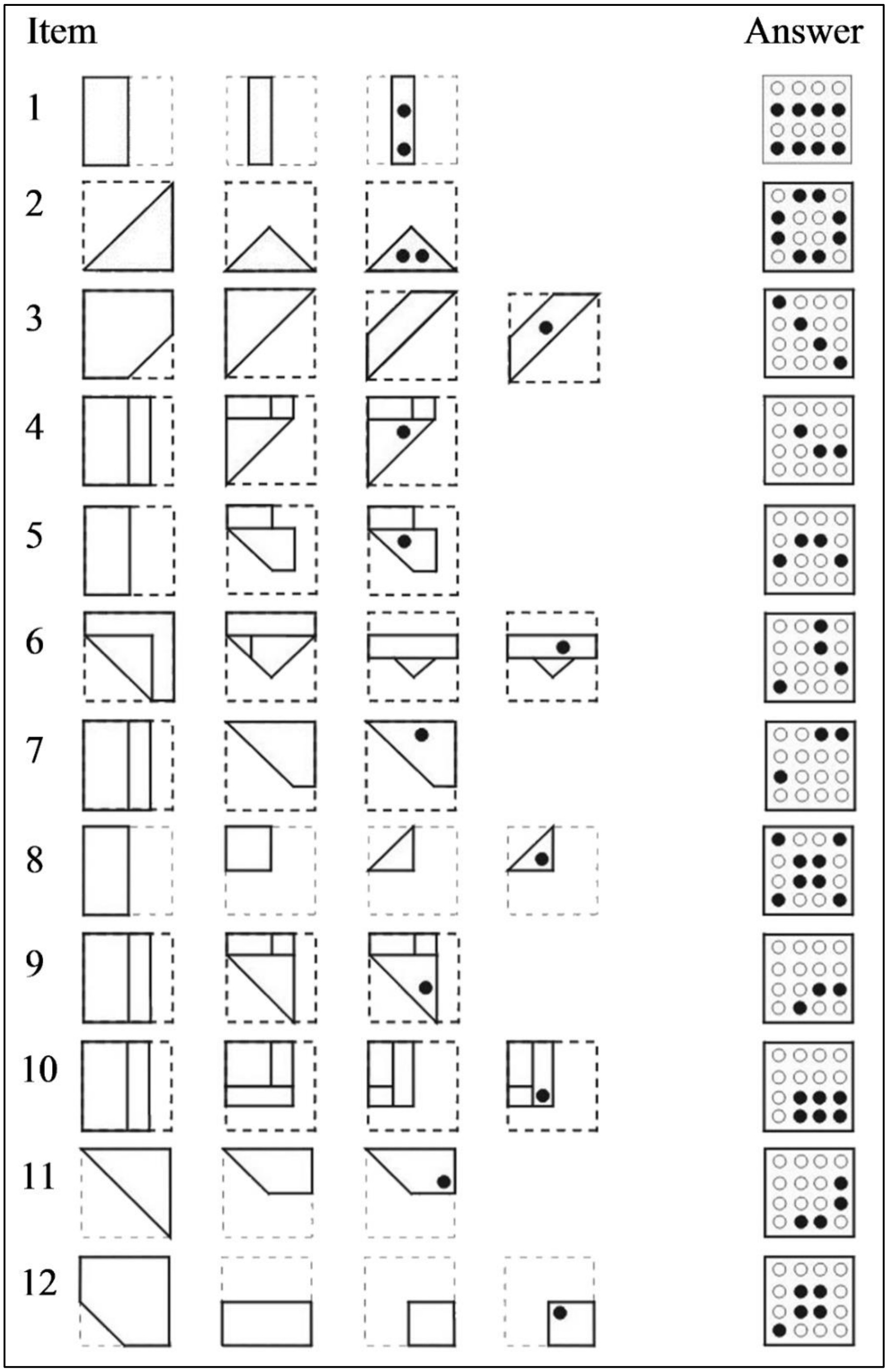

Figure 1. Hole-Punch Task. The 12 hole-punch items that were used in the experiment, with their correctly filled-in grids on the right.

APPENDIX B

Internal Control Index

Instructions: Please read each statement. When there is a blank _____, decide what your normal or usual attitude, feeling, or behavior would be.

1	2	3	4	5
(Rarely)	(Occasionally)	(Sometimes)	(Frequently)	(Usually)

Write the number that describes your usual attitude or behavior in the space provided.

1.	When faced with a problem I _____ try to forget it.	
2.	I _____ need frequent encouragement from others for me to keep working at a difficult task.	
3.	I _____ like jobs where I can make decisions and be responsible for my own work.	
4.	I _____ change my opinion when someone I admire disagrees with me.	
5.	If I want something I _____ work hard to get it.	
6.	I _____ prefer to learn the facts about something from someone else rather than have to dig them out for myself.	
7.	I will _____ accept jobs that require me to supervise others.	
8.	I _____ have a hard time saying “no” when someone tries to sell me something I don’t want.	
9.	I _____ like to have a say in any decisions made by any group I’m in.	
10.	I _____ consider the different sides of an issue before making any decisions.	
11.	What other people think _____ has a great influence on my behavior.	
12.	Whenever something good happens to me I _____ feel it is because I’ve earned it.	
13.	I _____ enjoy being in a position of leadership.	
14.	I _____ need someone else to praise my work before I am satisfied with what I’ve done.	
15.	I am _____ sure enough of my opinions to try and influence others.	

16.	When something is going to affect me I _____ learn as much about it as I can.	
17.	I _____ decide to do things on the spur of the moment.	
18.	For me, knowing I've done something well is _____ more important than being praised by someone else.	
19.	I _____ let other peoples' demands keep me from doing things I want to do.	
20.	I _____ stick to my opinions when someone disagrees with me.	
21.	I _____ do what I feel like doing not what other people think I ought to do.	
22.	I _____ get discouraged when doing something that takes a long time to achieve results.	
23.	When part of a group I _____ prefer to let other people make all the decisions.	
24.	When I have a problem I _____ follow the advice of friends or relatives.	
25.	I _____ enjoy trying to do difficult tasks more than I enjoy trying to do easy tasks.	
26.	I _____ prefer situations where I can depend on someone else's ability rather than just my own.	
27.	Having someone important tell me I did a good job is _____ more important to me than feeling I've done a good job.	
28.	When I'm involved in something I _____ try to find out all I can about what is going on even when someone else is in charge.	

APPENDIX C

Manipulation Check

Please circle the number that best represents how much you agree or disagree with the following statements.

1. I performed well on the hole-punch task.

1	2	3	4	5
(Disagree)				(Agree)

2. I think the scores I was shown during the hole-punch task were accurate.

1	2	3	4	5
(Disagree)				(Agree)

APPENDIX D

Feedback Script

First Set:

Below are **<u>your score</u>** and the **<u>average score</u>** of previous participants on the set you just completed. 100% represents a perfect score.

<u>Average score</u> of previous participants on first set: ___________ %

<u>Your score</u> on first set: ___________ %

Second Set:

Below are **<u>your score</u>** and the **<u>average score</u>** of previous participants on the set you just completed. 100% represents a perfect score.

<u>Average score</u> of previous participants on second set: ___________ %

<u>Your score</u> on second set: ___________ %