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Ironic Effects of Mental Control in Problem Solving: Evidence for the Implementation of Ineffective Strategies

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ABSTRACT

The ironic effect of intending to solve problems was examined in this study. Previous research has demonstrated ironic effects of mental control for numerous behavioral and cognitive processes. In this study, subjects were either asked to solve problems, or they were asked to solve the same problems as quickly and efficiently as possible. Based on previous demonstrations of ironic effects of mental control, it was expected that those exercising the greatest mental control would have the poorest performance. Results indicated that those subjects trying to solve problems quickly and efficiently actually solved fewer problems and committed more errors than those who were not intended to work quickly and efficiently. Furthermore, there is evidence that this ironic effect of mental control in problem solving was associated with the use of different strategies. The use of ineffective strategies is suggested as one explanation for the ironic effects of mental control.

INTRODUCTION

The theory of ironic processes of mental control suggests that in some situations, the process of intending to take some action can ironically lead to counter-intentional behaviors (Wegner, 1994). That is, by intending to do something, we sometimes find ourselves doing just the opposite. These ironic effects of mental control have recently been demonstrated in a number of domains, including thought suppression (Wegner & Zanakos, 1994), relaxation (Wegner, Broome, & Blumberg, 1997), sleep onset (Ansfield, Wegner, & Bowser, 1996), and motor

behaviors (Wegner, Ansfield, & Pilloff, 1998). In the present study, ironic effects of intention were investigated for subjects engaged in problem solving tasks.

According to Wegner & Pennebaker (1993, p. 1), "Mental control occurs when people suppress a thought, concentrate on a sensation, inhibit an emotion, maintain a mood, stir up a desire, squelch a craving, or otherwise exert influence on their own mental states." Quite a few studies have established that mental control can backfire, leading to cognitive or behavioral outcomes opposite of those that were intended. For example, people trying to fall asleep quickly tend to stay awake longer (Ansfield, Wegner, & Bowser, 1996). When people try to relax, they tend to produce elevated physiological indications of anxiety (Wegner, Broome, & Blumberg, 1997). Wegner and Zanakos (1994) found that when people try to suppress particular thoughts, they tend to find those very thoughts more accessible or intrusive. Recently, research in this lab revealed that when people tried hard to remember information, they tended to remember less than people who were not trying hard to remember (Hart & Randell, 2006). In the aforementioned studies, ironic effects of mental control typically arose when subjects were placed under conditions of elevated cognitive workload. While ironic effects do not occur every time mental control is exercised, they are certainly not isolated to a narrowly defined set of circumstances.

The concept of ironic effects of mental control is not new to psychology. Over a century ago, Freud (1901/1938) noted that an attempt to carry out one action can result in the production of an opposite or counter-intentional action. Wegner (1994) recently termed these failures of mental control that are in opposite directions of one's intended actions *ironic effects of mental control*. Wegner suggested that ironic effects of mental control tend to occur when high levels of workload cause mental control strategies to fail. Wegner's ironic process theory proposes that as mental control strategies fail, cognitive monitoring systems, operating outside of conscious awareness, increase the probability that effects opposite of those intended will be generated (Wegner, 1994). For example, if a person is trying to suppress a thought, there will be a conscious strategy employed to suppress the thought, and there will be a subconscious monitoring system that searches for evidence that the strategy is failing. That is, the monitor searches for evidence of the unwanted thought. According to Wegner, the conscious mental control systems sometimes fail when people are experiencing high cognitive workload. As these control systems fail, the subconscious monitoring system leads to the hyperaccessibility of the unwanted thought. Thus, the overall system failure leads to the ironic hyperaccessibility of the very thoughts one is trying to forget.

In this lab, we recently developed an alternative theory to account for ironic effects of mental control that we call *ineffective strategy implementation* theory (ISI). ISI suggests that when individuals exercise high mental control, they adopt new strategies in an attempt to alter their performance. These new strategies may be unproven, less effective, and more likely to fail as cognitive workload increases. As a consequence, high mental control often leads to the implementation of ineffective strategies, which leads to poor performance. While ISI has not been thoroughly examined, it does appear to be capable of accounting for the results reported in recent studies of ironic effects of mental control.

This study investigated whether ironic effects of mental control occur when subjects are consciously working hard to solve problems. Based on previous studies of ironic effects, it was expected that individuals who tried the hardest to solve problems would experience the most pronounced ironic failures. The hypothesis of this experiment was that a high level of intent to solve problems (high mental control) would be less effective than a lower level of intention to solve problems. Specifically, it was expected that an attempt to solve problems as quickly and efficiently as possible would result in poorer performance than if subjects were not attempting such a quick and efficient performance.

Another aim of this study was to determine if, in fact, subjects exercising high mental load appeared to utilize different strategies than those employing lower levels of mental control. According to ISI theory, there should be evidence that those subjects under high mental control use different strategies. In addition to performing worse, evidenced by solving fewer problems and committing more errors, it was believed that ironic failures would be associated with evidence of subjects using different strategies in their attempt to solve problems.

METHOD

Participants

Fifty-four male and female undergraduate students from introductory psychology courses served as participants in this experiment. Participation was voluntary. Informed consent was obtained from all participants in this study.

Design and Procedure

All participants were told that they would be attempting to solve word puzzle problems. Participants were randomly assigned to one of two groups. The two groups represented the two levels of the independent variable, mental control. The two groups differed in the problem solving instructions they were given. One group was told to simply solve the problems (low mental control), while the other group was instructed to solve as many problems as quickly and efficiently as they could (high mental control).

All participants were engaged in a word scramble task that required them to solve problems by rearranging four letter combinations in order to create words. For example, if participants were presented with the word scramble, *OWMR*, they would need to unscramble the letters and spell the word, *WORM*, on a sheet of paper. Similarly, if they were presented with the word scramble, *CKDU*, they would need to unscramble the letters and spell the word, *DUCK*, on the sheet of paper. All participants were given two examples of word scramble problems and their correct solutions prior to testing in order to ensure that all subjects understood the problem solving task. Participants were given a sheet of paper with forty-six of these word scramble problems. All participants were given three minutes to work on the word scramble problems, however, they were not told that a time limit was in place.

The three dependent measures for which data were collected were the number of correctly solved word scramble puzzles, the number of incorrectly solved word scramble puzzles, and the number of word scramble puzzles that were skipped. Correct solutions were

those that spelled out words found in Webster's New World dictionary (1984). Incorrect solutions were those that did not appear in the dictionaries. A skipped problem was defined as any word scramble problem for which a subject response was not provided, followed by a subsequent word scramble problem for which a subject response was provided. Correct and incorrect solutions were used to determine whether or not there had been ironic effects of mental control. Skipped problems allowed us to explore whether or not the participants in the two groups appeared to employ different strategies as suggested by ISI theory. This variable was selected as a result of observations made during a pilot study. It was observed that participants in the high mental control condition spent less time working on a problem before giving up and skipping ahead to another problem.

RESULTS

The Hotelling's Trace multivariate test indicated that there was a significant difference between the two sample groups, $F(3, 50) = 3.923$, $p < .05$. Univariate tests (independent *t*-tests) were used to examine group differences for each dependent variable.

The results indicated that there was a significant difference between the two groups in the number of word scramble puzzles solved, $t(52) = 2.537$, $p < .01$ (one-tailed), with subjects in the high mental control condition solving significantly fewer problems ($M = 18.62$, $SEM = 1.96$) than subjects who were in the low mental control condition ($M = 25.15$, $SEM = 1.66$). An analysis of data for the number of incorrect solutions revealed a significant difference between groups, $t(52) = 1.774$, $p < .05$ (one-tailed), with those in the high mental control condition generating more incorrect responses ($M = 2.19$, $SEM = .68$) than participants in the low mental control condition ($M = .89$, $SEM = .27$). An incorrect solution was defined as a solution to a word scramble puzzle that did not appear in English language dictionaries. These results are consistent with the prediction that ironic effects of mental control would occur when people tried to solve problems quickly and efficiently.

A third univariate analysis explored whether or not the subjects in the two groups appeared to employ different strategies as suggested by ISI theory. The specific hypothesis was that participants in the high mental control condition would skip more problems than those in the low mental control condition. An analysis of the number of problems skipped revealed a significant difference between groups, $t(52) = 1.706$, $p < .05$ (one-tailed), with participants in the high mental control condition skipping more problems ($M = 10.07$, $SEM = 1.81$) than participants in the low mental control condition ($M = 6.22$, $SEM = 1.36$). These results are consistent with the prediction that conditions associated with the production of ironic effects would also be associated with the use of different strategies.

DISCUSSION

The results of this study suggest that there are ironic effects of mental control for problem solving tasks. This finding adds to a growing body of evidence indicating that people exercising high levels of mental control experience ironic failures when compared to their counterparts who adopt less performance-driven approaches. Additionally, the apparent use of different strategies by individuals in this study is consistent with Ineffective Strategy Implementation theory. That

is, ironic failures associated with high levels of mental control may be due to the selection and implementation of strategies that are less than optimal for the task at hand.

Wegner (1994) suggested that ironic effects of mental control occur when conscious control mechanisms (i.e., the strategies) become overwhelmed by high cognitive workload, and an unconscious monitoring system continues to operate as the control system falters. According to Wegner, this monitoring system operating outside of conscious awareness begins to introduce thoughts of unsuccessful performance. These unconscious thoughts of the behaviors one is attempting to avoid begin to activate those very behaviors one had been attempting to evade. In the present case, Wegner's hypothetical unconscious monitor would be a system that constantly looked for examples of problems being solved slowly and inefficiently. The theory suggests that once the controlled problem solving processes began to fail, this unconscious monitor caused problem solving errors to occur. In the case of the present study, Wegner's theory can account for our observations; however, his theory does not account for the apparent differences in strategy between the two groups.

The results of this study, including the variations in strategy, do fit well with ISI theory. It seems that in many cases of ironic failures, people may simply be selecting and implementing ineffective strategies. For example, if people work hard to fall asleep quickly, they may adopt strategies such as counting sheep. As it turns out, these strategies might just increase mental activity, thereby ensuring that the person will stay awake longer than a person who has not implemented any conscious strategies whatsoever. Our ineffective strategy implementation theory suggests that when individuals are given some instructional cue to improve performance beyond levels with which they are accustomed, those individuals feel compelled to do something in addition to or different from what they typically do. They adopt a new strategy in order to affect such a change in performance. When we make an effort to exercise mental control over our problem solving capabilities, we inevitably call upon some strategy. That is, we try to do something in order to work faster. Because these novel strategies are untested, there is a chance that they are not wholly effectual. It may be that these ineffective strategies are selected without any explicit awareness on the part of the person. Cary and Reder (2002) noted that subjects select strategies and shift strategies without conscious awareness of the strategies or the factors that influence one's strategies.

Changes in cognitive workload may also lead to ironic failures of mental control. The application of new strategies necessitates shifting away from automatic processes toward more controlled processes. Controlled processes, by their nature, generate a greater cognitive workload than automatic processes (Jacoby, Yonelinas, & Jennings, 1997; Schneider & Shiffrin, 1977). It may be that these increases in cognitive workload contribute to the observed ironic effects. As people adopted controlled strategies in an attempt to increase problem performance, the additional cognitive workload burden might have depleted limited resources, causing a detectable drop in the pace of problem solving. Numerous studies have demonstrated that increases in cognitive workload can lead to such a decline in overall cognitive performance (Grasha, & Schell, 2001; Wickens, 1989). Further research will need to be conducted before any conclusion can be reached about the accuracy and value of ISI theory. However, this theory does appear to offer a plausible mechanism for ironic failures of mental control.

The outcomes of this study suggest that at times our attempts to expedite problem solving behaviors may result in poorer performance than one would expect otherwise. It might be that these ironic failures in problem solving are due to the selection of suboptimal strategies. Thus, by attempting to do a better job, we may be ironically performing actions that directly lead to inadequate performance or failure.

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