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IRONIC EFFECTS OF TRYING TO RELAX UNDER STRESS

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Summary—Two studies found that intentional relaxation under conditions of mental load or stress produces ironic increases in skin conductance level (SCL). In Experiment 1, participants instructed to relax under the high mental load of rehearsing a long number had higher SCL than those instructed to relax under low load, and tended to have higher SCL than those under high load not instructed to relax. In Experiment 2, participants were instructed to relax or were not so instructed while they answered questions described either as measures of IQ or as unimportant. Those in the more loading and stressful situation who were asked to relax had greater SCL during the questions than those not asked to relax.

INTRODUCTION

There are times in life when we feel anxious, stressed, and distracted, and it makes sense that at these times we try as best we can to relax. This never seems easy, however, and too often our efforts to cool down, withdraw, or calm ourselves seem to backfire—producing greater agitation than we had suffered before we even tried to relax. This research investigated whether trying to relax can produce such ironic effects, and whether the occurrence of such unwanted effects of intentional relaxation is indeed intensified by the presence of stressful or distracting conditions.

Paradoxical effects of intentional relaxation have been observed repeatedly among individuals who are dispositionally prone toward anxiety. Relaxation training aimed at people diagnosed with generalized anxiety disorder can yield relaxation-induced anxiety—an increase in signs of arousal prompted by the onset of intentional relaxation (Borkovec *et al.*, 1987; Braith, McCullough & Bush, 1988; Heide & Borkovec, 1983, 1984; Norton, Rhodes, Hauch & Kaprowy, 1985). Similarly, intentional relaxation efforts by those suffering from panic disorder often causes relaxation-induced panic attacks (Adler, Craske & Barlow, 1987; Cohen, Barlow & Blanchard, 1985). These effects have become so well known that the recommended practice for relaxation therapy now involves asking the client to tense and relax muscles alternately, without any specific instruction to 'relax' overall (Goldfried & Davison, 1994).

By and large, however, these phenomena have typically been explained by reference to the atypical states or processes of mind and body among people with anxiety disorders, and so have been understood as psychopathological manifestations rather than as an extension of normal processes (Barlow, 1988). The theory of ironic processes of mental control (Wegner, 1994) suggests, however, that the tendency to become aroused might result from intentional relaxation in anyone. It also proposes that this paradox is just one of a variety of counter-intentional effects that can accrue from the way in which mental control works. Evidence has accumulated for the theory's suggestions, for example, that thought suppression can lead to paradoxically high levels of activation of the suppressed thought (Wegner & Erber, 1992), that intentional concentration can increase the cognitive activation of distracters (Wegner, 1996), that intentional mood control can produce moods opposite those that are intended (Wegner, Erber & Zanakos, 1993), that intentional control of movement can prompt movements that are least wanted

(Wegner, Ansfield & Pilloff, 1996), that intentional attempts to sleep can induce wakefulness (Ansfield, Wegner & Bowser, 1996), and that intentional forgetting can produce remembering (Macrae, Bodenhausen, Milne & Ford, 1996).

Obviously, mental control does not always have these ironic effects, as it often proceeds quite successfully. The theory suggests that mental control succeeds, and also fails, as a result of the function of two subprocesses of mental control that fluctuate in their influence on the mind. One process is an *intentional operating process* that searches for mental contents consistent with the desired state of mind. So, for example, the person trying to relax might be thinking of relaxing thoughts or images, or reviewing relaxing bodily sensations. This operating process is conscious, effortful, and interruptible, and performs the 'work' of mental control. Accompanying this is an *ironic monitoring process* that searches for mental contents that indicate a failure to attain the desired state of mind. This process is unconscious, less effortful, but uninterruptible as long as mental control is exerted. In the case of intentional relaxation, the ironic monitor would search for thoughts indicating a failure to relax—to include, perhaps, arousing or stressful thoughts and images, as well as bodily sensations of arousal.

The two processes function together to produce the levels of mental control we usually enjoy. The operating process is typically more effective than the monitor, and it functions to activate desired mental contents. Whenever distractions reduce its efficiency, of course, mental control could fail. The monitoring process stays watchful for such failure. When such a lapse gains some preconscious activation, the monitoring process thrusts it into consciousness, so to reinstate the operating process and renew its efforts. In the case of intentional relaxation, this unconscious monitoring of anxious thoughts or sensations then allows for their control. At the same time, however, the monitoring process has the ironic effect of increasing the activation of the thoughts and sensations that the person is most hoping to avoid. Although the ironic process creates such activation only weakly, it can nevertheless create ironic effects on thought and behavior whenever the operating process is undermined for any reason.

This theory proposes, then, that when distractions, stresses, or mental loads impinge on the mind, they may not only undermine the operating process, but unleash the ironic monitoring process. This means that distractions do not merely reduce mental control to some 'zero' or baseline level. They may instead create counter-intentional or ironic effects by releasing the ironic monitoring process to activate precisely the least-desired thoughts, feelings, or actions.

If intentional relaxation functions as the theory suggests, it should be the case that people might find that their ability to relax themselves intentionally will become ineffective in the presence of mental loads, stresses, or other distractions. Indeed, intentional relaxation should ironically yield arousal under these conditions. Experiment 1 assessed this possibility by having normal participants attempt relaxation or not, while they were under either a high or low mental load imposed by the continuous rehearsal of a number. Experiment 2 examined this hypothesis among participants attempting to relax or not while taking an exam described as either important or unimportant. Self-report of relaxation was examined in the first study, and in both studies, electrodermal measures of arousal vs relaxation were taken.

EXPERIMENT 1

Method

Participants and design. Undergraduate students at the University of Virginia (n = 48) participated as a requirement for their introductory psychology class and were randomly assigned to the conditions of a 2×2 design. Participants were either instructed to relax or were not instructed to relax during a psychophysiological measurement period, and these instructions were combined with either a high or a low cognitive load. For this, participants attempted to remember either a 9-digit number (high cognitive load) or a 1-digit number (low cognitive load). Four participants failed to remember the 9-digit number and were not included in the analyses, so the final sample was 44 (21 men and 23 women).

Measurement of skin conductance level (SCL). The participant's SCL was measured by the standard procedure for finger electrode placement recommended by Fowles *et al.* (1981). After alcohol scrub, electrode conductivity gel was applied, and Ag/AgCl electrodes were adhered to the second phalanges of the first and third fingers of the participant's non-dominant hand with velcro fasteners. These electrodes were attached to a J & J Electronics I-330 PC-based SCL monitor, and readings taken every 10 sec were averaged by min.

Procedure. Participants were run individually by a female experimenter. The participant read and signed a consent form explaining that the experiment was about relaxation, and that sensors would monitor the body's physiological responses. The participant was seated in a comfortable chair, and a lapel mike and the SCL electrodes were attached. The experimenter pointed out a rating scale mounted in view, running from 1 (very little) to 5 (very much). The experimenter explained that the participant would report how he or she was feeling later on by indicating ratings on this scale. The experimenter went into the adjoining room and gave all further instructions by intercom.

After a pre-baseline period in which the experimenter made sure that the equipment was working, there was a 5-min baseline period when the participant sat in the chair and became accustomed to the lab and the equipment. Then, there was a 1-min question period in which the experimenter said, "Now I'm going to read you a list of 15 adjectives and I'd like you to rate each one based on how you feel right now using the 1 to 5 scale". The adjectives were: *relaxed, calm, sleepy, restless, bored, agitated, tranquil, happy, placid, composed, tired, anxious, tense, fidgety* and *upset*. There was then a 1-min baseline period when the participant sat quietly, followed by a 2-min instruction period in which the experimenter either talked the participant through a progressive relaxation protocol or not. When relaxation was not encouraged, the experimenter explained that it didn't matter whether the participant tried to relax or not during the session.

The progressive relaxation instructions were meant to help the participant relax different areas of the body in sequence (cf. Jacobson, 1938; Linden, 1990). The instructions were as follows:

> Okay, close your eyes, take a deep breath and hold it for three seconds, and then let it out slowly while counting to five in your head. Now take another deep breath, but this time as you exhale slowly, relax every muscle in your body. Inhale, and feel any tension in your facial muscles disappear, relax your jaw and your forehead. If your shoulders feel tensed up then try to press them down away from your neck. Remember to keep breathing and try to focus on a breathing pattern that is both even and relaxing. Let's continue relaxing the body by concentrating on the arms and the torso, let them feel heavy like they are weighted down and just sink into the comfort of the chair. Now try to make your hips and legs feel as heavy as the rest of your body, by letting your feet rotate to their natural turnout rather than trying to keep your inner ankle bones and big toes together. And now relax your toes and let them curl naturally rather than pointing them or tensing them. Before we continue, I want you to take one more deep breath and exhale while simultaneously letting your body sink into the chair. Now just continue to relax.

For the mental load manipulation, the participant was then told, "Now I'd like you to remember a number, and this is an important part of the experiment, so I'll keep repeating the number until you memorize it". A non-repeating 9-digit number was used for high load, and a 1-digit number for low load. The rehearsal of an 8- to 10-digit number is commonly used as a manipulation of mental load in research and has been checked as a manipulation repeatedly (e.g. Gilbert & Osborne, 1989; Wegner & Erber, 1992)—in that it typically interferes with other ongoing mental tasks. The experimenter shortened the longer number by 2 or 3 digits for those participants who said they could not memorize the number. Before the 5-min experimental period, participants in the relaxation condition were told: "For this next period, I'd like you to continue to relax while you remember the number". Participants in the no relaxation condition were told: "For this next period I'd like you to sit while you remember the number". Following the 5-min period, there was another 1-min question period in which the participants attempted to recall the number and then rated the adjectives again according to how they were feeling at that moment. Participants were then debriefed and thanked for participating.

Results and discussion

The manipulation of high mental load was expected to tax participants' cognitive resources, and this was demonstrated when 4 participants failed to recall at least 6 of the 9 digits in order following their experimental session. This error rate suggests, though, that these individuals may not have devoted the resources necessary for the task, and as noted earlier, their data were removed from subsequent analyses. (Analyses including their data do not alter the pattern of significant results.) All analyses were initially conducted with gender as a factor, but these did not reveal any main effects or interaction effects of gender and this factor will not be discussed further. All participants in the low cognitive load condition were able to remember the 1-digit number.

Skin conductance level (SCL). For all participants, the baseline SCL obtained after the adjective ratings but before the experimental instructions was subtracted from the mean SCL during the experimental period, yielding a single measure of SCL elevation during the experimental period. To investigate the effects of load and relaxation instructions, this measure was submitted to a 2 (high vs low load) $\times$ 2 (instruction to relax vs no instructions) analysis of variance (ANOVA).

The pattern of results was supportive of the ironic process theory prediction, but not conclusive. The analysis revealed a main effect for cognitive load, $F(1,40) = 8.86$, $P < 0.01$, $MSE = 0.6$, that is qualified by the anticipated interaction between load and instruction, $F(1,40) = 5.57$, $P < 0.05$. Tests of simple main effects showed that, as hypothesized, participants under low load who were instructed to relax had significantly lower SCL ($M = -0.728$) than those under low load who were not given any instructions ($M = 0.171$), $F(1,40) = 7.31$, $P = 0.01$. This, then, indicates successful relaxation when mental load was absent. However, under high load, participants instructed to relax had non-significantly greater SCL elevation ($M = 0.534$) than participants who were not given any instructions ($M = 0.255$), $F(1,40) = 1.35$, $P = 0.25$. Although SCL elevation in the high load condition was in the anticipated direction, the difference was not reliable in this study.

The ironic process theory would also suggest that mental load should increase arousal for individuals trying to relax, and this contrast was significant. When instructed to relax, participants under high load showed greater SCL elevation ($M = 0.534$) than participants under low load ($M = -0.728$), $F(1,40) = 14.38$, $P < 0.01$. This difference might seem attributable to the effect of cognitive load on SCL. If mental load were intrinsically arousing in this situation, however, then it should result in an increase in SCL in both instruction conditions. When given no instructions, though, participants under high load had no greater SCL elevation ($M = 0.255$) than participants under low load ($M = 0.171$), $F(1,40) < 1$.

Self-report of relaxation. To assess changes in self-reported levels of relaxation vs arousal, we began by conducting a principal components factor analysis with varimax rotation on post-experimental adjective ratings. This revealed four factors with eigenvalues greater than 1. The factors accounted for 71.7% of the variance, with the primary factor accounting for greater than half of that variance (36.9% of the total variance). An index of self-reported relaxation (Cronbach's $\alpha = 0.88$) was formed using the eight adjectives that loaded on the first factor. These included: *relaxed*, *calm*, *tranquil*, *happy*, *placid*, *composed*, and reverse-coded, *anxious* and *tense*, and the sum could range from 8 to 40.

An ANOVA revealed a main effect for relaxation instruction, $F(1,40) = 4.32$, $P < 0.05$, $MSE = 25.21$. Participants who were instructed to relax reported feeling more relaxed ($M = 32.46$) than participants who were not given instructions ($M = 29.30$). Cognitive load did not influence self-reported relaxation either directly or through interaction with instruction, $F < 2$ in each case.

Self-reported relaxation was not significantly related to SCL elevation, although the correlation was negative as might be expected, $r(42) = -0.23$. As such, the self-report measure indicates that participants under high load may not have been aware that their attempts to relax were unsuccessful. (Alternatively, demand characteristics within the experimental procedure may have led participants to report falsely that they had followed the relaxation instructions. The present study does not allow us to determine which possibility is the case.)

Summary. This study provides an indication that attempting to relax under cognitive load undermines relaxation as indexed by electrodermal activity. Although relaxation instructions yielded significantly reduced SCL for participants who were under minimal cognitive load, it did not significantly reduce SCL for those under high load—and instead the mean difference was reversed (although not significantly so).

EXPERIMENT 2

This study was undertaken to see if the ironic effect of relaxation under load would be observed more clearly under somewhat more stressful conditions. The prior study examined people whose only task was to sit in a chair and remember a number and this does not capture the conditions under which people usually wish themselves to relax. SCL elevation was relatively minor in all conditions, and self-reported relaxation was correspondingly quite high across all conditions. This may have contributed to the relatively small observed ironic effect, as there was little portent of arousal or anxiety for an ironic process to monitor.

In this experiment, participants were again instructed to relax or were not so instructed, but now with a more realistic manipulation of a stressful mental load. Some participants were given a series of test questions to answer aloud under the (presumably stressful) impression that these questions measured IQ. Others answered the same questions, but under the less stress-inducing impression that the questions were being evaluated. This manipulation of mental load departs somewhat from the simple cognitive manipulation used in the first study, and brings with it the possibility that the mental load itself might induce arousal. After all, the challenge of an IQ test might influence more than mere cognitive capacity and create affective and self-esteem-related changes as well. However, we judged such a manipulation as a more realistic simulation of the conditions under which people do choose to try to relax themselves. With the addition of a self-report manipulation check to test whether mental load was effectively influenced by this variation, we opted for this more active manipulation of mental load.

A second adjustment for this study was that the relaxation instructions were abbreviated from the lengthy protocol used in Experiment 1, such that the relaxation and no relaxation instructions were now of equivalent length. This change makes the study somewhat less reflective of therapeutic relaxation regimens, but as in the case of the load manipulation, perhaps somewhat more representative of what people might say to themselves under conditions of anxiety or distress.

Method

Participants and design. Undergraduates (47 women, 40 men) at the University of Virginia who participated as a course requirement were each randomly assigned to a condition of the 2 (Instruction: relax vs don't relax) × 2 (Mental load: high vs low) design. The study was run in two waves separated by several months.

Procedure. As in the prior study, participants began the session by having SCL electrodes attached. The experimenter then retired to the next room and informed the participant over the intercom that there would be several experimental tasks, the first of which was simply to sit in the chair for a 5-min baseline measurement period. Next, participants were given the instructions to relax or not to relax. The relaxation instructions were: "I need you to relax as much as you can. Using any technique, I want you to remove all anxiety, reduce all tension in your muscles, and become completely and totally relaxed. It is very important that you feel thoroughly relaxed for this part of the experiment. Please become relaxed as quickly as possible, but I will give you 5 min to achieve deep relaxation".

Non-relaxation instructions for the first wave of the experiment (n = 37) told participants that they should just "sit there" for the next 5 min. Post-experimental interviews indicated that some participants were attempting to relax under these conditions, so those in the later wave (n = 38) received more detailed instructions informing them that, not only were baseline readings being taken, but attempts to relax would adversely affect the results. They were instructed that "We are not interested in your ability to relax, and in fact, if you try to relax it may disturb our readings. Therefore, if you feel aroused or excited, please go ahead and experience those feelings".

After this 5-min pre-test period, the test was administered. During this time, participants answered questions that were either introduced as an intelligence test (high load) or as an assessment of some test items (low load). For the high load condition, participants were informed that "We are testing a new form of intelligence test. The problems will be given on audiotape, and they will come up quickly—so be sure not to fall behind in your answers. Because you are an intelligent person, we believe you will be able to complete most of the tasks correctly. Please do your best". The low load instruction announced that "We are pretesting a few problems for use in a later experiment with other subjects. Keep in mind that we are not really concerned about your scores—we just want to see how people generally respond to these questions. A lot of people do get these wrong, and we really don't care at this point".

The test was administered in two 90-sec parts by a tape player, and participants gave their answers aloud. (Between these parts, the relaxation or no relaxation instruction was briefly reiterated.) The parts of the test focused in turn on analogies and reverse digit recall. The first 30 sec involved instructions about the analogies: "You will hear a related pair of words followed by another word. Your task is to find a word that best expresses a relationship similar to the original pair. For example, if I say nicotine is to tobacco as caffeine is to blank, your answers might include coffee or Coca-Cola". This was followed by 60 sec for 9 analogy items. The next 30 sec were instructions about the reverse digit recall, which asked the participants to repeat in reverse order a series of numbers they had just heard. The final 60 sec allowed for 5 number series, each of which was longer and more difficult than the previous one. The order of the two test parts was counterbalanced across *S*s. Following the test, participants were given a post-test refractory period lasting 5 min and were asked to fill out a post-experimental questionnaire. On completion of the questionnaire, the participants were debriefed and dismissed.

The questionnaire checked for instances of panic disorder, and provided a check on the relaxation manipulation and mental load manipulation. Participants were asked to "Please rate the amount of pressure felt during the test" on a scale from 1 to 7 and to answer the question "How hard did you try to relax?" also on a scale from 1 to 7. Participants were also asked to describe what they thought was the hypothesis of the study.

Results and discussion

Initial analyses were undertaken to investigate the effects of study wave, participant gender, and counterbalanced order of the test parts. When these were included as additional independent variables in the ANOVAs, no significant interactive effects were observed that qualify the interpretation of the effects of instruction and load. Thus, these variables were not analyzed further. No participant successfully verbalized the hypothesis of the study.

Manipulation checks. Mental load was manipulated by varying participants' expectations about the nature of the test. Ratings of amount of pressure were submitted to a 2 (instruction) × 2 (load) ANOVA, which revealed the anticipated main effect for load, $F(1,83) = 5.00$, $P < 0.05$, $MSE = 2.80$, and no other significant effects. As expected, participants in the high load condition felt greater pressure to score well ($M = 4.52$) than did those in the low load condition ($M = 3.72$).

On the post-experimental questionnaire, participants were also asked to rate how hard they tried to relax. Analysis of these ratings revealed the anticipated main effect for instruction, $F(1,83) = 58.80$, $P < 0.001$, $MSE = 1.68$, and no other significant effects. The participants instructed to relax indicated trying harder to relax ($M = 5.44$) than those instructed not to relax ($M = 3.31$).

We did not expect that either cognitive load or instruction would influence participants' overall performance on the test. To check on this assumption, we examined the influence of these variables on test performance. No significant effects were revealed, all Fs < 1.3, $MSE = 0.01$. On average, participants answered 27.4% of the questions correctly (SD = 12.1%).

Skin conductance. SCL was recorded for each participant during each of three periods: 5-min pre-test, 3-min test, and 5-min post-test. As in the earlier study, SCL elevation over baseline was computed for each participant for each period. For this study, baseline SCL was highly variable at first, and also at the end of the baseline period. The baseline level was thus taken as the mean reading for the 90 sec of the 5-min baseline period immediately preceding the final 30 sec. Means for the 4 groups by minute are shown in Fig. 1.

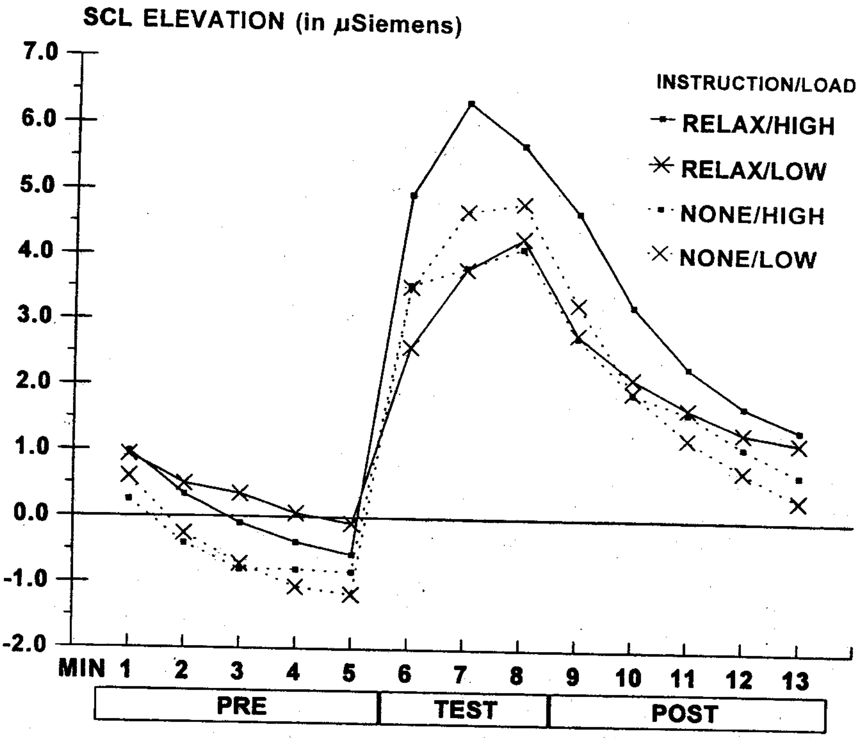

Fig. 1. SCL elevation by min during pre-test, test, and post-test periods in the instruction (relax, none) by load (high, low) conditions of Experiment 2.

We submitted the SCL elevation scores from the pre-test, test, and post-test periods to a 2 (load) × 2 (instruction) × 3 (period) ANOVA, with repeated measures on the third factor. The analysis revealed a main effect for period, $F(2,166) = 137.70$, $P < 0.001$, that was qualified by the anticipated 3-way interaction, $F(2,166) = 4.44$, $P < 0.05$, $MSE = 3.39$. To investigate this interaction, we analyzed the simple main and interaction effects of load and of instruction within each of the three time periods.

Within the pre-test period, a significant simple main effect of instruction indicated that participants instructed to relax were more aroused ($M = 0.20$) than participants not so instructed ($M = -0.52$), $F(1,83) = 7.75$, $P < 0.01$, $MSE = 1.43$. Neither group was particularly aroused as compared with the baseline. However, this finding indicates that there was an immediate ironic effect of the relaxation instruction in this experiment. It may be that the brief relaxation instructions, as compared to the more protracted progressive instructions used in the prior study, were more effective in yielding the expected ironic effect. Without instructions on how to carry out relaxation, and only with the admonishment to relax, participants became aroused before they even encountered the test period.

The pattern of means in the test period followed the ironic process prediction. As can be seen in Fig. 1, the group trying to relax under high load became particularly aroused during the test. This finding was indicated in a marginally significant simple interaction effect for the test period, $F(1,83) = 3.60$, $P < 0.07$, $MSE = 13.21$. Tests of simple main effects revealed that under low load in the test period, participants who were trying to relax were no more relaxed ($M = 3.58$) than participants who were trying to get excited ($M = 4.36$), $F(1,83) < 1$. However, under high load, participants who were trying to relax in the test period had higher SCL ($M = 6.02$) than participants who were not trying to relax ($M = 3.85$), $F(1,83) = 4.05$, $P < 0.05$. That is, cognitive load resulted in levels of arousal that were in the opposite direction of the participants' intentions. This load effect was most noticeable when participants were instructed to relax in the test period: participants who were under cognitive load had significantly higher SCL ($M = 6.02$) than participants who were not ($M = 3.58$), $F(1,83) = 5.16$, $P < 0.03$. When participants were not instructed to relax, those under load had no greater SCL than participants who were not under load, $F(1,83) < 1$. This suggests that the load manipulation during the test period was not intrinsically arousing, and only had the effect of increasing SCL if participants were trying to relax.

Within the post-test period, there were no significant simple main effects or interactions. And finally, a correlational analysis was conducted to examine relationships among SCL elevation and the self-reports of pressure felt during the test and of trying to relax. No significant correlations were found within conditions or across all conditions.

GENERAL DISCUSSION

These studies provide evidence that intentional relaxation in response to instruction can have ironic effects on electrodermal response. In Experiment 1, participants were instructed to follow a progressive relaxation protocol or were not given such a protocol, and then rehearsed either a long or a short number as a manipulation of cognitive load. Those instructed to relax under high load had higher SCL than those instructed to relax under low load, and also showed a tendency to have higher SCL than those under high load not instructed to relax. These results were suggestive of an ironic effect of relaxation under load. Experiment 2 was a conceptual replication that provided more conclusive evidence. Participants in this study were given brief instructions to relax or not, and then as a manipulation of mental load, answered aloud a series of questions described either as measures of IQ or as unimportant. Before the test, participants asked to relax had higher SCL than those not asked to relax. Then, during the test, those in the more loading and stressful question situation who were asked to relax had greater SCL than those not asked to relax, and also than those who were asked to relax in the less loading situation.

The results provide support for the theory of ironic processes of mental control (Wegner, 1994). They suggest that intentional relaxation may follow the pattern of other intentional mental control strategies, in that attempts at mental control under cognitive load yield not just control failure but the opposite of the intended mental state. Intended relaxation caused arousal among normal participants in these studies, at least as indexed by electrodermal activity. If this pattern holds in further research, the implications for the understanding of the intentional control of arousal and relaxation are several. Before we consider such implications, however, it is important to review what may be some key limitations on the generality and reliability of the observed effects in these experiments.

One limitation worth noting, is that the ironic effect of relaxation under mental load was observed here with just one psychophysiological measure—SCL. This measure was chosen due to its rapid response to psychological manipulations, and is generally responsive to even minor sympathetic nervous system arousal (Andreassi, 1989). It has been suggested that SCL may be particularly sensitive to attempts at cognitive inhibition (cf. Fowles, 1986; Pennebaker & Chew, 1985), however, and this possibility deserves consideration. If this were the case, the specific increments found here for participants under high load trying to relax might be interpreted as following from their active inhibition of the distracting load in the pursuit of relaxation. This possibility is contradicted by the finding that the direct instruction to engage in cognitive inhibition (e.g. "Don't think about the weather") does not increase SCL (Wegner, Shortt, Blake & Page, 1990). For this reason, an explanation based on a link between SCL and inhibition alone seems untenable. Still, given that self-reported relaxation did not parallel the ironic effects observed for SCL (when these were measured in Experiment 1), the limitation of the present results to the single SCL measure must be counted as a reason for concern about their generality.

The absence of self-report effects in the first study is itself a matter of some interest. In general, the ironic effects observed in past research have spanned both self-report and more behavioral and/or uncontrollable cognitive measures. So, for example, Wegner *et al.* (1993) (Experiment 1) found that individuals attemping to control their mood in a positive or negative direction while under mental load reported experiencing the mood opposite the one they were trying to produce. Research on ironies of motor control (Wegner *et al.*, 1996), thought suppression (Wegner & Erber, 1992), sleep onset (Ansfield *et al.*, 1996), and intentional forgetting

(Macrae *et al.*, 1996), on the other hand, has focused on behavioral or relatively automatic cognitive measures, and has uncovered ironic effects in all these domains. It may be that participants in the present case experienced ironic excitation when they tried to relax under load, but were not sufficiently aware of this change to be able to report it. The lack of a self-report index in the second experiment makes it difficult to evaluate this effect, and the nature of consciously reportable excitement in response to intentional relaxation thus remains to be examined in further research.

Another stipulation regarding these findings is that they are limited to intentional relaxation and may not extend to the control of arousal vs relaxation more generally. In particular, the studies did not examine the potentially mirror-image effects of intentional arousal, and this would be worth examining for at least two reasons. For one, the theory does predict that intentional arousal under load ironically increases relaxation, and it would be theoretically interesting to know whether this symmetrical effect is obtained. Another reason for such research would be to determine whether there are any peculiarities of relaxation-seeking under load that might have produced the observed ironic arousal effects. It might be, for instance, that intentional relaxation somehow magnifies the anxiety-producing effect of a mental load. Although our findings in both studies suggest that enhanced arousal due to load seems limited to conditions in which participants are trying to relax, it would be helpful to reverse the entire mechanism in an experiment and thereby rule out the possibility that mental load is somehow frustrating or threatening to people who are trying to relax.

Our finding that the ironic effect on SCL was more pronounced in the second study than in the first suggests some further observations. As mentioned earlier, the chief changes from the first study to the second were the abbreviation of the relaxation instructions and the introduction of a fairly arousing 'test' situation. We cannot determine whether one of these variables or mere chance prompted the stronger findings in the second study, but it is possible to suggest that these changes might have been pivotal. In departing from the quasi-clinical context of a progressive relaxation protocol and introducing the threatening element of a mental test, Experiment 2 may have captured more effectively the circumstance in which ironic effects of intentional relaxation may normally accrue. Just when people most want to relax, in other words, is when they may encounter ironically increased arousal.

The implications of this research for the use of progressive relaxation as a treatment for anxiety disorders are several. Perhaps the most basic implication is to suggest that mental load and/or stress are exactly the wrong conditions for the practice of relaxation therapy! Although these are the very conditions that normally precipitate the use of such therapeutic techniques, our results suggest that it is these conditions that are prone to yield ironic arousal rather than the intended relaxation. Beyond the relaxation-induced anxiety (Heide & Borkovec, 1983, 1984) and relaxation-induced panic (Adler *et al.*, 1987) found in clinical populations, therefore, this research suggests that there may be reason to be concerned about the production of *relaxation-induced-stress* in normal populations. People under load in everyday life who try to relax may find that they experience arousal as a result. It might be that if such arousal is met with further attempts to relax, the person could enter a self-perpetuating cycle yielding chronic arousal and/or anxiety. The finding that individuals with anxiety disorders are often high in anxiety sensitivity, a chronic fear of anxiousness itself (Reiss, Peterson, Gursky & McNally, 1986), is consistent with the notion that one source of the maintenance of chronic anxiety may be the ironic effect of intentional relaxation (cf. Wegner & Zanakos, 1994).

These findings also suggest that there may be ways in which relaxation therapy can be done 'right' or 'wrong'. As mentioned earlier, therapy training manuals (e.g. Goldfried & Davison, 1994) already recommend that simple admonitions to relax may not be as effective as more detailed instructions to relax one muscle area, another, and so on. This suggestion is consistent with our findings (particularly the increased level of the ironic effect in Experiment 2 when progressive relaxation instructions were not used, and a direct instruction to relax was given instead). It may be that in the practice of relaxation therapy, instructions that make the client too motivated to achieve relaxation could be problematic, yielding ironic effects more often than the intended effects. It might be helpful even to disguise the overall aim of relaxation procedures in some way, perhaps taking Goldfried and Davison's advice (Goldfried & Davison,

1994) one step further. Anxious clients who are given a paradoxical instruction to become anxious sometimes fare as well in relaxation as those who are instructed to relax (Schotte, Ascher & Cools, 1989), after all. The communication of therapeutic intentions that downplay the importance of mental control to the client might override tendencies toward relaxation-induced stress.

Our findings also may be relevant to understanding the role of intentional relaxation in the production of insomnia. Ansfield *et al.* (1996) have found that when people are instructed to try to sleep quickly ("in record time"), they have particular difficulty in the presence of a mental load—Sousa march music. The parallel between this effect and the present ironic relaxation findings is remarkable, and it suggests that there may be connections between the processes involved in intentional relaxation and intentional sleep onset. At a minimum, the phenomenology of the operating processes involved in both cases appears similar—as we all know what it feels like to try to relax or sleep by focusing our minds on relaxing or sleep-inducing thoughts and sensations. The ironic processes that yield wakefulness and arousal may also correspond in certain ways, and the possibility that the problems they produce may be interwoven is worth considering.

As a final note on these studies, it should be observed that the potential exists here for understanding a wide range of circumstances in which people seem to get excited inappropriately. When performance settings lead us to "choke under pressure" (Baumeister, 1984) or experience unwanted anxiety, it may be that the very desire to be calm and collected in these circumstances is the culprit in creating the unwanted somatic effects. In hoping to control our minds and bodies, we find that under mental load or stress they become particularly unwieldy—and unfortunately, this is partly the result of our own meddling. In these straits, we might be better off simply capitulating to our anxieties, so to overcome at least our own role in making them undermine our relaxation.

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