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Ironic Processes of Mental Control

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A theory of ironic processes of mental control is proposed to account for the intentional and counterintentional effects that result from efforts at self-control of mental states. The theory holds that an attempt to control the mind introduces 2 processes: (a) an operating process that promotes the intended change by searching for mental contents consistent with the intended state and (b) a monitoring process that tests whether the operating process is needed by searching for mental contents inconsistent with the intended state. The operating process requires greater cognitive capacity and normally has more pronounced cognitive effects than the monitoring process, and the 2 working together thus promote whatever degree of mental control is enjoyed. Under conditions that reduce capacity, however, the monitoring process may supersede the operating process and thus enhance the person's sensitivity to mental contents that are the ironic opposite of those that are intended.

> I am not more certain that I breathe, than that the assurance of the wrong or error of any action is often the one unconquerable force which impels us, and alone impels us to its prosecution.
>
> —Poe, *The Imp of the Perverse*

It sometimes seems that our desires to control our minds are met by an inordinate measure of failure. Whether we want to stop a worry, concentrate on a task, go to sleep, escape a bad mood, distract ourselves from pain, be humble, relax, avoid prejudice, or serve yet other mental goals, we find ourselves faltering again and again. Indeed, our attempts at mental control fall short so often that we may stop to wonder—along with Poe—whether there is some part of our minds, an imp of the perverse, that ironically strives to compel our errors. The theory of ironic processes of mental control makes precisely this claim.

Outline of the Theory

Ironic process theory holds that processes that undermine the intentional control of mental states are inherent in the very exercise of such control. According to this idea, the ironies of mental life are not just happenstance examples of the frailty of human endeavors but rather are logically entailed by the nature of mental control. The theory says that attempts to influence mental states require monitoring processes that are sensitive to the failure of the attempts and that these processes act subtly yet consistently in a direction precisely opposite the intended control. This means that when efforts to implement the intended mental control are undermined in any way, the monitoring process itself will surface and ironically overwhelm the intended control to yield the opposite of the mental state that is desired.

The Basic Idea

It does not take a great deal of psychological sophistication to notice that people have serious deficiencies in the ability to control their mental activities. Humans are thwarted not just by a frequent inability to think, want, or feel what they desire but by the all-too-common discovery that their efforts to control these things go beyond failure to produce effects diametrically opposed to their original intent. It is not just that we make errors, in other words, but that a large proportion of them fall into an especially aggravating category: the precisely counterintentional error. In a particular social situation, for instance, there may be some things to say that would be perfectly appropriate, many others that would be vaguely suitable or at least innocuous, and a few that would be perfectly disastrous—and it is those in the latter group that we find ourselves blurting out more often than we would like.

Precisely counterintentional inner states seem to populate our mental lives more than they carry into our outward expressions, and this is fortunate indeed. We may think, feel, or desire exactly the wrong thing much more often than we do it. Yet the number of times that precisely counterintentional errors happen in daily life seems excessive and even suspicious. Why is it that trying so hard sometimes seems to guarantee not just a failure of control but its ironic reversal? It is not just that we cannot sleep, for instance, or that we cannot stop thinking about food when on a diet; the problem is that the more we want to sleep or to banish food thoughts the more we fail. We stay awake worrying that we cannot sleep, and we spend all day mentally in the refrigerator when we are hoping to diet. The agony of mental control is this oppositional quality that always seems to haunt attempts to direct our minds.

The situation is not entirely dire, of course, because there are many examples of successful mental control in everyday life. People often concentrate or study effectively, distract them-

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selves from unwanted thoughts, control their emotions and moods, fall asleep when they try, relax their minds or bodies in anxious circumstances, squelch moments of pridefulness or braggadocio, hold back the impulse to be aggressive or prejudicial, and otherwise exert broad control over their psychological states. At times, in short, it seems people are quite adept at influencing their thoughts, emotions, and motives according to priorities represented in their conscious thoughts. Mental control appears to be a paramount function of human consciousness, an ability we have that arises from our capacity to reflect on our own mental activities and influence their operation (Wegner, 1989; Wegner & Pennebaker, 1993b; Wegner & Schneider, 1989). The fundamental issue for a general theory of mental control, then, is when we have it and when we do not.

The theory of ironic processes suggests that the central variable dividing successful control from ironic effects is the availability of mental capacity. In this view, the normal operation of mental control is often successful when there is adequate mental capacity to achieve control. When capacity is reduced for some reason (such as distraction, cognitive load, stress, time pressure, and so on), however, the intended control does not merely decline to some uncontrolled baseline or zero level. Rather, mental control exerted during mental load will often produce ironic effects, resulting in mental states that go beyond "no change" to become the opposite of what is desired. Desired happiness becomes sadness, desired relaxation becomes anxiety, desired interest becomes boredom, desired love becomes hate, and so on.

The potential for these ironic effects exists because of the nature of the processes that allow us the normal mental control we enjoy. The theory holds that normal and successful mental control occurs through two processes that work together to promote desired mental states: an intentional operating process that searches for the mental contents that will yield the desired state and an ironic monitoring process that searches for mental contents that signal the failure to achieve the desired state. So, for instance, when a person is trying to be happy, the operating process searches for mental contents pertinent to happiness, whereas the monitoring process searches for mental contents that indicate that happiness has not been achieved. Whereas the operating process is effortful and consciously guided, however, the monitoring process is usually unconscious, autonomous, and less demanding of mental effort.

The two processes produce mental control by cooperative interaction. The operating process creates the desired change by filling the mind with thoughts and sensations that are relevant to the desired state. The monitoring process searches surreptitiously for mental contents that indicate when control is needed, and so regulates whether or not the operating process will be initiated at any given time. If the monitor finds indications of control failure, it reinitiates the operating process. Because the monitor stays watchful of lapses in control, however, it keeps the mind sensitive to the mental conditions that indicate that intentional mental control is failing. Thus, when mental capacity is undermined and the operating process is limited, the sensitivity supplied by the monitor can be our undoing. Under mental load, intentions to control the mind unleash a monitoring system that not only searches for the failure of mental control but then tends itself to create that failure. The search for thoughts or sensations pertinent to failed control is sometimes enough to invite them into consciousness and thus subvert the intended control with precisely counterintentional error.

Traditions of Irony

An appreciation for the ironies of mental life can be found in the history of psychology, most clearly in three lines of thinking: Chevreul's analysis of movement opposing the will, Freud's early work on the counterwill, and Baudouin's statement of the law of reversed effort. These ideas foreshadow the present work in several respects, and it is important to review them to explicate the ironic process theory.

Movement opposing the will. One of the favorite phenomena of the spiritualist vogue of the 19th century was the apparently occult movement of the hand-held pendulum. A weighted body suspended by a string from the fingers was found to oscillate back and forth when concentrated on, seemingly of its own accord. This automatic movement was attributed to mystical forces and was exploited, among other things, ostensibly to divine the chemical composition of materials over which the pendulum was suspended. The French chemist Michel Chevreul (1833) conducted studies that uncovered the psychological character of such movement, debunked its ostensibly spiritual origins, and henceforth attached his name to the effect as the Chevreul pendulum illusion (Easton & Shor, 1976).

Chevreul discovered that the oscillations of the pendulum were entirely dependent on the involvement of the person holding it. The effect dissipated when the person's arm and hand were stabilized, and, more important, it vanished when the person was blindfolded. Modern analyses by Easton and Shor (1975, 1976, 1977) corroborated this conclusion. Chevreul came to understand the effect as a kinesthetic illusion: the causation of movement without the perception of one's own muscles initiating and maintaining the movement. He remarked on the "intimate link established between the execution of certain movements and the thought which is relative to them, although this thought is not the will which commands the muscular organs" (1833, p. 260). He believed that, as long as the person expected or believed in the possibility of movement, the effect would be likely to ensue. The critical condition for the occurrence of this illusion, though, was that the person was specifically not trying to move the pendulum.

As it turned out, other kindred phenomena of 19th-century spiritualism—from automatic writing and divining rods to ouija boards and talking tables—were eventually understood to operate on similar principles. Carpenter (1884) summarized the scientific viewpoint on some of these curiosities by saying that "in certain individuals and in a certain state of mental concentration, the expectation of a result is sufficient to determine—without any voluntary effort, and even in opposition to the will—the muscular movements by which it is produced" (p. 287). This was the beginning of the notion of ideomotor action, which was later popularized by William James. For our purposes, though, suffice it to note that the pendulum illusion was an early observation of an ironic effect, a behavior that is not only independent of the will but apparently in opposition to it. When one is intending not to move in a particular way, and

yet does so, one has produced a precisely counterintentional error.

Counterwill. One of Freud's experiments with the hypnosis of a hysterical patient led him to propose the concept of the counterwill (Freud, 1892–1893/1950). He was treating a woman who was having great difficulty breast-feeding her beloved newborn, and he observed that her desire to succeed in this intended endeavor was accompanied by "subjective uncertainty . . . represented by a collection of . . . 'distressing antithetic ideas' " (p. 121). He went on to propose that "when it comes to the carrying out of the intention, the inhibited antithetic idea can put itself into effect . . . just as easily as does a volitional idea in normal circumstances. The antithetic idea establishes itself, so to speak, as a '*counter-will*' " (p. 122). He maintained that the

> emergence of a counter-will is chiefly responsible for the daemonic characteristic which hysteria so often exhibits—the characteristic, that is, of the patients' not being able to do something precisely when and where they want to most passionately, of doing the exact opposite of what they have been asked to do, and of being obliged to cover everything they most value with abuse and suspicion. (pp. 126–127)

The idea of the counterwill is relevant to ironic processes in two respects. A first major resemblance is Freud's (1892–1893/1950) recognition that people might suffer from a problem that goes beyond mere "*weakness* of will . . . [to encompass] a *perversion* of will" (p. 123). That is, he anticipated the notion of the precisely counterintentional error. His theorizing went another step toward the present observation in the added suggestion that "the *antithetic* idea gains the upper hand as a result of general exhaustion" (p. 125). In essence, he observed that a lack of mental capacity could produce ironic effects of the will. He attributed such "exhaustion" uniquely to hysterical neurosis, however, and did not remark on the possibility that exhaustion-induced irony might occur in normal living. Rather than tracing the counterwill to mental control generally, Freud ascribed its operation specifically to suppression: "It is the suppressed—the laboriously suppressed—groups of ideas that are brought into action in these cases, by the operation of a sort of counter-will, when the subject has fallen a victim to hysterical exhaustion" (p. 126).

Even with these limitations, though, it is noteworthy that Freud's early understanding of hysteria presaged the ironic process idea so well. Eventually, as he elaborated on the notion of the counterwill in his more general studies of slips and errors, he lost track of this fundamental notion in the pursuit of an interpretive system that could accommodate a far wider range of error than the precisely counterintentional error (Freud, 1901/1960). In hopes of achieving a scheme rich enough to allow the understanding of all the various perversions and translations of the will that he envisioned, he abandoned the simplicity of irony.

Law of reversed effort. A third line of thinking on the foibles of mental control that antedates ironic process theory was proposed by Charles Baudouin (1921). Baudouin described his work as an elaboration of the principles of suggestion and autosuggestion devised by Emile Coué, founder of the movement called the second Nancy School of psychotherapy. Coué (e.g., 1917) was a proponent of the practice of affirmation or the rehearsal of positive thoughts and recommended a variety of techniques for mind control based on principles of repetition and autosuggestion (Paulhus, 1993). In his exposition of this approach, Baudouin formalized what he believed to be a basic principle of autosuggestion, the law of reversed effort, as follows:

> *When an idea imposes itself on the mind to such an extent as to give rise to a suggestion, all the conscious efforts which the subject makes in order to counteract this suggestion are not merely without the desired effect, but they actually run counter to the subject's conscious wishes and tend to intensify the suggestion.* (Baudouin, 1921, p. 116)

The examples that Baudouin (1921) offered of the operation of this law center on precisely counterintentional errors:

> This law of reversed effort is familiar in all its simplicity to everyone who has learned to ride a bicycle. When we are at length able to wobble painfully along, we see a big stone lying in the middle of the road, and we know that all our attempts to avoid it serve only to direct our steering wheel towards the obstacle, upon which it impinges with deadly precision. . . . This is something more than a quaint experience. It is an illustration of a law valid for all the obstacles we have to encounter in our path through life. (pp. 116–117)

Baudouin offered the law as a principled recommendation against direct efforts at the self-control of mental states. It was an admonition that the stronger the motive to achieve mental control, the more likely that reversed efforts would result. Baudouin (1921) wrote,

> We can concentrate voluntary attention upon any physical or mental modification we please . . . Yet now, when we concentrate voluntary attention upon the good idea which we are to substitute for the bad idea, when we devote all our energies to this substitution, what will happen? A reversal of effort, nothing more. The harder we try to think the good idea, the more violent will be the assaults of the bad idea. (pp. 122–123)

The conclusion indicated by these observations, at least to Baudouin, was that voluntary mental control is to be avoided.

The alternative to voluntary control of mind was described as the relaxation of attention, a process that involves, among other things, the avoidance of distractions and the recision of the intention to engage in control. There are thus glimmerings here of the notion that the availability of mental capacity determines whether mental control is effective or leads to the reversal of effort. Like Chevreul's pendulum and Freud's counterwill, the law of reversed effort stands as an early discovery of the remarkable frequency with which intentional efforts to influence the mind, often under conditions of restricted mental capacity, prompt the ironic occurrence of precisely counterintentional errors.

Mechanism of Mental Control

Mental control and its ironies flow from the operation of a simple mechanism: the interplay of an intentional operating process and an ironic monitoring process. This section explores this mechanism in some detail with a view toward specifying the nature of each process and the form of their interaction.

The notion that it takes at least two processes to control men-

tal functioning is, by itself, not new. In developing the study of cybernetics, Wiener (1948) observed that it takes two processes to control anything at all. Control involves changing something to a certain criterion, and processes are thus needed to provide both the change and the assessment of success in reaching the criterion. Miller, Galanter, and Pribram (1960) proposed accordingly that goal-directed behavior is the result of two processes: the "operate" and "test" mechanisms in a test–operate–test–exit unit or "TOTE" unit. Just as thermostats find a favorite temperature by operating the furnace and testing to see when it is warm enough, control theories suggest that people approach goals by performing goal-oriented behaviors and testing to see whether their goals are met.

Operating and monitoring processes have been proposed in several mental or cognitive control theories (e.g., Carver & Scheier, 1981; Powers, 1973; Uleman, 1989), and a variety of architectures of such control systems have been suggested. The present theory is unique in proposing that the two processes underlying mental control are cognitive search processes that increase the conscious accessibility of a range of stimuli. Each process in the mental control system is an attentional process in that it orients the person toward a particular set of inputs. In each case, when the process locates an item for which it has been searching, it increases the likelihood that the item will be brought to consciousness. The two processes differ, however, in their search target, degree of consciousness, effortfulness, and conditions of activation in the overall cycle of control. In the following discussion of the processes, each of these points of difference is considered in turn.

Operating Process

During mental control, the operating process endeavors to create the desired state of mind. It does this by searching consciously and effortfully for items consistent with the state and continues until this effort is undermined by distractions that require effortful processing.

Search target. The operating process orients the person toward items of sensation and memory that are consistent with the desired state of mind so as to increase the likelihood that the state will be achieved. Some mental states are, of course, primarily orientations of attention (e.g., concentration, suppression), and in these cases there is nothing beyond such orientation for the operating process to achieve; the initiation of the operating process entails the production of the desired state. Other more complex mental states—such as relaxation, joy, sleep, anger, belief, or the like—may include not only momentary cognitive orientations but more stable cognitive structures as well as key bodily states. The bodily accompaniments range from patterns of autonomic nervous system arousal to motor movements, facial expressions, and postures, even to patterns of brain activation and inhibition. To the degree that attention or disattention to certain thoughts can influence activities of this kind—and such influence is often far from perfect—the operating process extends beyond the control of attention to the control of complex mental states.

In general, the desire for a mental state creates an operating process that seeks items consistent with that state, whereas the desire to avoid a state creates an operating process that seeks items inconsistent with that state. That is, an operation can only bring items into consciousness, not avoid them or drive them away. In the case of the desire to concentrate on a difficult passage in a book, for example, the operating process is a search for the sensations provided by the passage as stimulus, perhaps along with a search for memory items relevant to the passage. The operating process in the case of desired thought suppression, in turn, also searches for items consistent with the desired state, but in this instance these would be items that are not the unwanted thought. The search turns to distracters in the attempt to provide mental control.

Consciousness. One of the fundamental problems left unsolved in past analyses of mental control processes has been how such processes not only influence the mind but at the same time occur within the mind. Mental control is, after all, a curiously reflexive business. The processes that attempt to influence consciousness must be compatible with the conscious states they are creating, because the processes of control may, on occasion, appear in consciousness themselves. This *reflexivity constraint* suggests that any processes of control that are represented in consciousness during the exertion of control must be compatible with the state of mind that is the goal of the control mechanism. The intentional operating process proposed here complies with this constraint because it is aimed only at items consistent with the intended state of mind. To the degree that the search process itself, along with any partial steps in its operation, is represented in conscious thought, these thoughts will not interfere with the intended state of mind.

The operating process is present in consciousness in that it is the "dominant action system" (Shallice, 1978), "current concern" (Klinger, 1978), or "prepotent act identity" (Vallacher & Wegner, 1987) at the point of its activation. It is also likely that individuals are aware of some of the operating system's ongoing efforts and are able to report on the occurrence of these as they are underway. If questioned, the operation is what people would say they are "doing" as their act of mental control.

Effortfulness. The operating process is effortful in much the same sense that controlled (nonautomatic) or resource-dependent cognitive processes are effortful (see Bargh, 1984, 1989; Hasher & Zacks, 1979; Logan, 1979, 1988; Navon & Gopher, 1979; Posner & Snyder, 1975; Shiffrin & Schneider, 1977). That is, the operating process is subject to interference from other attentional demands and does not necessarily resume functioning when these demands subside. It should be remembered, however, that the various criteria by which automaticity and control have been distinguished in past research are both logically and empirically separable. The observation that a process takes cognitive capacity, for instance, holds no necessary implication for the degree to which the process must be consciously guided (as opposed to autonomous) or might be open to voluntary initiation or inhibition (Bargh, 1989; Jonides, Naveh-Benjamin, & Palmer, 1985; Kahneman & Treisman, 1984). To say that the operating process is effortful, then, is to distinguish it from other processes that are relatively less vulnerable to interference from concurrent task demands.

Activation. The operating process is activated by the monitoring process. Whenever the monitor is satisfied that a failure of the intentional operation has been found, the operating process is reset to begin. This means that the operating process is

seldom continuous, and rather, it occurs cyclically in response to the monitor's signal of operating process failure.

As a rule, the initial intention to engage in mental control is the starting point for both the monitor and the operator. Because mental control is not likely to be attempted when it is already successful, the monitor typically indicates that the operation is failing at the outset and so initiates the operating process. From that point on, the operating process begins to work, absorbing the person's attention. This may happen indefinitely under conditions that do not invite attentional absorption in other tasks or trigger the monitor to discover that the operating process is failing. Normally, though, the efforts invested in the operating process are successful, and the person's attention becomes absorbed by stimuli consistent with the sought-for state of mind. Such absorption has the consequence of discontinuing the operating process. The individual who is trying to get into a good mood, for instance, might listen to a song on the radio, begin humming along, and then become absorbed in the song and no longer search for a mood-elevating experience. The song could take a sorrowful turn as the pedal steel guitar comes in, of course, and this could well be picked up by the monitor in its search for failed happiness. At this point, the monitor would initiate the operating process once again.

The operating process could also be set aside by other intrusive demands for mental capacity. Distracters of one kind or another from without or within could demand mental resources and thus sidetrack the operating process and reduce its effectiveness. It might be that the operation would subside completely in these circumstances, not to be renewed until some further initiation of the intention to engage in mental control resets the system. Alternatively, the operating process might retain sufficient capacity that it could survive the distractions and continue functioning without specific prompting by the monitor.

Monitoring Process

During mental control, the monitoring process searches continuously for sensations and thoughts that are inconsistent with the achievement of successful control. This search is not conscious, requires relatively little cognitive effort, and continues until the attempted mental control is terminated by a conscious choice.

Search target. The monitoring process searches for indications of the failure of mental control. Such a search process seems to be more efficient than processes proposed in other theories that search for indications of the success of control or that otherwise measure ongoing mental states against some "standard" or "reference value" (cf. Carver & Scheier, 1981; Powers, 1973; Uleman, 1989). These other potential monitoring systems require the processing of larger amounts of information than a simple failure search because they would need to sort through a wide array of mental contents, some of which indicate failure of the operating process, some of which indicate success, and some of which are irrelevant. Then, the degree of success relative to failure needs to be computed and proper parameters applied to allow a decision. A search simply tuned for failure acts as an especially uncomplicated monitor because it needs only to hold up a single template against which input can be compared. The monitor merely reviews potentially conscious material, noting those items that imply failed control and increasing their activation. This increases the likelihood that the items will surface in consciousness so that the operating process can renew its work.

The existence of a general error-monitoring system is suggested by the analysis of human event-related brain potentials (ERPs) accompanying errors. In particular, there is a regular ERP associated with errors in reaction time tasks (Gehring, Coles, Meyer, & Donchin, 1990). This error-related brain activity is observed shortly after the onset of electromyographic activity in the muscles of the limb that is about to make the error, and it peaks about 100 ms after its onset. The error-related ERP takes the form of a sharp, negative-going deflection of up to 10 μv in amplitude and is largest at electrodes placed over the front and middle of the scalp. The response is enhanced when subjects strive for accurate performance and is also related to attempts to compensate for the erroneous behavior. Such an ERP makes sense as an indicator of the proposed ironic monitoring process.

Neuropsychological findings also support an ironic error monitor that can be disabled, given certain patterns of damage to the brain. Luria (1966) identified such dysfunction among patients with massive lesions of the frontal lobes. The "frontal syndrome" he described amounted to a breakdown of voluntary activity accompanied by an inability to discern when actions are in error. He noted that a preponderance of cases of frontal lobe damage resulted in an inability to respond even to direct commands. A patient who is asked to squeeze a bulb repeatedly, for example, might squeeze a few times, after which the pressure of the squeeze gradually diminishes. The patient might repeat verbally "yes, squeeze" on each trial without making any movement. In other patients, the movement changes over trials into a series of related, uncontrolled movements, or the bulb is squeezed without stopping to the point that the patient must be instructed to let go. Luria noted that, characteristically, a patient who is asked to "squeeze three times," for example, would later respond to queries on the instructions by saying "yes, I squeezed three times" even though there were actually six squeezes or perhaps none at all. Contemporary neuropsychological theorizing suggests that such a syndrome is part of a lapse in "frontal control" (Stuss & Benson, 1987) that may permeate a variety of cognitive and memory systems in frontal lobe pathology. The key feature of such failed control is the patient's unawareness of errors of action, a seeming obliviousness to even the most conspicuous mistakes. Although research has not examined the connection of brain activity to ironic effects, the existence of a global error monitor is consistent with the proposed ironic monitoring process.

Consciousness. When the conscious monitoring of a mental state is attempted, ironic effects follow. In a seminal study by McFall (1970), for example, the effect of the conscious monitoring of smoking was manipulated by asking some smokers to count the number of cigarettes they smoked and asking others to count the times they thought of having a cigarette but did not smoke. The conscious monitoring of smoking increased actual smoking, whereas the conscious monitoring of nonsmoking decreased actual smoking. According to the ironic process theory, this intensification caused by monitoring is a normal part of the

control of any activity, mental or physical. The theory suggests that trying to quit smoking, for example, normally institutes a monitoring process that focuses on cigarettes smoked and so undermines the attempt to quit. The theory also holds that trying to start smoking, in turn, institutes the monitoring of cigarettes not smoked and thus undermines the attempt to start. McFall's results suggest that conscious monitoring, therefore, has the same effects that are produced ironically when monitoring processes are set into motion by the attempt at mental control.

During mental control attempts, however, the monitoring process is usually not reflected in conscious thought. Although conscious monitoring of smoking could coexist with attempts to quit, conscious monitoring becomes particularly problematic when the mind is trying to control itself (rather than behavior). The monitor, after all, is the part of the system that must be hidden from consciousness to satisfy the aforementioned reflexivity constraint. It is only beneath conscious awareness that the monitor can reference information that would be damaging to the goal of mental control if the information were conscious. This information is, of course, the template for failure: criteria for determining whether particular inputs indeed signal the failure of the intentional operating process. Were these criteria conscious, they would corrupt the intended control by definition. This constraint is perhaps most clear in the case of intentional thought suppression. A monitor searching for failure during thought suppression would search for the to-be-suppressed thought (cf. Wegner, 1992), and the presence of this thought in consciousness (even as part of a monitoring process) would certainly disallow the possibility of any meaningful sort of suppression.

Effortfulness. The monitoring process is less effortful than the operating process in that it is far less likely to be disturbed by the allocation of attention to concurrent tasks. It may be that there are costs of this lack of effort in that the monitor may be a relatively weaker process than the operator. Measured on some common metric, the ability of the monitoring process to bring items into awareness could be less than that of the operating process. The benefit of the reduced effort of monitoring, though, is that the monitor is thus relatively unimpeded by variations in the allocation of attention. Unlike the cumbersome and easily derailed operating process, the monitor remains on track even during distractions.

Activation. The monitoring process is activated by the initiation of mental control. Once the intention to control the mind is implemented, the monitoring process stays on continuously until the intention is rescinded. The monitor is, in this sense, an involuntary, autonomous process that is initiated by conscious intention, what Bargh (1989) termed a *goal-dependent* automatic process. This way of conceptualizing the generation of an automatic process is quite unlike prior formulations. To date, automaticity has been understood primarily as a format that cognitive processes assume when they have been practiced repeatedly. So, for example, researchers have traced increments in automaticity that accrue when a social judgment is performed again and again (Smith & Lerner, 1986) or have asked subjects to repeat a statement over and over to increase its automaticity (D. A. Houston & Fazio, 1989). This view of the development of automaticity suggests that people who show automaticity in, say, depressive thinking (Bargh & Tota, 1988; Gotlib & McCann, 1984), phobic thinking (Watts, McKenna, Sharrock, & Trezise, 1986), or stereotyping (Devine, 1989) have reached this pass by virtue of some sort of repetitive or habitual process. They have somehow thought these things too often, and so have reached chronic levels of automatic activation of the thoughts (see Higgins, 1989).

The ironic process theory suggests that repetition may not be so necessary. Instead, high levels of automatic activation of mental states may be produced by the mental control strategies people use in their attempts to overcome these very states. The depressed person who is trying hard to overcome sadness, for example, could unwittingly initiate and then suffer from the monitoring processes that make continued depressing thoughts and feelings accessible to consciousness. More generally, the stresses that introduce cognitive load at many points in life may have the result of turning our struggle against unwanted, seemingly involuntary mental states into an invitation for these states to overwhelm us.

Conditions of Irony

If mental control can crash and burn to produce its precise opposite, it is essential to understand just when such catastrophes can be expected. Predictions of ironic effects can be based on an understanding of (a) the role of the intention to control, (b) the controllability of specific mental states, (c) the role of effort in the balance between the operating and monitoring processes, and (d) the range of the searches undertaken by the processes.

Intention to Control

The occurrence of both intentional and counterintentional effects of mental control are dependent on an important precondition: The person must be attempting control. Thus, the person must not only want to control a mental state but must, in fact, be implementing the control. It is only when mental control is initiated and ongoing that the effects predicted by this theory can be expected to unfold.

This precondition is useful for understanding the distinction between the ironic process theory and other theoretical frameworks that pertain to the production of oppositional mental states or behaviors. There are many odd reversals and contradictions in psychological life, from dyslexias to bipolar affective disorders, and many of these fall far outside the range of ironic process theory. For example, the opponent process theory (Solomon, 1980) suggests that repeated exposure to affective events produces opposing internal states that increase in intensity with exposure. The theory of psychological reactance (Brehm, 1966), in turn, suggests that certain social pressures to behave may introduce negativistic tendencies that motivate opposing internal states. These and other oppositional processes can come and go without the occurrence of intentional mental control, and so can be distinguished from the ironic processes targeted by the present theory.

Controllability of Mental States

There are many mental control tasks so difficult that no amount of mental capacity devoted to an operating process can

produce the desired state of mind. Trying to make oneself smart or creative or healthy, for instance, may not work no matter what the mind does or for how long it does it (Wegner, 1990). Clear theoretical principles for determining whether a particular mental state is susceptible to control are difficult to derive, however, despite broad scientific and popular interest in testing the limits of control. The extensive market in self-help books claiming methods for the control of mind, body, memory, emotion, and love, not to mention hair, indicates only that we desire to control these things, not that we can.

There are often empirical criteria, of course, for determining whether mental control in a particular domain can be successful. Despite the ongoing controversies over whether we have mental control over particular aspects of memory (Kihlstrom & Barnhardt, 1993) or physiological function (Hatch, Fisher, & Rugh, 1987), for example, there certainly are ways of ascertaining whether mental control exists in these areas (Wegner & Pennebaker, 1993a). Most often, this simply amounts to asking people to assume control of some mental state and then measuring that state to learn whether it has been controlled. Observations of the degree or duration of apparent control allow the determination of whether significant control can be achieved.

Controllability is a key precondition for the occurrence of ironic effects. If there is no evidence of successful mental control in a particular domain, this suggests that the operating process that has been initiated by the intention to control falls short as a means of creating the desired state. The operating process may be slave to a faulty choice of strategy, or it may be that the manipulation of attention simply has no relevance to the desired mental state. In either case, an ironic monitoring process set to search for the failure of this futile operating process would not itself be likely to have significant effects on mental state. The ironic monitor also has its effects by guiding attention, after all, and if attention in the desired direction is useless, then attention in the opposite direction is likely to be useless as well. If one cannot turn on a light across the room by dint of will, odds are that one cannot turn it off by an error of will either.

Balance of Processes

Both the operating and monitoring processes occur in one human mind, so they must necessarily compete with one another for access to mental capacity (Navon & Gopher, 1979). The operating process typically requires far more effort than the monitoring process, however, so any competition from additional sources is more likely to undermine the operating process than the monitoring process. Any situational or dispositional limitations imposed on mental capacity will impair the operating process more than the monitoring process, thus yielding increases in ironic states of mind. Cognitive loads in the form of concurrent tasks or time pressure will have this effect, as will a variety of affective and stress-related preoccupations (Gilbert, 1991; Logan, 1979). Anything that distracts the person's attention from the task of mental control will undermine the operating process and so enhance the effect of the monitoring process. Alcohol- or drug-induced impairment of attention should increase the chances of ironic effects (Steele & Josephs, 1990), and general attentional deficits suffered by individuals with low intelligence or other more specific impairments might incline them toward frequent ironic effects as well.

The experimental manipulation of cognitive load is the primary way in which ironic effects have been produced in research to date. Once it is determined that mental control is indeed effective in some domain, the theory predicts that (a) the addition of load should tilt the balance of the mental control processes away from the operating process and toward the ironic monitor and (b) thus ironic effects will begin to be expressed. These should become increasingly prominent as load is increased, with the eventual result at extreme load levels that ironic effects approaching the magnitude of (unloaded) intentional effects may be observed.

The parameters of this crossover are likely to vary across domains of mental control. In some cases, the operating process may be extremely effective even with little allocation of cognitive resources, whereas in others the operating process may barely be able to exert control even with maximal mental capacity. There may even be mental control tasks that are so difficult that they require more cognitive effort than people can exert. Unlike efforts extended toward the control of entirely uncontrollable mental states, however, efforts directed at such difficult control tasks might instead produce large and immediate ironic effects. It is well known, for example, that under normal conditions many people can go to sleep at night when they wish to do so. On the night before the circus comes to town, however, a few of us may find that no amount of attention to restful thoughts seems enough to cause sleep, and even framing the desire to try to sleep may be the beginning of ironic wakefulness.

Range of Searches

The operating and monitoring processes search for complementary ranges of input. Anything that is not the target of the operating process, after all, indicates failure of the operating process and should be monitored. The two search processes typically differ, then, in that one is a feature-positive search and the other is a feature-negative search. In the case of concentration on some item, *X*, for example, the operating process will be searching for the presence of *X*, a feature-positive search, whereas the monitor will be searching for items that are not *X*, a feature-negative search. In the case of suppression of *X*, in turn, the operating process will search for not *X*, a feature-negative search, whereas the monitor will search for *X*, a feature-positive search.

This distinction is important because feature-positive searches are far easier than feature-negative searches (Newman, Wolff, & Hearst, 1980). It is easier to locate a presence than an absence, and for this reason some kinds of mental control are easier than others. An attempt at mental control that induces a monitoring process to engage in a feature-positive search will be particularly problematic because the monitor's job is easy compared with the feature-negative search undertaken by the operating process. Ironic effects should predominate, and this is precisely what happens in the event of instructed thought suppression; trying not to think about something induces a feature-negative operation of looking for distracters and a feature-positive monitor that looks for the unwanted thought. In contrast,

when mental control induces the monitor to engage in a feature-negative search and the operator to engage in a feature-positive search—as in the case of concentration—the operator's task is much easier than the monitor's, and ironic effects should be relatively less frequent. Intentional concentration seems to work better than intentional suppression.

The range of searches undertaken by the operating and monitoring process is further influenced by the way in which the mental control intention is framed (cf. Rugg, 1941; Tversky & Kahneman, 1981). For many mental states, names of opposite states exist that may also form the basis for control. For instance, one might try to be happy or one might try not to be sad. Although these intentions are superficially similar, they introduce quite different sorts of operating and monitoring processes and so should yield disparate ironic effects. Trying to be happy should engender an operating process tuned to find happy thoughts and a monitoring process aimed at any thoughts that are not happy. These not-happy thoughts could include both sad thoughts and the wide range of potential thoughts that are neutral and irrelevant to happiness or sadness. The ironic effect of an emphasis on the monitor in this search for happiness, then, would be an increase in the accessibility of both sad and neutral thoughts. Compare this with the much more pointed ironic process created by the desire not to be sad. Trying not to be sad yields an operating process aimed at both happy and neutral thoughts and a monitor focused specifically on sad thoughts. If the monitor is freed to influence consciousness by itself, the result will be an ironic barrage of sad thoughts.

Effects like these can be expected for all those mental states that have well-known semantic opposites. Like happiness and sadness, there are contrasting states of anxiety and relaxation, belief and disbelief, prejudice and impartiality, sleepiness and wakefulness, love and hate, and so on. These different names for mental states allow people different ways of framing their mental control intentions. The influence of such intentions on the differential search ranges of the operating and monitoring processes is illustrated in Figure 1. Here the darkened areas represent the ranges of search targets toward which the operating and monitoring processes are directed in each of four possible mental control intentions that might be exercised regarding a particular state.

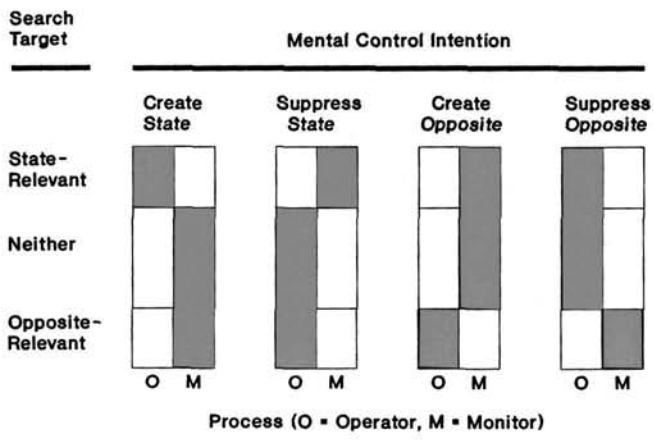

Figure 1. Search targets of the operating and monitoring processes as a function of different mental control intentions.

To consider the possibilities, imagine that the state is happiness and the opposite state is thus sadness. Attempts to create the state of happiness (the first block in Figure 1) would involve an operating process aimed at happiness-relevant targets and a monitor aimed at both sadness-relevant targets and neither (to include all neutral targets). Attempts to suppress happiness (the second block in Figure 1) would entail an operator searching for sadness-relevant targets and targets reflecting neither state and a monitor aimed at happiness-relevant targets. Attempts to create sadness (the third block in Figure 1) would use an operator searching for sadness-relevant targets and a monitor searching for happiness-relevant targets and targets relevant to neither state. Finally, attempts to suppress sadness (the fourth block in Figure 1) would invoke an operator searching for happiness-relevant targets and targets relevant to neither state and a monitor searching for sadness-relevant targets.

The overall influence of these variations can be grasped when it is recognized that, like feature-positive as opposed to feature-negative searches, specific searches are easier than general searches (Sternberg, 1966). Operating processes entailing easy, specific searches occur in attempts to create a state or to create its opposite, whereas monitoring processes entailing easy, specific searches occur in attempts to suppress a state or to suppress its opposite. The conclusion suggested by this analysis, then, is that ironic effects are more likely to arise when mental control attempts are conceptualized as efforts at the suppression of states of mind than when they are understood as efforts at the creation of states of mind. Translations of mental control intentions from suppression of a state into creation of the opposite state should have the general effect of reducing the occurrence of ironic effects. In other words, we will find greater joy in trying to be happy than in trying not to be sad. Perhaps Freud's attribution of the counterwill to suppression was a recognition of this general asymmetry.

Evidence of Ironic Effects

Evidence for ironic effects is available for several domains of mental control. The typical study of such effects crosses differing mental control instructions with differing levels of mental load, with the prediction that if intended control is found under low load, ironic effects will be observed under conditions of higher load.

Ironic Effects of Thought Suppression

The sheer perplexity that people show in the attempt to suppress a thought was the observation that prompted the initial proposal of an ironic process (see Wegner, 1989, 1992). The early experiments on suppression asked people to think aloud as they tried to suppress the thought of a target such as a white bear (Wegner, Schneider, Carter, & White, 1987). In trying to stop thinking about this, people reported consciously trying to think of something else, and they even succeeded on occasion. Complete success was rare, however, because the white bear returned again and again. Each time it returned, subjects would try anew to distract themselves, and this cycle often repeated

itself. Subjects in such studies reported that they felt unusually sensitive to the unwanted thought throughout the period of suppression. Preoccupation with the suppressed thought was verified not only through these self-reports but also psychophysiologically (Wegner, Shortt, Blake, & Page, 1990).

A glimpse into the separable functioning of the operating and monitoring processes in suppression was supplied in research by Wegner and Erber (1992, Experiment 1). The strategy used to examine ironic process here was the imposition of time pressure on subjects' word association responses during thought suppression. Time pressure disturbs the operation of resource-dependent processes and interferes less with the operation of automatic processes (e.g., Bargh & Thein, 1985; Strack, Erber, & Wicklund, 1982). It was expected that individuals whose operating processes were undermined during thought suppression might show evidence of the ironic monitoring process and reveal extreme levels of preoccupation with the suppressed thought.

The subjects were instructed to think or not think about a target word (e.g., house), and over several trials their tendency to respond with that target word to related prompts (e.g., home) and unrelated prompts (e.g., adult) was observed. Suppressing subjects who were under time pressure to report associates responded frequently with the target word to target-relevant prompts, blurting out the very word they had been trying not to think about. They did this more often than did suppressing subjects who were not under time pressure to give their associations. More important, suppression with time pressure boosted responses of the target word to target-relevant prompts over even the level of subjects under time pressure who were actively trying to think about the target. This result fits with the idea that, when the effortful operating process that looks for distracters during suppression is hampered by time pressure, a relatively effortless monitoring process is released to sensitize the person to the unwanted thought.

An experiment by Wegner, Erber, and Zanakos (1993, Experiment 2) tested the ironic process prediction for suppression in the Stroop (1935) color–word interference paradigm. Subjects were asked to either suppress or concentrate on a target word while responding with keypresses to indicate whether various words on a computer screen appeared in red or blue. For the manipulation of cognitive load, subjects rehearsed a six-digit number on some color-naming trials and rehearsed only a two-digit number on others. It was found that on high-load trials (when the operating process was presumably undermined), suppression ironically increased the accessibility of words and concentration ironically decreased the accessibility of words, in each case by comparison to the accessibility of nontarget words. During suppression, subjects took longer to name the colors of target words than nontarget words; during concentration, they took longer to name the colors of nontarget words than target words. It seems that when the range of the ironic monitor is sharply focused by the intention to suppress, it is all too easy for a mental load to undo the intended operation and reveal the ironic monitor's activity.

These studies suggest why we often find that the very thing we do not want to say or think comes forward when we are distracted or distressed. Freudian slips that are precisely the least appropriate thing to say in a given situation might be explained in this way (Baars, 1985). Cognitive busyness or time pressure could interfere with processes of self-presentation, deception, or self-control that depend on thought suppression for their success and so promote social blunders, unintentional disclosures of deceit, or self-control lapses that are not entirely random. Rather, because the most unwelcome thoughts are typically chosen as targets for suppression, these very thoughts are the ones that are ironically exposed when the processes of suppression are disrupted.

Ironic Effects of Concentration

Concentration, like suppression, is a variable quantity. We never seem to be able to concentrate fully, perfectly, or continuously, finding instead that our attention jiggles and shimmers no matter how much we wish it to converge to a hard point. Ironic processes provide a way to explain this Achilles' heel of concentration: the tendency of our voluntary attention to drift despite our resolve to keep it in place (see Wegner, in press).

If an ironic monitoring process is tuned to find failures of concentration, it makes sense that we would be continually influenced by its background activation, dogged by a subtle interest in all that would distract us. Under conditions of stress or load, we might find ourselves not just drifting but focusing unintentionally on anything but our intended target. This effect drew comment by William James, who also recognized the role of mental fatigue in the process:

> No one can possibly attend continuously to an object that does not change . . . How long, O healthy reader, can you now continue thinking of your tomb? In milder instances the difficulty is as great, especially when the brain is fagged. One snatches at every passing pretext, no matter how trivial or external, to escape from the odiousness of the matter at hand. (James, 1890, Vol. 2, p. 421)

The Stroop color-naming study by Wegner et al. (1993, Experiment 2) provided evidence relevant to the irony of concentration. As noted earlier, this study revealed that subjects intending to concentrate on a target word when they were under cognitive load actually named the colors of nontarget words more slowly than the colors of target words. This suggests that the semantic properties of the nontargets were more easily accessed than those of the targets: The distracters were more accessible than the targets of concentration.

To study the influence of mental load during concentration on ironic sensitivity to distracters in another way, Wegner and Erber (1991) asked subjects to study a map containing names of 40 unfamiliar African cities. Subjects were asked to concentrate their attention on half of the cities—those highlighted in yellow on the map—because a later test would ostensibly cover only those. During the study period, cognitive load was varied in that some subjects were given a nine-digit number to hold in mind and recall at the end of their studying, whereas others were given no number. After studying and then spending some time on a filler task, all subjects then completed a recognition test for the entire map in which they were to indicate on a list whether each of the cities (as well as 40 other ones) had appeared on the map.

An obvious expectation for this study is that cognitive load would reduce memory for the cities that were the target of concentration, and this was indeed found. Subjects under load who

were concentrating on the highlighted cities recognized them less well (by a recognition index of hits minus false alarms) than did those with no load. The less obvious, ironic effect was also observed: Subjects under load who were concentrating on the highlighted cities later recognized more of the unhighlighted cities than did those who were not under load. Apparently, the load manipulation undermined the operating process and thus allowed the monitoring process to come forward and produce the ironic effect. Subjects trying to concentrate under load ended up memorizing the distracters.

An earlier result like this one was reported by Zukier and Hagen (1978). In their research, distracting conditions were found to enhance recall of incidental information while reducing recall of task-relevant information. Taken together, however, these studies fail to rule out the possibility that subjects under load or distraction simply forget the task instructions and thus attend more often to irrelevant items. All we know at this point is the curious result that adding a memory load can increase subjects' memory for incidental items.

A technique introduced by Jonides (1981) provides relevant evidence. Subjects were presented with arrows in various parts of the visual field as a means of directing their attention. It was found that peripheral cues are processed more automatically than central cues. When given instructions to ignore an attention-directing cue, subjects were able to comply when the cue appeared in the center of the display, but they were less able to do so when the cue appeared in the periphery. This finding suggests that the visual field might be mapped for the relative influence of the operating versus monitoring effects, with operating processes centered at the fovea and monitoring processes extending to the periphery. The imposition of mental loads would lessen the effectiveness of the operating process aimed at the center of the visual field and so increase the relative effectiveness of the monitoring of peripheral or distractive cues. Ironic process theory suggests that similar mappings should occur for other sensory modalities and for memory search processes as well.

Ironic Effects of Mood Control

It is widely reported that people try to control their moods, particularly the negative ones (Clark & Isen, 1982; Klinger, 1982; Nolen-Hoeksema, 1993; Zillmann, 1988), and it has been found that they can indeed control moods when they are asked to do so (e.g., Slyker & McNally, 1991). It is also true that such mental control often falls short of resounding success (Wenzlaff, 1993; Wenzlaff, Wegner, & Roper, 1988). If ironic processes account for some of these failures, it is expected that cognitive loads imposed on individuals who are attempting to control a mood would have the consequence of dispelling that mood and intensifying the opposing mood.

To explore this possibility, Wegner et al. (1993, Experiment 1) asked subjects to recall either a sad or a happy life event and to write down their thoughts as they reminisced about the event. Subjects reminiscing about sad events were asked to try not to be sad, were given no special instruction, or were asked to try to be sad. Subjects reminiscing about happy events either were asked to try to be happy, were given no special instruction, or were asked to try not to be happy. Some subjects were also given the cognitive load of remembering a nine-digit number during the session. Measurements included observer ratings of the mood that subjects showed in the written reminiscence protocols and subjects' mood self-ratings made after the reminiscence session.

Individuals in this experiment who tried to control their moods even as they were purposefully contemplating mood-relevant memories were able to exert control to a significant degree (Figure 2). Those trying to gain a positive mood (being happy or not being sad) indeed became more positive; those trying to attain a negative mood (being sad or not being happy) became more negative. However, those subjects who were asked at the same time to perform the distracting mental task of rehearsing a number failed resoundingly in their mood control exercise. After the reminiscence, they reported moods that were significantly in opposition to the ones they had tried to achieve. Those seeking positive mood under load became sad, whereas those seeking negative mood under load became happy.

The results of this study also were largely consistent with the predictions of the theory regarding the differential effectiveness of trying to create a mood versus trying to suppress a mood. Subjects under load who were trying not to feel sad or trying not to feel happy were clearly unsuccessful, whereas those under load who were trying to feel happy or trying to feel sad were only marginally unsuccessful.

Ironic Effects of Intentional Relaxation

Trying to relax is typically not easy. People seem to require aids to relaxation such as alcohol or exercise or need to be trained in relaxation techniques rather than being able to "sit down and relax." Indeed, there are often times in which the attempt to relax has just the opposite effect (Heide & Borkovec, 1983). When panic disorder patients listened to a tape recording promoting progressive relaxation, for example, as opposed to a comparison tape recording containing a reading from a popular

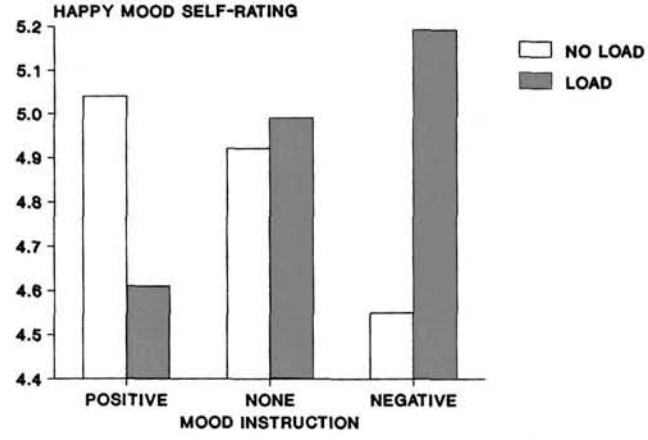

Figure 2. Self-ratings (range = 1–7) on a six-item happy mood scale for subjects who, either with or without cognitive load, were instructed to change their moods in a positive direction, were given no instruction, or were instructed to change their moods in a negative direction. Based on data from Wegner, Erber, and Zanakos (1993, Experiment 1).

novel, they reported more severe panic symptoms and showed elevated heart rates as well (Adler, Craske, & Barlow, 1987). Such relaxation-induced panic might arise from ironic processes in anyone but perhaps is especially likely among people who experience frequent panic attacks. Panic sufferers' experiences might make them unusually motivated to avoid further attacks and perhaps might also induce a level of stress that could itself serve as a chronic source of mental load.

Tests of ironic effects of relaxation have been conducted in normal college students by Wegner, Broome, and Blumberg (1993). In one experiment, subjects were given progressive muscle relaxation instructions or were invited merely to sit for an equivalent period in a comfortable chair. Subjects were then asked to remember a nine-digit number or were given no such load as they continued to either relax or sit. Electrodermal measurements indicated the instructions had a significant influence in the intended direction on the skin conductance level (SCL) of subjects in the no-load condition; SCL decreased with relaxation compared with no instruction. However, this effect reversed for subjects given the higher memory load. For these individuals, intentional relaxation rendered their SCLs higher than no instruction.

In a second experiment, this result was replicated among individuals who were given a simple one-sentence instruction to relax just before they completed brief series of arithmetic and vocabulary questions. Among subjects given a stressful and presumably loading interpretation of the questions (an IQ test), the relaxation instructions increased SCL relative to no instructions. Among those given a less stressful interpretation of the questions (the validity of the items was being checked), relaxation instructions decreased SCL relative to no instructions (Figure 3). With stress as the mental load manipulation in this experiment, then, we can see the special irony that confronts people when they attempt to relax under stressful conditions. The stress may not have much influence on sympathetic arousal

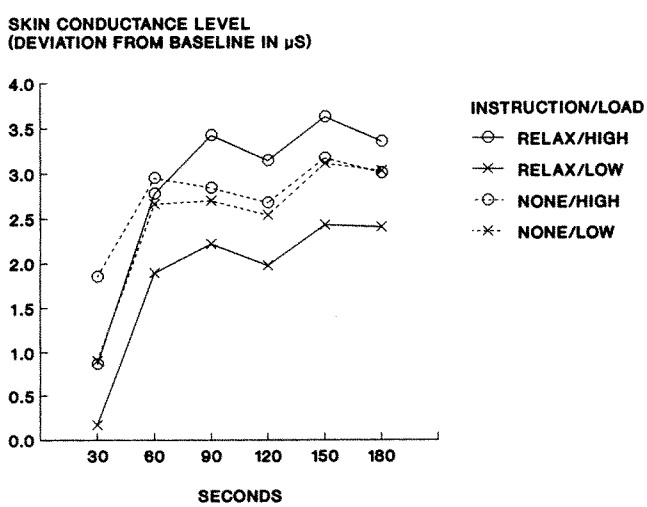

Figure 3. Skin conductance level (in μSiemens) for subjects who, either with or without cognitive load, were instructed to relax or were given no instructions. Based on data from Wegner, Broome, and Blumberg (1993).

by itself, but because it acts as a mental load, it confounds attempted relaxation, reverses its influence, and thus yields a stress-relevant psychophysiological effect nonetheless.

These kinds of ironic effects may be implicated in the production of anxiety and its disorders: the chronic failure to relax. Clinical theorists have often observed that individuals suffering from general anxiety, panic disorders, and phobias are highly motivated to avoid these states, experiencing "fear of fear" (Frankl, 1966) or "anxiety sensitivity" (McNally, 1990). Such a motive should lead to frequent attempts at the control of anxiety, and this intended control in the face of the ongoing stress of anxiety itself could produce the continuing aggravation of further anxiety through ironic monitoring.

Ironic Effects of Pain Control

A key controversy in the study of the control of pain centers on the relative effectiveness of distraction from the pain and attention to the pain. The given wisdom of the dentist's office, of course, is that distraction is always superior to doing nothing and that distraction is also obviously better than the fool's errand of attending directly to the pain. Yet research on the relative effectiveness of these different mental control strategies indicates that, under some conditions, attention is more effective than distraction in reducing pain experience (e.g., Ahles, Blanchard, & Leventhal, 1983; McCaul & Haugtvedt, 1982). Cioffi (1993) summarized this literature by indicating that distraction works better when pain is acute, whereas attention (or "sensory monitoring") works better when pain is persistent.

This difference makes sense in view of the different ironic monitoring processes that are initiated by distraction and attention. Intentional distraction from pain usually involves thinking about some target other than the pain. This therefore introduces an ironic process tuned to search for whatever items are not the chosen distracter, including the pain. As the distraction operating process deteriorates over time, then, an ironic monitor set up by the intention to distract would tend to reintroduce the pain to consciousness. Purposeful attention to the pain, in contrast, yields an ironic process tuned to search for anything other than the pain. Although the operating process associated with such attention would thrust pain into consciousness all too often at first, the eventual replacement of this pain immersion with an ironic process that searches for all nonpain stimulation would be soothing indeed. In essence, intentional attention to the pain allows time and natural diversion to unleash an automatic process tuned to provide constant distraction. The initial discomfort may prove worthwhile when the ironic monitor surfaces to yield relief.

The ironic process approach also suggests that the suppression of pain should be less effective in general than distraction from pain. This is because suppression yields ironic monitoring of only the pain, whereas distraction yields ironic monitoring of everything that is not the chosen distracter, only one facet of which is the pain. Although the operating processes in both cases should deflect pain by forcing consciousness of nonpain sensations, the ironic process associated with suppression should allow slightly more pain monitoring. Cioffi and Holloway (1993) recently found supportive evidence that subjects ex-

periencing laboratory pain indicate greater pain perception with suppression than with distraction.

Ironic Effects in Attempted Sleep and Wakefulness

Encouraging insomniacs to stay awake can help them to sleep (Ascher & Efran, 1978; Turner & Ascher, 1979). This paradoxical effect may occur because the recommendation to stay awake discontinues the person's attempt to try to sleep and thus cuts short the ironic monitor that promotes wakefulness. It might be that the typical insomniac suffers from wakefulness because the considerable worry and distress associated with sleep loss (cf. Borkovec, 1982) act as a cognitive load, thus undermining the operating processes that normally engage sleep, releasing the ironic process, and promoting a wakeful state. One test of this idea is to instruct people to try to go to sleep as quickly as possible. Just such a test by Gross and Borkovec (1982) found exactly the ironic effect: that this interfered with sleep onset.

A more specific test of the ironic process prediction is to determine whether a bit of insomnia can be induced in normal subjects by the combined presence of an instruction to sleep and a cognitive load. Wegner, Ansfield, and Bowser (1993) tested this by arranging for normal subjects to take home a cassette tape to play to themselves on a Walkman as they lay down to sleep at night. Subjects set a clock at bedside to allow estimates of time to fall asleep and completed a sleep diary in the morning (see Bootzin & Engle-Friedman, 1981). For some subjects, the tape narrator began by strongly encouraging sleep, asking subjects to sleep "as fast as you can." For the others, the narrator instead left subjects to sleep "whenever you want." The remainder of the tape then contained a cognitive load manipulation. For some subjects, the tape continued with a low-load program consisting of restful New Age music and nature sounds. For the others, the tape continued with a high-load program: a medley of John Philip Sousa marches. Subjects were asked to play the tape recordings at a comfortable listening volume, and the music continued for 45 min.

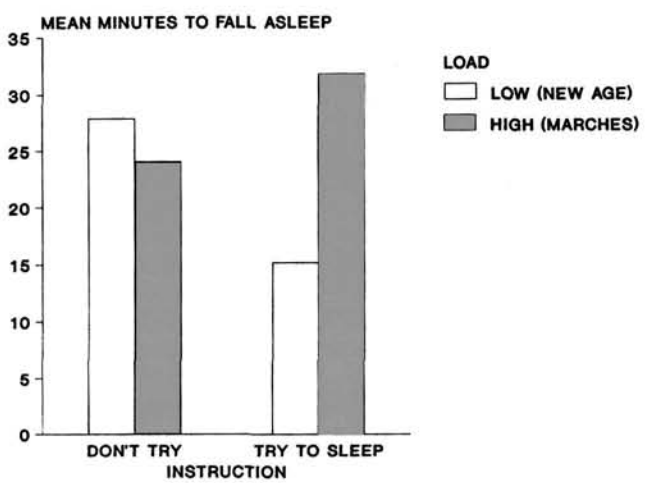

Figure 4. Mean self-reported minutes to fall asleep for subjects with or without cognitive load who were instructed to try to sleep or not to try to sleep. Based on data from Wegner, Ansfield, and Bowser (1993).

The reports of time to fall asleep revealed both intentional and ironic effects. As shown in Figure 4, subjects were indeed able to fall asleep as instructed under low load. Those trying to sleep did so more quickly than those not trying. Under high load, however, this trend was reversed; subjects who were trying to sleep actually fell asleep more slowly than those who were not trying. The Sousa marches proved to be undisturbing to subjects who were not trying to sleep, whereas they were particularly bothersome to those who were trying to sleep. These findings suggest that insomnia can indeed be self-inflicted. All that may be required to make a dripping faucet, barking dog, or passing brass band into a serious impediment to sleep is the strong desire to slumber.

A complementary prediction suggested by these findings is that people who are trying to stay awake would be particularly inclined to fall asleep under mental load. Those of us who have tried desperately not to doze off during a difficult lecture may recognize the phenomenon each time our heads jerk back upright and we look around to see if anyone noticed. It remains for research to determine whether such an effect is reliable.

Ironic Effects of Intentional Belief and Disbelief

Belief and disbelief are mental states that are relatively difficult to control. They seem to follow more from the information to which we are exposed than from willful exertion on our parts (Gilbert, 1993; Wilson & Brekke, in press). Despite this apparent intransigence, James (1897/1979) proposed that a "will to believe" might operate to influence our acceptance or rejection of propositions over time. The selective rehearsal of supportive or discrepant evidence could allow for some belief change independent of external events, and such a process should operate on principles that allow for not only intentional effects but ironic effects as well. If, for example, parents desire to believe that their daughter is not abusing drugs, they may rehearse memories consistent with that preference and so bolster their opinion even as they sit at home and wait for their daughter to return at night. Under mental load, however, this effort could yield ironic attention to evidence that the daughter is in fact abusing drugs, thus undermining and perhaps even reversing their hoped-for conclusion.

To test such possibilities, C. E. Houston and Wegner (1993) arranged for a group of subjects to witness a persuasive communication. Subjects saw a 4-min video spot discussing the pros and cons of the use of amino acid dietary supplements. Some subjects were asked to try to believe that the supplements were beneficial, others were given no instruction, and yet others were asked to try not to believe that the supplements were beneficial. Some subjects in each of these groups received an additional instruction designed to create mental load; they were asked to count all the plural nouns uttered by the communicator.

A complication in any attitude study, of course, is that subjects may alter their responses merely in response to the experimenter's demands. This research was vulnerable to such demand effects given the instructions to change belief, so we made special arrangements to solicit subjects' private opinions. After the videotape, subjects completed a set of self-report questions on the desirability of amino acid supplements. Later, they were given a second questionnaire and were informed that the exper-

imenters were aware that there might have been some pressure to react to the videotape in particular ways on the first form. Subjects were asked to give their true and unbiased opinions on the second survey and to detach this form from the study booklet and return it separately without any identifying information. Subtle identifying marks were present, however, that allowed us to assess these ostensibly private beliefs.

The degree to which subjects privately believed in the efficacy of the dietary supplements in the different conditions is shown in Figure 5. Without cognitive load, belief increased across the "don't believe," no instruction, and "try to believe" conditions, indicating that subjects did have some control over this. However, under cognitive load, the opposite trend is apparent. Belief was greatest when subjects tried not to believe, moderate with no instruction, and least when subjects tried to believe. These results suggest that belief may be subject to the same vagaries of control observed for other mental states. Trying to control belief can be successful, but with distraction this effort can render plausible exactly the beliefs that are least preferred.

Ironic Effects of Self-Presentation

Although making impressions on others can be relatively effortless, it more often seems to require considerable effort and thought (DePaulo, 1992; Jones, 1990). Attention must be directed not only toward producing appropriate external behaviors but toward mental control as well (Wegner & Erber, 1993). One cannot please the boss or infatuate a date, after all, by thinking absently about the cheeses of France. Mental control becomes relevant in the presentation of self as sincere or truthful, and it also plays a role in presenting the self in a positive light. There is evidence that in each of these domains ironic effects may accrue when self-presentation meets mental load.

Presenting oneself as sincere and truthful, particularly in the act of telling a lie, would seem to require several mental control activities. One must concentrate on the substance of the lie to keep it straight and meanwhile suppress thoughts of the truth and of one's dishonesty and guilt. Control of external signs of arousal or turmoil might be needed, too, so the suppression of mental states associated with these signs would be important. Such self-imposed pressure should prompt ironic processes to search for the mental counterparts of these unwanted expressive cues. Under strong motivation to lie successfully, then, people should be prone to display signs of their deceit. Just such "motivational impairment" of deception has been observed by DePaulo, Lanier, and Davis (1983). They found it easier to detect the deceit of the motivated liar as the result of subtle, nonverbal signs. With the imposition of a cognitive load—in the form of an admonition that the target of the lie is especially wary—this effect is further amplified (DePaulo, LeMay, & Epstein, 1991).

Self-presentation of a favorable image also may have ironic effects. To present oneself in a positive way to others, one must attend to one's admirable traits while also suppressing thoughts of one's less praiseworthy attributes. This mental control required in the enterprise of boasting turns to an opposing emphasis on one's shortcomings when modest self-appraisals are more appropriate. Effects relevant to ironic processes in the exercise of self-presentation have been observed by Paulhus (1993). In these studies, subjects who completed self-esteem ratings under time pressure showed increases in rated self-esteem over those who did so without pressure. This suggests that people normally try to be modest in filling out self-esteem measures and that this intention was countered by the ironic process to create a positive self-appraisal under load. It may be that attempts to appear good or bad to others have the ironic effect of increasing the accessibility of the opposing self-views such that, under load, pridefulness yields a negative self-concept and humility yields a more positive self-concept.

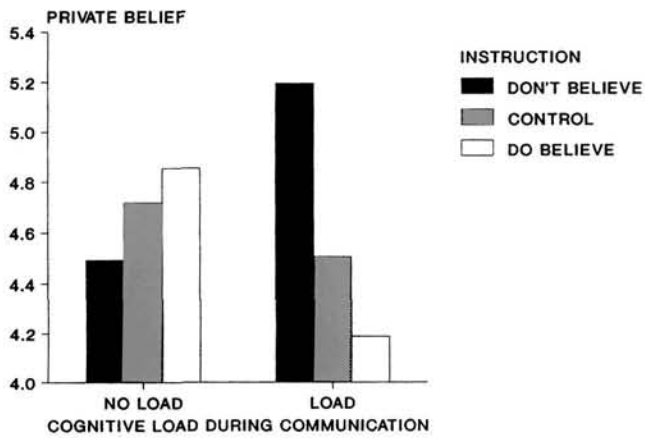

Figure 5. Mean private belief on a scale of 13 Likert-type items for subjects who watched a videotape on dietary supplements with or without load and who were instructed to try to believe, were given no instruction, or were instructed to try not to believe that the supplements are effective. Based on data from C. E. Houston and Wegner (1993).

Ironic Effects in the Control of Prejudice

Allport (1954) observed that people often hold back the expression of prejudice and described this restraint as the "inner check." He suggested that such checks might sometimes occur merely because the situation is not ideal for the expression of prejudice, but that at other times they might happen as the result of a genuine desire to overcome lapses in ethics. The desire to be unprejudiced may thus be the starting point for a wide range of mental control attempts (Devine, 1989; Fiske, 1989; Wegner, 1989; Weitz, 1972). The person who wishes to become less sexist in judgments of women, for example, must marshall appropriate thoughts and quell inappropriate ones repeatedly in daily life. The person who wishes to overcome belief in negative stereotypes of a racial minority, in turn, may need to exert significant mental control whenever topics relevant to the minority come to mind. The ironic effect of this may be felt at times: In the attempt not to be sexist, the person who encounters an absorbing cognitive load may in fact blurt out sexist remarks. In the attempt not to be racist, the person under load or stress may ironically focus on racist sentiments or stereotypes.

Experiments by Wegner, Erber, and Bowman (1993) explored this reasoning in the context of sexist remarks. Male and female subjects in these studies were given the task of completing a series of tape-recorded sentence stems. Some of these prompted judgments relevant to sexism, because they were derived from

items on the Attitudes Toward Women Scale (ATWS; Spence & Helmreich, 1972). So, for instance, subjects heard someone say "Women who go out with a lot of men are . . ." and were asked to complete the sentence. An egalitarian sentence completion might be something like "popular," whereas a sexist completion might be something like "sluts." For these experiments, some subjects were given the instruction to try not to be sexist in their responses, and others were given no special instruction about how to respond. For some sentence completions, mental load was imposed by asking for immediate responses; for others, mental load was reduced by allowing subjects an interval of up to 10 s for their response. The frequency of sexist responses (those that coders gave mean ratings of 4 or higher on a 5-point sexism scale) was examined in each of the conditions.

Representative results of one study (Experiment 2) are shown in Figure 6. The ironic effect of trying not to be sexist is very clear. The number of sexist sentence completions under low load was substantially reduced when subjects were admonished not to be sexist. However, the rate of sexist completions was significantly increased by such instructions under conditions of high load. This result was observed for both males and females, and it also did not differ between subjects who were high in sexist attitudes as measured by the ATWS and those who were low in such sexist attitudes. In short, the attempt not to be sexist under time pressure increases the likelihood that sexist comments will be made regardless of the person's sex or attitudes toward women.

These results offer an interesting counterpoint to recent research on automatic and controlled processes in stereotyping. Devine (1989) uncovered evidence for the proposition that stereotypes are automatically activated in social judgments. She found, for example, that subjects primed at levels below awareness with words related to Black stereotypes made more negative judgments of a person than did subjects for whom such words were not primed and that this was true for both prejudiced and unprejudiced subjects. Her subsequent finding that unprejudiced subjects reported fewer stereotypic attributes when they were simply asked to list thoughts about Blacks led her to suggest that low levels of prejudice involve controlled monitoring and suppression of stereotypical beliefs.

Figure 6. Frequency of sexist completions of sexism-relevant sentence stems for subjects responding under time pressure or without pressure who were instructed not to be sexist or given no instructions. Based on data from Wegner, Erber, and Bowman (1993).

The ironic process theory and our findings regarding sexism suggest that automatic and controlled processes in stereotyping that were assessed in these independent ways in this research are not so independent in everyday life. Instead, in the very attempt to control prejudice, people may initiate ironic, automatic processes that promote prejudice. The discovery of automatic activation of stereotypes under conditions of load may be less an expression of the individual's basic prejudice than it is an indication of the individual's attempt to avoid prejudice.

Ironic Effects in Movement

To complete the swing of the pendulum here, there is one more piece of evidence on ironic effects that should be mentioned. The Chevreul pendulum illusion noted earlier, as it happens, is also susceptible to the ironic effects of mental load that the theory predicts. Wegner and Ansfield (1993) asked subjects to hold a pendulum consisting of a 2-g weight on a nylon fishing line in their right hands, with instructions not to allow the weight to swing along an axis drawn on a sheet of paper below. Observers recorded the degree of pendulum swing after this instruction. Subjects who were given the simultaneous task of counting backward from 1,000 by 7s showed significantly more pendulum movement along the forbidden axis. Perhaps some proportion of the stray movements we experience in motor tasks—from the surgeon's slip in a delicate operation to the baseball player's throwing error—accrue as ironic effects of the desire not to make exactly those mistakes.

This movement research suggests that behavior control may follow many of the same ironic pathways traced by mental control. It may be that in some cases of behavior control, however, people are able to catch and compensate for ironic effects of mental control before these effects prompt ironic behavior. When we preview our thoughts and emotions on the way to some carefully chosen and deliberate behavior, for example, we may be able to screen out the influences of many of the most impetuous ironic processes. Ironic errors do not seem all that common, after all, in the text of a presidential inauguration speech or on the many other occasions when people have plenty of time to check for erroneous motivation, emotion, and thought that might prompt faulty action. Only when behavior is occurring "on line," contemporaneously with mental control as in the case of the pendulum, does it seem fully susceptible to ironic failure.

Theoretical Extensions

Ironic process theory has a number of implications for which empirical tests are not yet available. These implications center on the questions of when ironic effects are most and least likely to occur and the issue of when ironic effects might be particularly difficult to dispel. This section focuses in turn, then, on susceptibility to ironic effects, resistance to ironic effects, and the chronic production of ironic effects.

Susceptibility to Ironic Effects

The theory suggests that the obnoxious lapses we have called ironic effects will prevail primarily when people attempt to implement their intentions under adverse conditions. This summary of the theory suggests that there are two ways in which we make ourselves susceptible to a lifetime litany of counterintentional errors. First, it makes sense that, if ironic effects occur under the adverse conditions of stress, mental load, time urgency, and the like, these factors increase susceptibility to ironic effects. The ironic monitor will be more inclined to guide our conscious thought and behavior if we steal from the operating process the mental capacity it needs to do its job. This observation suggests that the monitoring and regulation of distracting or preoccupying mental conditions might often serve as a useful adjunct to the exercise of mental control. Therapies based on the reduction of stress or the achievement of more peaceful states of mind may, by this means, reduce the overall degree of ironic error in a person's life and so aid the furthering of the person's true intentions (cf. Jacobs & Nadel, 1985).

The other path to counterintentional error is the basic intention to engage in mental control. We cannot produce counterintentional effects if we have no intentions. This form of susceptibility to ironic error suggests that the decision to disengage or retract mental control might find its place in the arsenal of antierror weapons. After too many sleepless nights, the person driven to insomnia by the desire to sleep might just find relief in the decision not to try to sleep. By the same token, people whose fears of sadness, hate, belief, anxiety, or the desire for fattening foods have left them obsessively monitoring these states and ironically succumbing to them might be well advised to relax their mental control attempts.

Admittedly, mental control attempts are not entirely elective. People who are convinced that they need to achieve certain mental states are not likely to agree very easily that they ought to reverse field all of a sudden either to abandon their control attempts or, yet worse, to try achieving the opposite of their desired state. The theory suggests, however, that this strategy may often be the only way out of an otherwise impossible situation. When mental load and stress cannot be overcome, the relaxation of mental control may be the only remaining path to the elimination of tragic ironies.

Unfortunately, it is not very clear just how one goes about repealing or rescinding mental control. Is stopping the desire to sleep the same thing as trying to stay awake, for example, or is there some way to sidestep the entire dimension and stop the exertion of control over sleep in any direction? This may not be an important practical question because the theory suggests that either way of deescalating the ironic effects of the attempt to control sleep would be beneficial. Indeed, research on paradoxical therapy indicates that telling people to reverse or repeal control (however this happens) can be effective in a variety of domains (Shoham-Solomon & Rosenthal, 1987).

Even the enlightened use of paradoxical intention, however, might encounter significant obstacles. If a person versed in this theory cleverly attempted to trick the usual ironic process—for example, trying to fall asleep in a state of mental load by trying not to fall asleep—it is difficult to tell just what might happen. The person would still be aware at some level of the initial motive to sleep, and the attempt at a self-deceptive reversal of intention might fall short as a technique for the attainment of mental control. There is precious little research to illuminate what happens when people attempt to second-guess their mental control tendencies, and it is important not to overestimate the degree to which our proclivity toward ironic effects can be overcome by the shrewd transformation of intentions.

Resistance to Ironic Effects

How might people build up the capacity to resist ironic effects? Resistance of some kind should be conveyed, of course, by a simple application of the two principles noted previously that predict sensitivity to these effects. That is, avoidance of mental load and care in the deployment of mental control intentions would each follow from the theory as means to lessen the frequency or intensity of ironic error. There is one other path to resistance, however, that is worth considering: the automatization of the operating process.

The intentional operating process that supports the application of any mental control intention should, after all, be trainable. Like other conscious and intentional processes that become automatic when subject to repetition, it should increase in automaticity with training and so become progressively less conscious, less effortful, and perhaps less susceptible to interruption and inhibition as well. These changes, in turn, might eliminate the need for the ironic monitor or at least lessen its influence. Although there might still be some form of monitoring system that functions to make us sensitive at some level even to the breakdown of automatic processes, such monitors would not seem to have the same degree of access to consciousness that occurs in the case of the ironic monitoring of conscious mental control. (If every automatic system that failed in some way was reported to consciousness immediately, our minds would be chattering constantly with these recountings.)

Consider the case of the consciousness of normally automatic or skilled action. Many people share the intuition that they make mistakes when they become conscious of what they are doing (Sudnow, 1978). Becoming conscious of the movement of one's fingers typing on a keyboard, for example, is often seen as a preamble to error, as is being conscious of one's movement in playing a musical instrument or in executing a tennis backhand (cf. Vallacher & Wegner, 1987). It could be that errors are introduced in this situation because an intentional operating process and ironic monitoring process are superimposed on the automatic action, thus introducing ironic—and relatively automatic—error into the automatic action sequence. This observation suggests that some of the cases in which people "choke under pressure" to unleash the very error that is most harmful to their current purpose (Baumeister, 1984) may occur because they have been influenced to make their otherwise automatic actions into intentional ones, and so they lose the resistance to irony that is normally conveyed by practice and automaticity.

The idea that mental control might become automatic, and so resist ironic effects, has implications as well for the general effectiveness of mental control attempts. It might be that people who practice thought suppression often enough, for example, develop such skilled and automatic operating processes that they become quite capable of effective suppression and suffer

few intrusions from the ironic monitoring processes. By the same token, practiced relaxation or practiced mood control could be keys to effective self-regulation that sidestep the vagaries of ironic process documented in this article. To the degree that some people do seem to be self-control savants, showing off their magical powers of mental control in acts of repression, self-denial, or apparent self-deception, it may be that their skills have arisen by turning mental control activities into well-learned habits through repeated practice.

Chronic Production of Ironic Effects

The ironic effects observed in research to date are not particularly huge. As experimental effects go, they are detectable but far from overwhelming. One repeated refrain in this article, however, has been the idea that ironic effects could underlie certain forms of psychopathology that are indeed overwhelming both in effect size and in everyday human cost. The path from modest experimental effects to substantial real-world influence may be understood in terms of a potentially important cyclic effect implied by the theory. This is the idea of the *self-loading ironic system.*

Ironic effects could be magnified toward psychopathological extremes in everyday settings when small ironies themselves create mental load. Such increased load, in turn, would prompt the occurrence of further ironies and thus intensify load and stir further irony. A positive feedback system of this kind (cf. Maruyama, 1963) would have the effect of rapidly and relentlessly magnifying the ironic effect to the extreme. Not all ironic processes would necessarily participate in such systems because there are ironic errors that need not have the effect of increasing mental load. The ironies of falling asleep when one is trying to stay awake, of relaxing when one is trying to be alert, or of losing interest in an item on which one is trying to concentrate, for example, do not usually seem to prey on the mind in such a way as to enhance mental load. In these cases, self-loading systems would not be expected, and the amplification of irony to chronic levels should not occur.

When ironic effects are themselves mentally taxing, self-loading ironic cycles can be set into motion. Ironic effects that create embarrassment or social disapproval, for example, should draw attention away from the task at hand and toward self-evaluation and so impose a mental load of sorts (Duval & Wicklund, 1972). Ironic effects that promote negative affect may slow the mind (Sullivan & Conway, 1989), and ironic effects that yield anxiety or stress may prove to reduce mental capacity as well (Easterbrook, 1959). If these various influences increase mental load while leaving the person's initial intention to engage in mental control intact, they should participate in the formation of cycles that escalate quickly into irony-making systems.

It may be in this way that the person who most desires happiness becomes depressed or that the person who most desires calm becomes anxious. There could often be precipitating events, of course, that set off the cycle by providing an initial jolt to the system. A significant personal loss could prompt sadness, for instance, or a frightful event could prompt anxiety. When these events provoke us to attempts at mental control, however, and the ironic effects of this control disturb our endeavors and yield yet further distraction, we have become caught in a system that can cast us brutally and persistently into the very mental predicaments we most desire to avoid.

Conclusions

The theory of ironic processes of mental control holds the potential to explain an assortment of psychological effects that arise when people attempt to control their minds and actions. The two-process mental control system described by the theory offers an explanation of the mechanism by which people consciously control the states of their minds. The mechanism includes a conscious operating process that seeks mental contents consistent with the proposed change and an unconscious monitoring process that tests for the effectiveness of this control by searching for mental contents that are inconsistent with the proposed change. In this aspect, the theory is relevant to the way in which people move from the intention to seek or avoid thoughts, emotions, and motives toward the realization or suppression of such states of mind. The theory also accounts for one further class of effects, a class that cries out for explanation and from which we often cry out for relief. The theory suggests that the ironic monitor is responsible for the instances in which we find that we do, say, think, or feel precisely what we least intend.

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Call for Nominations

The Publications and Communications Board has opened nominations for the editorships of *Behavioral Neuroscience*, the *Journal of Experimental Psychology: General*, and the *Journal of Experimental Psychology: Learning, Memory, and Cognition* for the years 1996–2001. Larry R. Squire, PhD, Earl Hunt, PhD, and Keith Rayner, PhD, respectively, are the incumbent editors. Candidates must be members of APA and should be available to start receiving manuscripts in early 1995 to prepare for issues published in 1996. Please note that the P&C Board encourages participation by members of underrepresented groups in the publication process and would particularly welcome such nominees. To nominate candidates, prepare a statement of one page or less in support of each candidate.

- For *Behavioral Neuroscience*, submit nominations to J. Bruce Overmier, PhD, Elliott Hall—Psychology, University of Minnesota, 75 East River Road, Minneapolis, MN 55455 or to psyjbo@vx.cis.umn.edu. Other members of the search committee are Norman Adler, PhD, Evelyn Satinoff, PhD, and Richard F. Thompson, PhD.

- For the *Journal of Experimental Psychology: General*, submit nominations to Howard E. Egeth, PhD, Chair, *JEP: General* Search, Department of Psychology, Johns Hopkins University, Charles & 34th Streets, Baltimore, MD 21218, to egeth@jhuvm.bitnet, or to fax number 410-516-4478. Other members of the search committee are Donald S. Blough, PhD, Martha Farah, PhD, and Edward E. Smith, PhD.

- For the *Journal of Experimental Psychology: Learning, Memory, and Cognition*, submit nominations to Donna M. Gelfand, PhD, Dean, Social and Behavioral Science, 205 Osh, University of Utah, Salt Lake City, UT 84112-1102 or to fax number 801-585-5081. Other members of the search committee are Marcia Johnson, PhD, Michael Posner, PhD, Henry L. Roediger III, PhD, and Richard M. Shiffrin, PhD.

First review of nominations will begin December 15, 1993.