CHAPTER 27

Elbow Grease: When Action Feels Like Work

Jesse Preston *and* Daniel M. Wegner

Abstract

This chapter examines the experience of effort across different domains of exertion: physical exertion, mental concentration, and self-regulation. Despite the differences among these kinds of effort, in general, the feeling of self-mustered energy is the same no matter how it is applied. Rather than a specific sensation germane to a particular source, effort is a general cognitive feeling of work that applies to different kinds of intentional activity. The sensation of effort provides a constant monitor on energy expenditure and is fundamental in the production and judgment of personal action. Important information about task difficulty is given by subjective feelings of effort during an action—allowing one to predict the probability of success and to adjust the intensity of effort to an appropriate level of difficulty. In the cognitive domain, feelings of mental difficulty can affect judgments of familiarity, diagnosticity, confidence, and the like, depending on the mental activity and the salient features.

Keywords: effort, human action, energy, physical exertion, mental concentration, self-regulation

Human action is fueled by the exertion of the person in action. Just as cars run on gas and toy bunnies run on batteries, agents run on effort. Effort is easily recognizable all around us. We can see it in others when they strain and sweat and grimace as they work; we can see it in ourselves each time we raise a hand or walk up a hill or scrub potatoes for dinner. Our ease in perceiving effort brings up key questions about how such effort perception and experience is related to the actual expenditure of energy that occurs in our minds and bodies. This chapter examines a variety of the manifestations of effort that have appeared in psychological research and theory, with the goal of understanding how the *experience* of effort is involved in the psychology of human action.

The Experience of Effort

Why would the experience of effort be important? Some might say that the human experience of effort, the mere sensation of elbow grease, is quite beside the point: A physicist could suggest that effort should be understood as the actual expenditure of energy—defined by Newton as a physical variable (*work*, the acceleration of a mass over a distance). Many psychologists have been equally dismissive of self-reports of effort, focusing instead on "real" effort, for example, how mental or physical tasks can be differentially disrupted by

concurrent task demands and so seem to require different degrees of attentional or cognitive resources. Effort in action has been studied in the same way one might study a physical system—by examining what taxes the system to see how much "effort" the system requires.

Yet despite the attempts to ignore it or set it aside, the experience of effort continues to surface in psychology in various ways. Lay theories of action see effort as a causal force in action that is internal to the actor and under personal control (Heider, 1958). Actions carried out with vigor are perceived to be more motivated (Malle & Knobe, 1997) and ultimately are expected to be more successful (Kruger, Wirtz, Van Boven, & Altermatt, 2004). Beliefs about the exertion of effort have influences on the person's effort expenditure as well (e.g., Dweck & Leggett, 1988). The experience of effort seems to have a variety of psychological influences quite apart from any role as an indicator of the expenditure of energy occurring in the underlying mental and physical systems. The experience seems to have a life of its own.

The experience of effort is the particular feeling of that energy being exerted, or the phenomenal experience of effort (Block, 1995; Morsella, 2005; Nagel, 1974). In Nagel's (1974) terms, there is "something it is like" to exert effort. Imagine yourself pulling on a rope in a tug of war, running to catch a bus, or trying to conduct regression analyses in your head. Exertion is accompanied by a sensation of strain and labor, a feeling that intensifies the harder a person tries. But unlike the strain felt from some external force (like having one's arm pulled), effort feels mustered from within. It taps one's personal strength and at the same time demands that the person continue to draw on that energy.

The phenomenal experience of effort during action influences both the production and the judgment of action as it occurs. More broadly, the experience of exertion is connected to the concept of willpower that establishes the agent as a personal force behind action. To the person in action, subjective feelings of exertion serve as an authorship indicator for attributions of personal responsibility (Wegner & Sparrow, 2004). That is, effort felt during movement indicates that it is the self who is responsible for that action. In what follows, we review the literature on the interplay of effort experience and action and then conclude with recent studies from our laboratory indicating that misattributions of effort can lead people to take personal responsibility for actions performed by another.

Sources of Effort

Feelings of effort are experienced during *physical exertion* (e.g., lifting weights), *mental concentration* (e.g., studying statistics), and *self-restraint* (e.g., dieting). Although sometimes the sensation can feel localized, like the straining of particular muscles, the sense of effort can also surface as a nonspecific feeling of labor and difficulty that is transferable between different channels of exertion. The effort mustered in these activities is directed toward very different ends, but similar feelings of intensity and self-applied energy is common to all effortful pursuits. To examine the sources of the experience of effort, it is helpful to review how effort is sensed in physical, mental, and self-regulatory pursuits.

Physical Exertion

The kind of effort people are most familiar with is physical exertion—the muscular effort put into labor. Just where the feeling comes from—whether from a centrally generated muscle sense or from

sensory feedback from peripheral cues—was the subject of hot debate among early psychologists (James, 1890/1983; Sherrington, 1900). The dispute appeared to reach some resolution with evidence that both efferent (brain to body) and afferent (body to brain) pathways leave a trace of action detailing the expected bodily sensation, such as feelings of muscular movement or shifting joints (Gandevia, 1987; Jeannerod, 1997). However the perception of *force* in action appears to be cued by a centrally generated impulse sent along efferent pathways (e.g., Gandevia & McCloskey, 1976) that is sometimes called *corollary discharge* (Sperry, 1950) or *efference copy* (von Holst, 1954). Greater efferent activity generally results in greater feelings of effort during the activity. For example, effort feels more intense as a handgrip is squeezed harder, as measured by actual tension on the handgrip (Stevens & Cain, 1970), and numerous replications have shown that the perception of effort correlates with overall cardiovascular output in a predictable formula (e.g., Borg, 1982; Gearhart, Becque, Palm, & Hutchins, 2005). Perceived effort increases with the actual difficulty of a task, such as resistance level on a treadmill (Rejeski, 1981) and the strength of gravity (Ross & Reschke, 1982). If efferent activity is increased artificially (e.g., by shortening the muscle, changing the joint angle), perceived effort intensifies even if the absolute force and difficulty remain constant (Cafarelli & Bigland-Ritchie, 1979; Gordon, Huxley, & Julian, 1966). In contrast, movement that is initiated involuntarily (through tendon taps, muscle vibration, or transcranial magnetic stimulation) feels completely effortless (Goodwin, McCloskey, & Matthews, 1972). And if capacity is completely extinguished so that efferent activity is not possible (e.g., in paralysis), then no effort is felt even when intentionally trying to move (Rode, Rossetti, & Boisson, 1996).

Although effort is often associated with feelings of difficulty, the sensation of effort seems separable from both pain and pleasure—particularly when the effort is minimal. At low levels of exertion, sense of effort may amount to little more than the mere perception of bodily movement. Once inertia is overcome, a little bit of exercise can be energizing. It gets the blood rushing and prepares one for new challenges. Cases of clinical depression are often marked by lack of activity and energy, but getting depressed persons to increase activity can alleviate depressive symptoms, and even small amounts of exercise have been shown to boost mood (Dunn & McAuley, 2000). As more energy is expended the sensation of effort intensifies both in instantaneous force production (Nussbaum & Lang, 2005) and in continued exertion over time (Stevens & Cain, 1970).

Mental Concentration

The intensity of effort is generally expressed in physical metaphors (e.g., muscle power, sweat, or "elbow grease") that conjure images of manual labor. However, the experience of effort also extends to cognitive activities such as decision making, problem solving, and paying attention (Kahneman, 1973). Engaging in these activities requires deliberate concentration, channeling cognitive resources away from other matters to the task at hand. Like physical acts, mental acts vary in their difficulty and the amount of effort required for success. It is much easier to listen to a George Carlin comedy routine than to the Queen's address to the Commonwealth or to read an article in *Reader's Digest* than the original text of *The Odyssey.* The concentration mustered in these activities has an intensive active aspect

that differs from mere consciousness, akin to the intensity felt in muscular exertion.

Mental ease is sometimes associated with the perceived fluency of thought. Some thoughts may appear and reappear in consciousness with such frequency that they seem to require no effort at all (Wegner, 1989). A slow steady rate of cognition, however, feels turgid and mentally difficult (Jacoby & Dallas, 1981; Schwarz et al., 1991). In an early test of the availability heuristic, Tversky and Kahneman (1973) found that people estimate there are more words that begin with the letter "t" than have "t" as the third letter (though the opposite is true) simply because it is much easier to generate examples. Schwarz et al. (1991) expanded on this general finding to show that it is not the content of thoughts that impacts these judgments but the experience of mental ease in generating the thoughts. In one study, participants who listed many instances when they acted with either low or high self-assurance rated themselves as lower on the target trait than those who listed only a few. Even though they had more examples of behavior available, listing 12 instances of any behavior is difficult, so people given this arduous task concluded that the trait was not particularly self-descriptive.

The experience of ease of thinking can also influence mood, even leading to experiences of elation, self-confidence, and grandiosity. Pronin and Wegner (2006) asked participants to read a series of mood-induction statements, either all positive (e.g., "I'm feeling better all the time") or all negative (e.g., "I'm down in the dumps today"). The statements indeed had the effect initially observed by Velten (1968)—the positive statements enhanced good mood, whereas the negative statements induced bad mood. However, when participants were prompted by the computer to read their statements rapidly (as compared to another group who read them slowly), there was an independent influence of reading pace on mood. Those participants who read statements quickly, whether the statements were positive or negative, reported more positive mood as well as increased energy and indications of the confidence, self-perceived creativity, and grandiosity often associated with mania.

There are no sensory nerves in the brain, so there can be no true proprioception for thought as there is for physical activity. However, the intensive aspect of mental effort is accompanied by physical arousal (Berlyne, 1960), increased cortisol (Fibiger & Singer, 1989), and cardiovascular response (Van Roon, Mulder, Veldman, & Mulder, 1995), just as is found in physical exertion. Perhaps the most common physical indicator of both kinds of effort is the contraction of the corrugator muscle, the key muscle involved in scrunching the eyebrows down toward the nose as one frowns. Cacioppo, Petty, and Morris (1985) have observed that cognitive effort experienced by participants is often accompanied by a visible or invisible activation of the forehead muscle. Consistent with a growing literature on social embodiment effects demonstrating a bidirectional association between emotional expression and affective experience (e.g., Cacioppo, Priester, & Bernston, 1993; Epley & Gilovich, 2001; for a review, see Barsalou, Niedenthal, Barbey, & Ruppert, 2003), recent research has found that adopting a furrowed brow can elicit feelings of mental effort.

In an update of the study on mental ease by Schwarz et al. (1991), participants listed instances in which they felt either low or high self-assurance while they either smiled or furrowed their brow (Stepper & Strack, 1993). As expected, the brow furrowers identified less with the trait than those who had been smiling during the task. Notably, the effect worked only for subjects who

could successfully maintain the furrowed brow and not for participants who could not hold the expression. In another study, furrowing the brow was found to impact judgments of familiarity and attributions of fame (Strack & Neumann, 2000). Ordinarily, exposure to nonfamous names has a sleeper effect: At a second viewing of names, the familiarity resulting from initial exposure is falsely credited to the person's celebrity (Jacoby, Kelley, Brown, & Jasechko, 1989). However, false attributions of fame declined if people were induced to furrow their brow at the second viewing. The furrowed expression suggested feelings of doubt and difficulty in remembering the name, countering the feelings of familiarity from the initial exposure (Strack & Neumann, 2000).

Self-Restraint

Effort can also be felt when inhibiting action, if one is otherwise inclined to act. Dieters, newly reformed smokers, and other miscellaneous addicts must exercise deliberate restraint to keep from indulging in their favorite vices (Baumeister, Heatherton, & Tice, 1994). When a bad habit is given up for good, the difficulty of self-regulation is compounded by the fact that the overall goal can never be fully completed. Alcoholics who overcome their addiction still consider themselves to be alcoholics years after they have given up drinking because they believe relapse remains a constant possibility. Attempts to delay gratification temporarily can be extremely difficult and taxing on the individual, especially when under stress or when resisting "hot" impulses that have a strong hedonic attraction (Metcalfe & Mischel, 1999). Just like other forms of effort, the capacity for continued self-regulation is limited. Exhibiting self-control in the face of temptation can make continued resistance more difficult, and indulgence in other vices more likely in the future (Baumeister, Bratslavsky, Muraven, & Tice, 1998). Periods of intense resistance can negatively impact performance on other cognitive tasks, such as reading comprehension and analytical ability (Schmeichel, Vohs, & Baumeister, 2003). Acts of both self-control and problem solving have a cognitive component, but, notably, self-control tasks have also been shown to impact performance on physical actions. Persistence at squeezing a handgrip, for example, deteriorates more rapidly if people are asked to simultaneously inhibit emotional responses to an emotionally arousing film (Baumeister et al., 1998; Martijn, Tenbült, Merckelbach, Dreezens, & de Vries, 2002). Although in this case one must inhibit rather than initiate action, doing so is difficult and tiring, and the energy to regulate behavior depletes over time just as physical effort does.

One Effort to Rule Them All

Physical exertion, mental concentration, and self-restraint are activities directed toward different goals and manifest themselves in very different forms. What these activities share, however, is the experience of effort exerted toward achieving the goal. Whether a person spends the day grading exams or digging graves, the work feels difficult and grueling, and the feeling intensifies as greater personal force is applied. The feeling of effort is more than a mere sense of movement, as though it were the body's own speedometer or gas gauge. Rather, effort is a general feeling of labor and personal strength common to all deliberate activity. Whereas muscular force and sweat characterize the bodily feelings associated with physical exertion, the experience of effort is probably best characterized as a cognitive feeling (Schwarz & Clore, 1996) that commonly accompanies labor of all kinds.

Similar to the way specific emotions can arise from nonspecific arousal (Schacter

& Singer, 1962), nonspecific feelings of effort must be interpreted in the context of the action being performed. Effort felt during exercise therefore feels like physical exertion, and effort felt during a statistics lecture feels like concentration. The nonspecific quality of effort has two important implications for how effort is experienced by the individual. First, effort can be easily misinterpreted. An exam written in messy handwriting might wind up with a poorer grade than the same work in clear writing simply because the reader would have to exert that much extra effort just to make sense of the answer. Second, effort is transmutable, or easily transferred between different channels of exertion.

Physical effort can interfere with performance on mental activities (e.g., Wegner, Ansfield, & Pilloff, 1998). Efforts at physical self-regulation deplete mental resources (Vohs et al., 2008) just as efforts at mental self-regulation deplete physical strength (Muraven, Tice, & Baumeister, 1998). Baumeister and colleagues suggest that a single fluid energy source (that they identify as the executive control, or self) fuels all these activities, and this is why engaging in different effortful activities is mutually exhausting (e.g., Baumeister et al., 1998). In addition to their shared origins, these activities also share a common phenomenal experience. If a person were to perform two difficult tasks simultaneously (e.g., grading exams while digging graves), it might be difficult to tell where feelings of effort were coming from and which of the tasks was creating more difficulty.

The Value of Effort Experience

The fact that effort exertion is accompanied by a phenomenal experience raises the question, Why do we feel effort? What does the experience of effort do for us? Life would certainly be more pleasant if no effort was ever felt—imagine the work you could do if you never got tired or felt any difficulty. Some have argued that phenomenal experiences like effort or even consciousness itself do not require an explanation, that they are merely epiphenomenal to other biological activity (e.g., Kinsbourne, 1996; Pinker, 1997). Others, meanwhile, say that the production costs involved in creating the phenomenal experience requires that its existence be justified by some useful function. For example, Morsella (2005; Chapter 30) has recently suggested that effort represents one type of conscious conflict—like pain—where one need must be chosen over another, and this conscious conflict ultimately serves a self-regulatory function. But whether effort is functional or epiphenomenal, the experience of effort does provide (at least) three important benefits to the actor. First, effort provides direct feedback about task difficulty, allowing the actor to adjust exertion appropriately. Second, feelings of effort prompt conservation of energy when it becomes necessary, as the levels of personal strength deteriorate over time. Third, effort is an indicator of personal authorship for action, contributing to the feeling of conscious will.

Judgments of Difficulty

An important benefit to sensations of effort during labor is that it provides important information about task difficulty. This can be used to predict the probability of success in a task and to adjust the intensity of effort to an appropriate level match difficulty. Discrepancies between the effort felt in an action and the actual force can inform an individual of impaired motor function (Burgess & Jones, 1997). Increased feelings of effort in action can result in some distorted perceptions related to the action. For example, people overestimate the weight of objects when they are fatigued compared to when energy levels are high (McCloskey, Ebeling, & Goodwin, 1974).

Just as in physical acts, the difficulty associated with cognitive activities can help to regulate the amount of effort and attention given to the particular cognitive task. One might turn down the car radio while searching for a street address or elect to spend more time reading notes for an advanced string theory course than for Basket Weaving 101. Feeling of mental effort can also impact judgments about the subject of thought itself (Schwarz, 2002; Schwarz & Clore, 1996). For instance, in the mental ease study by Schwarz et al. (1991) discussed earlier, people thought a trait was less self-descriptive if they had to think of many instances they acted in a way consistent with that trait compared to just a few. The difficulty experienced coming up with many examples was interpreted as having to do with the topic rather than the task.

Depending on the particular subject of thought and context, difficulty can be construed in different ways (Unklebach, 2006). If you find yourself having to exert intense effort to pay attention to a colloquium talk, you could attribute the effort to an unconvincing argument, difficult statistical analyses, or to the speaker's coarse accent.

There are times, however, when difficulty results in distortions of the action produced. For instance, in *effort justification,* people seek to reconcile the amount of effort exerted toward some goal and the value of the outcome (Aronson & Mills, 1959). As in general dissonance theory (Festinger, 1957), people are motivated to see internal consistency between their thoughts and actions. For example, fraternities that employ hazing rituals usually arouse more love and loyalty from their members than clubs that do not require such a harsh initiation (Aronson & Mills, 1959). The effort put into gaining membership does not detract from the value of the goal; rather, it only makes it seem more worthwhile. By the same token, doing a favor for someone can actually increase liking for that person (Jecker & Landy, 1969) or a potential love interest who "plays hard to get" might seem more attractive (Roberson & Wright, 1994). People generally expect that effort will lead to successful actions, so people might inflate the success of an outcome to be consistent with the exertion of effort (Kruger et al., 2004; Preston & Wegner, 2005).

Another example of distortions caused by effort is the altered perceptions of inclines during difficult physical tasks. When carrying a heavy load, the inclines of hills appear steeper than when without extra weight (Bhalla & Proffitt, 1999; Proffitt, 2006). The authors account for these distorted perceptions by the increased effort required to perform the task successfully. Mismatches between difficulty and force can result in unsuccessful action. This is true when not enough energy is put into a difficult task and also if one puts too much energy into an easy task. For example, imagine you are walking up a staircase, but at the very last step you are distracted and do not notice when the plateau has been reached. Expecting another step to come, you raise your leg with unnecessary height and force—only to find yourself doing something like a John Cleese silly walk as the anticipated resistance melts into unexpected ease. Proffitt and colleagues argue that the perception of incline is exaggerated under fatigue or weight load because this illusion maintains proper relation to physiological capacity (Bhalla & Proffitt, 1999). Walking uphill requires more energy from a person than walking on flat surfaces both in the size and the force of the gait. If a person must walk uphill with a backpack full of groceries, the energy required is even greater than usual. Although the reported incline changes as a function of fatigue and load, actual action toward the incline does not. That is, people

may distort how they see the incline but manage to adjust their walking steps to the appropriate size. The distorted perceptions of the incline under high load or fatigue might help one to adjust action to the appropriate level of force.

Feelings of mental effort have been shown to influence judgments of diagnosticity (Schwarz et al., 1991), confidence (Alter, Oppenheimer, Epley, & Eyre, 2007), truth (Reber & Schwarz, 1999), familiarity (Jacoby & Dallas, 1981), stimulus clarity (Whittlesea, Jacoby, & Girard, 1990), and event frequency (Tversky & Kahneman, 1973). For instance, in the *revelation effect,* judgments of familiarity increase for words that are revealed one letter at a time rather than presented intact (e.g., LeCompte, 1995). But, interestingly, the revelation effect works even if the item being judged is different than the one that is revealed—for example, if participants solve an unrelated anagram, such as RAINDROP, before judging the familiarity of another word, such as VINEYARD (Westerman & Greene, 1996). The mere activity before judgment increases feelings of recognition and familiarity and does not depend on the relevance of that activity to the actual target of judgment. This suggests the revelation effect results from an increase in *conceptual fluency* rather than perceptual fluency (Westerman & Greene, 1996). It was not so much that people's vision clarified in the task but rather that they felt clarified when they were making the judgment.

Conservation of Energy

Unfortunately, effort is a limited resource (Chapter 23). We cannot keep going and going like the Energizer bunny because it would eventually lead to collapse or death. A second advantage to having a feeling of effort is that it allows us to monitor energy expenditure and then to conserve energy when necessary. Prolonged exertion is tiring, and mustering the strength to act becomes less invigorating and more uncomfortable as one goes on. Running the second mile in a marathon is a breeze compared to running the 23rd mile later on, even though actual physical output and pace have both slowed down considerably (Garcin & Billat, 2001). When muscles are fatigued, people tend to overestimate the weight of objects because it takes more energy to move those objects (e.g., McCloskey et al., 1974). The increased effort felt as one tires is associated with actual detriments in muscle capacity—fatigue increases directly with reduced strength in relation to task difficulty (Jones & Hunter, 1983). Feelings of fatigue may signal to a person that the capacity to continue action has depleted (Burgess & Jones, 1997) and can prompt one to restrict spending either by deteriorating the strength of action over time or by ceasing action altogether. After a rest, energy supplies are restocked, and one can continue in a task rejuvenated.

One of the principal determinants of withholding exertion is the agent's own perceived efficacy—beliefs about personal ability to perform action (Bandura, 1986). Quite reasonably, people prefer to put their energy toward tasks that are expected to succeed but are reluctant to waste effort by pursuing goals that are impossible. Effort is usually enjoyable if it is in favorable relation to the outcome, that is, if the exertion is not too hard and success is likely (Atkinson & Feather, 1966). Experiences with repeated failure reinforce an apparent noncontingency between effort and outcome, which can ultimately extinguish effort altogether (Abramson, Seligman, & Teasedale, 1978). A further reason to conserve energy supplies is to save some energy to devote to other (more important) tasks that might arise unexpectedly. Goals that are of high importance or desirability tend to be pursued more heartily than those of minimal importance (Lynch, 2005)—for

example, the p
is generally ma
for a really gre
tant goals (sa
food) seem to l
the actor so tha
than the same d
important goal.
other words, is
the adaptive eq

Sensation of A

A third adv
of effort is tha
identifying on
2002). In a mec
energy that pro
mate source of
within the self.
Mischel, 1999;
responsibility m
nitive compone
something I'd
component th
for the most pa
rienced as an a
than a reasoned
themselves to h
they have the
causation. Whe
will is challenge
will with argum
when they have
lar justification
bones or *knou*
tion of effort du
the feeling of wi
Applying one's
deliberate atten
overriding other
sponses. As effo
feels more willf
Effortlessness i
hand, is charact
the easiest actio
conscious super

example, the pursuit of romantic partners is generally more vigorous than the search for a really great tie clip. The most important goals (biological drives like sex and food) seem to have an energizing effect on the actor so that it seems to take less energy than the same effort directed toward an unimportant goal. The experience of effort, in other words, is valuable as a guide toward the adaptive expenditure of effort.

Sensation of Authorship

A third advantage of the experience of effort is that it provides a marker for identifying one's own actions (Wegner, 2002). In a mechanistic sense, effort is the energy that produces action. But the ultimate source of power seems to come from within the self, or willpower (Metcalfe & Mischel, 1999). Attributions of personal responsibility may have both a cold, cognitive component (hmm, that seems like something I'd do) and a "hot," affective component (that was me, alright!). But for the most part, conscious will is experienced as an authorship emotion rather than a reasoned deduction. People judge themselves to have caused action because they have the strong feeling of personal causation. When the veridicality of the will is challenged, people defend their free will with arguments that they "just know" when they have caused an action or similar justifications like they *feel it in their bones* or *know it in their gut.* The sensation of effort during action helps produces the feeling of will as the action takes place. Applying one's personal strength requires deliberate attention and control, usually overriding other competing behavioral responses. As effort increases, the exertion feels more willfully forced by the agent. Effortlessness in action, on the other hand, is characteristic of automaticity, as the easiest actions require little control or conscious supervision (Bargh, 1994). In this sense, the experience of effort during action contributes to the development of a sense of self as author when none might exist if actions were never experienced as effortful or consciously willed (Wegner, 2005).

Studies of passivity experiences in schizophrenia have suggested that feelings of effort exertion are crucial in distinguishing the acting self from the acting other (e.g., Daprati et al., 1997; Frith, Blakemore, & Wolpert, 2000). Passivity experiences are a common symptom in schizophrenia when a patient lacks the appropriate feelings of will for own actions. Although patients with schizophrenia are equally able to exert energy as normal controls (van Beilen, van Zomeren, van den Bosch, Withaar, & Bouma, 2005), they may not properly sense the exertion, so when the action is initiated, they do not feel responsible. This is supported by evidence that schizophrenic patients who suffer from delusions of control show little memory of their previous movements. When identifying a drawing they had previously made without visual feedback, they showed much poorer accuracy than normal controls, suggesting they had no memory for the feeling of drawing. Similarly, reports of verbal hallucinations (i.e., hearing voices) in schizophrenia may also result from failed sensory feedback (Hoffman, 1986). The voices heard can often be traced to the patient's own speech—voices are no longer heard when patients undertake a maneuver to prevent subvocalization (Bick & Kinsbourne, 1987). As in cases of motor illusions, the voice is not recognized as self-produced and is attributed instead to some external source (Silbersweig, Stern, Frith, & Cahill, 1995).

In mental activities, the effortlessness of creative bursts can carry with it the sense that it is *happening to* a person rather than *authored by* the person (Csikszentmihalyi, Abuhamdeh, & Nakamura, 2005),

as though the artist is the medium for an external source of inspiration. In some cases the ease of creativity leads the artist to make attributions to supernatural or divine influence—such as the nine Muses of ancient Greek mythology. Instances of insight are often characterized by the suddenness of the idea in mind, feeling like a flash of knowledge that occurs from nowhere (e.g., Metcalfe & Weibe, 1987; Schooler & Melcher, 1995). Across such experiences, the thinkers often report as much surprise at the occurrence of the idea as they do to the details of the idea itself. The abrupt nature of insight means that it comes with no foreshadowing or means of prediction (Bowden, 1997). When the solution does arrive, it typically feels completely unwilled by the thinker and is attributed solely to unconscious processes (Schooler & Melcher, 1995). Ironically, the greatest mental achievements a person ever has might feel completely alien, not a product of the person's own earnest labors.

Misattributions of Effort in Action: The Case of Inadvertent Plagiarism

If an idea is reached through careful reasoning and concentration, flowing directly from the thoughts that precede it, it feels controlled and intentional. If, on the other hand, a solution comes into the mind that is discordant with prior mental activity, it is unclear to the thinker how she arrived at the idea. The hard work put into the action emphasizes feelings of authorship. Key in the experience is the point that effort is released—the moment of realization when the solution is found or idea is discovered. When one is truly generating an idea or solution, mental effort should be high as one grapples with the problem and low when the effort is released as the idea comes into mind. The point of idea realization represents a shift from difficult thought to fluid thought. However, these feelings of effort can sometimes falsely indicate authorship, just as physical effort can sometimes distort other judgments of an action's success (Aronson & Mills, 1959) or the perception of the environment (Proffitt, 2006). When people are trying to solve problems together, effort experiences can be the basis for unintended plagiarism. Two people working on the same problem might have the same high–low effort shift when a problem is solved regardless of who actually did the solving. Consequently, people might be more likely to take credit for their partners' solutions if they also exerted effort working on the problem before it was solved.

We recently investigated the effect of effort cues on plagiarism by having pairs of people take turns in an anagram task as they exerted effort on an unrelated activity, such as squeezing a handgrip (Preston & Wegner, 2007). One partner would try to solve an anagram problem that appeared on a computer screen, followed by the presentation of the anagram solution on-screen. After each anagram, partners switched turns, and the other person tried to solve the next anagram. As participants worked on these anagrams, the effort exerted by both partners varied between high or low during the appearance of both the problem and its solution. Thus, the presentation of each anagram problem and its solution was associated with one of four different effort patterns: (a) low effort during problem, low effort during solution; (b) low effort during problem, high effort during solution; (c) high effort during problem, low effort during solution; and (d) high effort during problem, high effort during solution. The high–low effort pattern most closely resembles the sequence of real effort experienced when one generates a solution. Effort is released just as the answer is presented, much like the experience of discovery after a period of intense thought. Other patterns of effort—for example, low effort

during the p
effort whe
to less pla
semble the
with feelin
to other p
that the e
to low exer
feelings of
process, mis
produced id

In one stu
to induce fe
in previous
mental ease
1989). The
solutions cha
(low effort t
ing (high ef
an anagram
screen to bot
to solve it. A
or she knew
appeared on
wrote down
Later, a surpr
all words in the

Fig. 27.1 P
plagiarism by
(in Preston & W
e

during the problem phase followed by high effort when idea is produced—should lead to less plagiarism because they do not resemble the sequence of exertion associated with feelings of authorship. As compared to other patterns of effort, we predicted that the experience of a shift from high to low exertion would be misattributed as feelings of responsibility for the thought process, misleading people to feel they had produced ideas they had not.

In one study, we manipulated font clarity to induce feelings of mental effort, which in previous studies has affected perceived mental ease (Jacoby, Baker, & Brooks, 1989). The fonts of both the problems and solutions changed between black lettering (low effort to read) and pale yellow lettering (high effort to read). On a given trial, an anagram problem would appear on the screen to both partners as one partner tried to solve it. After the player indicated if he or she knew the correct answer, the solution appeared on the screen, and both players wrote down the word on a piece of paper. Later, a surprise memory test was given for all words in the anagram task and some new words. Participants were asked to identify whether the word was new (i.e., not on the anagram task), presented on their partner's turn, or presented on their own turn. Plagiarisms were defined as instances when a participant falsely recalled both that (a) a partners' anagram had been on one's own turn and (b) the anagram was successfully solved in time. As predicted, plagiarism was more prevalent for words that appeared in the high–low effort sequence compared to the other effort patterns (see Figure 27.1). Plagiarism increased only if effort was felt during the problem phase and dissipated as the solution appeared—the pattern that occurs when one truly generates an idea. Notably, the magnitude of this effect was moderated by the perceived difficulty of the yellow font. Plagiarism was amplified in the high–low effort pattern among participants who rated the yellow font as highly difficult, but the effect did not emerge for those who rated the yellow font as relatively easy to read. This is consistent with our hypothesis: Greater effort felt during the problem should be interpreted as harder work in trying to solve the anagram.

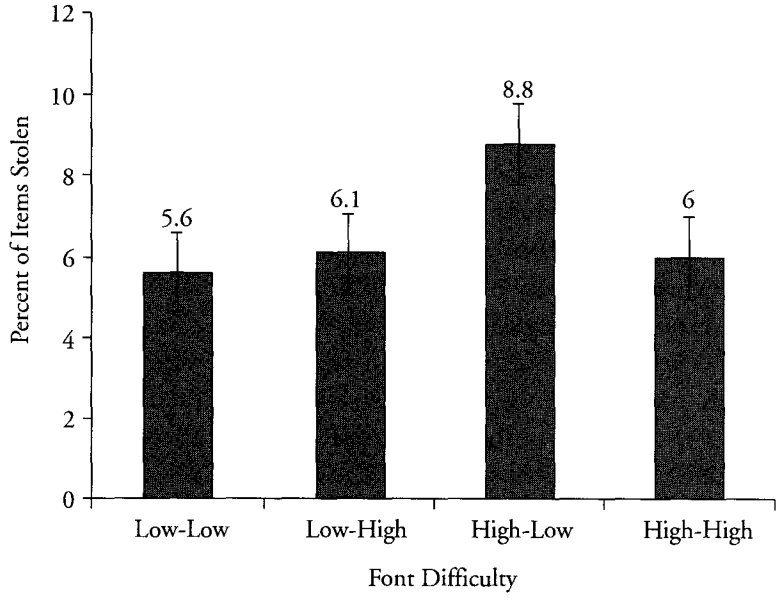

Fig. 27.1 Percentage of plagiarism by font difficulty (in Preston & Wegner, 2007, experiment 2).

A second plagiarism study specifically addressed the problem of the generality of effort. Recall our earlier suggestion that because effort is a nonspecific feeling of labor, it is easily misinterpreted and transmutable between different channels of sensation. In this second study, we had people solve anagrams with a partner as they exerted effort in a physical task. Participants were asked to squeeze a handgrip with their nondominant hand whenever a red dot appeared in the bottom right corner of the screen. Instances of plagiarism were highest when participants squeezed during the anagram and released the grip just as the answer was presented as compared to the other three patterns. Replicating the results of the font study, inflated plagiarism was only found when the effort dissipated as the solution appeared, just like the feeling of effort experienced in genuine idea generation. But also important is the fact that mental authorship was cued by physical actions, that is, squeezing the handgrip. Effort experienced in one domain was misattributed to activity in another domain despite the fact the two entail very different kinds of work. Not only does this suggest that the experience of effort is malleable, but also there is a crossover between physical and mental agency. Rather than separate systems of attribution, there may be an authorship processing mechanism that accepts as input the experience of effort from both physical and mental actions.

The results of these two studies fit in with a long line of research on the perception of psychological states by observation of internal physiological states (e.g., James, 1890-1983; Schachter, 1964). In such research, misattributions result when the true source is unclear, but the misattributed cue is salient. Such mistakes might be less likely, however, if the true source were to become salient. When Schachter and Singer (1962) warned participants that an epinephrine shot could lead to increased feelings of arousal, participants did not report the usual heightened euphoria or anger but remained in a relatively neutral mood. Zillman, Katcher, and Milavsky (1972) found in studies of "excitation transfer" that residual arousal from exercise could be misinterpreted as emotional reactivity. For example, after cycling on a stationary bike, people responded more aggressively to provocation. Excitation transfer happened only if the exercise had already been stopped for a while. People fail to account for lingering physical impact of exercise on arousal, but immediately after the cessation of exercise the source of arousal is clear.

To pursue these ideas, a third plagiarism study was conducted. In line with the findings of Zillman, we predicted that an admonition to attend to effort cues would reduce the incidents of plagiarism. We replicated the anagram task using the font clarity manipulation but added a reminder condition that directed participants' attention to the font difficulty. Immediately following each anagram trial, people in this condition were asked to report the font color of both the problem and the solution. Any enhanced feeling of authorship they felt as a result of the high–low effort pattern could be discounted at this time, preventing the inflation in plagiarism normally associated with this effort pattern. As predicted, there was an interaction between the font pattern and reminder condition on levels of plagiarism. In the control condition, people plagiarized more often in the high–low pattern, replicating our previous results. However, this was not the case for those participants who were reminded of the font color after each trial. These people showed no differences in plagiarism, and if anything there was a trend to decrease plagiarism for the high–low effort items. When participants' attention was directed to the font color as the explanation of their feelings of effort,

they discounted the inflated feelings of difficulty elicited by reading the yellow lettering and, by doing so, avoided plagiarizing in the high–low effort pattern. Plagiarism did not disappear completely, but it dropped to the same levels of plagiarism observed in the low–high effort pattern.

In these studies, plagiarism increased when a person experienced a period of mental exertion and release that coincided with the generation of a mental action by an external source. People remembered having solved their partner's anagrams if they had been induced to exert irrelevant effort during the problem phase and then to relax that effort at the moment the solution was presented. Inadvertent plagiarism was not affected when people had experienced effort in some other sequence relative to the idea, such as a sudden onset of effort at the presentation of the solution or a constant level of high effort. Just as in physical action, authorship for thoughts is indicated by an effortful process that precedes the thought.

The sense of effort is only one kind of many authorship indicators that gives rise to a feeling of conscious will for action, along with other cues like foreknowledge of the act, or a desire for outcome (Wegner & Sparrow, 2004). But unlike mental states such as intentions and plans, which may be easily forgotten, the sensation of effort is often vivid and memorable to the actor. In this sense, the experience of effort may be a particularly important source of "authorship emotion"—the feeling one gets on doing something that one indeed performed the action (Wegner, 2002). Perhaps in defense of free will, people should add that they *know it in their muscles* and *feel it in their furrowed brows* to their list of reasons to believe in their own roles as the causes of their actions. With so many actions prompted by unconscious processing, the self can sometimes be misplaced among automaticities. But the effort mustered to perform the action emphasizes the person's role as an intentional actor and resurrects the self as the primary controller of action—or at least so it would seem to the actor.

The Virtue of Effort

With attributions of responsibility for action also come the implications of moral responsibility. An agent who exerts herself in an action seems purposive and strong willed, and it is the agent's determination rather than ability that seems responsible for the end result. Unlike other causes of success—natural ability, low difficulty of a task, or just good luck—an agent is given personal credit for the amount of effort put into a task (Weiner & Kukla, 1970), and the degree of effort is strongly linked to perceptions of a person's character (Graham & Brown, 1988; Nicholls, 1976). Self-regulation is associated with its own moral virtues—for example, delay of gratification, obedience to moral restrictions, and long-term planning all require a person to control action and restrain impulses.

Lack of effort, however, is often looked on with disgust and considered to be lazy and even shameful. Consider the recent scandal surrounding Rafael Palmeiro, who in the summer of 2005 became the fourth player in Major League Baseball to reach 500 home runs and 3,000 hits. Not long after he reached the tremendous milestone (hit number 3,018), he tested positive for steroids and was suspended from play. When he returned from suspension to his first home game, he was greeted by booing fans at the stadium, holding up signs that read "Welcome Back Cheater." The resistance to artificial enhancers is partly because it is seen as unfair, making the playing field uneven between those who do and do not take risky substances.

A similar attitude exists in the general population toward the development and

use of "smart drugs" that enhance mental function (Rose, 2002; Riis, Simmons, & Goodwin, in press). Gazzaniga (2005) notes that people are wary of smart drugs because it seems like cheating: "If, somehow, someone gets ahead through hard work, that's okay . . . But popping a pill and mastering information after having read it only once seems unfair" (p. 73). An additional reason for the aversion to smart drugs, we suspect, lies in the concern that the burgeoning intelligence would not really be one's true mind. By taking these medications, a person dissolves personal control in exchange for ease.

Yet there is some inconsistency in how we decide what we can do to improve our own performance. Health food stores are stocked full of various supplements and vitamins designed to enhance muscle bulk and improve energy. Late night television is teeming with ads for new devices and contraptions sold with the promise of making exercise virtually effortless. In a busy day, a person may neglect to eat his cereal, drink his juice, or even take his vitamin supplement—but rarely do people forget their caffeine fix. Shortcuts to success like steroids or smart drugs are condemned because the success they reap seems unnatural and less than genuine. But at the same time, people condone other shortcuts they view as enhancers of success, unlocking potential that was always present but not realized. The dividing line seems to fall on whether the drug is the direct cause of performance—making success in the task effortless—or an enhancer of performance that improves the efficiency of the effort. As long as success requires hard work, then enhancement is not dishonorable.

Conclusion

Effort encompasses two interrelated components: It is the energy that is used to propel an agent and the feeling of difficulty and labor experienced during exertion. In this chapter, we reviewed the experience of effort across different domains of exertion: physical exertion, mental concentration, and self-regulation. There are differences among these kinds of effort, but in general the feeling of self-mustered energy is the same no matter how it is applied. Rather than a specific sensation germane to a particular source, effort is a general cognitive feeling of work that applies to different kinds of intentional activity. The sensation of effort provides a constant monitor on energy expenditure and is fundamental in the production and judgment of personal action. Important information about task difficulty is given by subjective feelings of effort during an action—allowing one to predict the probability of success and to adjust the intensity of effort to an appropriate level of difficulty. In the cognitive domain, feelings of mental difficulty can affect judgments of familiarity, diagnosticity, confidence, and the like, depending on the mental activity and the salient features. Feelings of effort are also used to monitor reserves of energy. Prolonged exertion drains resources and prompts the actor to conserve energy by restricting output, at least until energy supplies are replenished. Finally, the feeling of effort serves as an authorship indicator in feelings of conscious will for action. The experience of effort contributes to the important task of accounting for who does what in social life, helping us to determine what we have done and what has been done by others. Effort is not just a drain on personal resources but also drain on the person, not merely an exertion of power but also an exertion of willpower.

Acknowledgments

Preparation of this chapter was facilitated by funding from NIMH grant MH 49127 and from SSHRC of Canada.

References

Abramson. L. Y. J. D. (19[illegible]. Critique and *Psychology* [illegible]

Alter, A., Oppe[illegible] (2007). O[illegible] difficulty a[illegible] *Experimental* [illegible]

Aronson, E., & M[illegible] ity of initia[illegible] *Abnormal and* [illegible]

Atkinson, J. W. [illegible] *achievement* [illegible]

Bandura, A. [illegible] scope of self-[illegible] *Clinical Psy*[illegible] *ory in Con*[illegible]

Bargh, J. A. [illegible] ticity: Awaren[illegible] trol in social [illegible] Srull (Eds. [illegible] (pp. 1–40 [illegible] Associates.

Barsalou, L. W., N[illegible] pert, J. A. [illegible] (Ed.), *The psy*[illegible] 43, pp. 43–9[illegible]

Baumeister, R. F. [illegible] Tice, D. M. [illegible] self a limited [illegible] *Social Psychol*[illegible]

Baumeister, R. F. [illegible] (1994). *Losing* [illegible] *self-regulation*. [illegible]

Berlyne, D. E., [illegible] *ity*. New York: [illegible]

Bhalla, M., & Pro[illegible] recalibration in *Journal of Exp*[illegible] *ception and Per*[illegible]

Bick, P. A., & Ki[illegible] hallucinations [illegible] phrenic patien[illegible] *144*, 222–225.

Block, N. (1995). [illegible] of consciousne[illegible] *18*, 227–287.

Borg, G. (1982). [illegible] exertion. *Medi*[illegible] *ercise, 14*, 37[illegible]

Bowden, E. M. (1[illegible] unreportable h[illegible]

References

Abramson, L. Y., Seligman, M. E., & Teasdale, J. D. (1978). Learned helplessness in humans: Critique and reformulation. *Journal of Abnormal Psychology, 87*(1), 49–74.

Alter, A., Oppenheimer, D., Epley, N., & Eyre, R. (2007). Overcoming intuition: Metacognitive difficulty activates analytical thought. *Journal of Experimental Psychology: General, 136,* 569–576.

Aronson, E., & Mills, J. (1959). The effect of severity of initiation on liking for a group. *Journal of Abnormal and Social Psychology, 59,* 177–181.

Atkinson, J. W., & Feather, N. T. (1966). *A theory of achievement motivation.* New York: Wiley.

Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of Social & Clinical Psychology.Special Issue: Self-Efficacy Theory in Contemporary Psychology, 4*(3), 359–373.

Bargh, J. A. (1994). The four horsemen of automaticity: Awareness, intention, efficiency, and control in social cognition. In R. S. Wyer Jr. & T. K. Srull (Eds.), *Handbook of social cognition* (2nd ed. (pp. 1–40)). Hillsdale, NJ: Lawrence Erlbaum Associates.

Barsalou, L. W., Niedenthal, P., Barbey, A. K., & Ruppert, J. A. (2003). Social embodiment. In B. Ross (Ed.), *The psychology of learning and motivation* (Vol. 43, pp. 43–92). San Diego, CA: Academic Press.

Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology, 74,* 1252–1265.

Baumeister, R. F., Heatherton T. F., & Tice, D. M. (1994). *Losing control: How and why people fail at self-regulation.* San Diego, CA: Academic Press.

Berlyne, D. E., (1960). *Conflict, arousal, and curiosity.* New York: McGraw-Hill.

Bhalla, M., & Proffitt, D. R. (1999). Visual-motor recalibration in geographical slant perception. *Journal of Experimental Psychology: Human Perception and Performance, 25,* 1076–1096.

Bick, P. A., & Kinsbourne, M. (1987). Auditory hallucinations and subvocal speech in schizophrenic patients. *American Journal of Psychiatry, 144,* 222–225.

Block, N. (1995). On a confusion about a function of consciousness. *Behavioral and Brain Sciences, 18,* 227–287.

Borg, G. (1982). Psychophysical bases of perceived exertion. *Medicine and Science in Sports and Exercise, 14,* 377–381.

Bowden, E. M. (1997). The effect of reportable and unreportable hints on anagram solution and the aha! experience. *Consciousness and Cognition: An International Journal, 6*(4), 545–573.

Burgess, P. R., & Jones, L. F. (1997). Perceptions of effort and heaviness during fatigue and during size-weight illusion. *Somatosensory and Motor Research, 14,* 189–202.

Cacioppo, J. T., Petty, R. E., & Morris, K. J. (1985). Semantic, evaluative, and self-referent processing: Memory, cognitive effort, and somatovisceral activity. *Psychophysiology, 22,* 371–384.

Cacioppo, J. T., Priester, J. R., & Bernston, G. G. (1993). Rudimentary determination of attitudes II: Arm flexion and extension have differential effects on attitudes. *Journal of Personality and Social Psychology, 65,* 5–17.

Cafarelli, E. W., & Bigland-Ritchie, B. (1979). Sensation of static force in muscles of different length. *Experimental Neurology, 65,* 511–525.

Csikszentmihalyi, M., Abuhamdeh, S., & Nakamura, J. (2005). Flow. In A. J. Elliot & C. S. Dweck (Eds.), *Handbook of competence and motivation* (pp. 598–608). New York: Guilford Press.

Daprati, E., Franck, N., Georgieff, N., Proust, J., Pacherie, E., Dalery, J., et al. (1997). Looking for the agent: An investigation into consciousness of action and self-consciousness in schizophrenic patients. *Cognition, 65*(1), 71–86.

Dunn, E. C., & McAuley, E. (2000). Affective responses to exercise bouts of varying intensities. *Journal of Social Behavior and Personality, 15,* 201–214.

Dweck, C. S., & Leggett, E. L. (1988). A social cognitive approach to motivation and personality. *Psychological Review, 95,* 256–273.

Epley, N., & Gilovich, T. (2001). Putting adjustment back in the anchoring and adjustment heuristic: Divergent processing of self-generated and experimenter-provided anchors. *Psychological Science, 12,* 391–396.

Festinger, L. (1957). *A theory of cognitive dissonance.* Stanford, CA: Stanford University Press.

Fibiger, W., & Singer, G. (1989). Biochemical assessment and differentiation of mental and physical effort. *Work and Stress, 3,* 237–247.

Frith, C. D., Blakemore, S., & Wolpert, D. M. (2000). Abnormalities in the awareness and control of action. *Philosophical Transactions of the Royal Society of London, 355,* 1771–1788.

Gandevia, S. C. (1987). Roles for perceived voluntary motor commands in motor control. *Trends in Neuroscience, 15,* 81–85.

Gandevia, S. C., & McCloskey, D. I. (1976). Perceived heaviness of lifted objects and effects of

sensory inputs from related, non-lifting parts. *Brain Research, 109*(2), 399–401.

Garcin, M., & Billat, V. (2001). Perceived exertion scales attest to both intensity and exercise duration. *Perceptual and Motor Skills, 93,* 661–671.

Gazzaniga, M. (2005). *The ethical brain.* New York: Dana Press.

Gearhart, R. F., Becque, M. D., Palm, C. M., & Hutchins, M. D. (2005). Rating perceived exertion during short duration, very high intensity cycle exercise. *Perceptual and Motor Skills, 100,* 767–773.

Goodwin, G. M., McCloskey, D. I., & Matthews, P. B.C. (1972). The contribution of muscle afferents to kinaesthesia shown by vibration induced illusions of movement and the effects of paralyzing joint afferents. *Brain, 95,* 705–748.

Gordon, A. M., Huxley, A. F., & Julian, F. J. (1966). The variation in isometric tension with sarcomere length in vertebrate muscle fibres. *Journal of Physiology, 184,* 170–192.

Graham, S., & Brown, J. D. (1988). Attributional mediators of evaluation, expectancy, and affect: A response time analysis. *Journal of Personality & Social Psychology,* 55, 873–881.

Heider, F. (1958). *The psychology of interpersonal relations.* New York: Wiley.

Hoffman, R. E. (1986).Verbal hallucinations and language production processes in schizophrenia. *Behavioral and Brain Sciences, 9,* 503–548.

Jacoby, L. L., Baker, J. G., & Brooks, L. R. (1989). Episodic effects on picture identification: Implications for theories of concept learning and theories of memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 15,* 275–281.

Jacoby, L. L., & Dallas, M. (1981). On the relationship between autobiographical memory and perceptual learning. *Journal of Experimental Psychology: General, 100,* 306–340.

Jacoby, L. L., Kelley, C., Brown, J., & Jasechko, J. (1989). Becoming famous overnight: Limits on the ability to avoid unconscious influences of the past. *Journal of Personality and Social Psychology, 56,* 326–338.

James, W. (1983) *The principles of psychology.* Cambridge, MA: Harvard University Press. Original work published 1890)

Jeannerod, M. (1997). *The cognitive neuroscience of action.* Oxford: Blackwell.

Jecker, J., & Landy, D. (1969). Liking a person as a function of doing him a favour. *Human Relations, 22,* 371–378.

Jones, L. A., & Hunter, I. W. (1983). Effect of fatigue on force sensation. *Experimental Neurology, 81,* 640–650.

Kahneman, D. (1973). *Attention and effort.* Englewood Cliffs, NJ: Prentice Hall.

Kinsbourne, M. (1996). What qualifies a representation for a role in consciousness? In J. D. Cohen & J. W. Schooler (Eds.), *Scientific approaches to consciousness* (pp. 335–355). Hillsdale, NJ: Lawrence Erlbaum Associates.

Kruger, J., Wirtz, D., Van Boven, L., & Altermatt, T. W. (2004). The effort heuristic. *Journal of Experimental Social Psychology, 40,* 91–98.

LeCompte, D. C. (1995). Recollective experience in the revelation effect: Separating the contributions of recollection and familiarity. *Memory and Cognition, 23,* 324–334.

Lynch, J. G. (2005). The effort effects of prizes in the second half of tournaments. *Journal of Economic Behavior & Organization, 57,* 115–129.

Malle, B. F., & Knobe, J. (1997). The folk concept of intentionality. *Journal of Experimental Social Psychology, 33,* 101–121.

Martijn, C., Tenbült, P., Merckelbach, H., Dreezens, E., & de Vries, N. K. (2002). Getting a grip on ourselves: Challenging expectancies about loss of energy after self-control. *Social Cognition, 20*(6), 441–460.

McCloskey, D. I., Ebeling, P., & Goodwin, G. M. (1974). Estimation of weights and tensions and apparent involvement of a "sense of effort." *Experimental Neurology, 42,* 220–232.

Metcalfe, J., & Mischel, W. (1999). A hot/cool-system analysis of delay of gratification: Dynamics of willpower. *Psychological Review, 106,* 3–19.

Metcalfe, J., & Wiebe, D. (1987). Intuition in insight and noninsight problem solving. *Memory and Cognition, 15,* 238–246.

Morsella, E. (2005). The function of phenomenal states: Supramodular interaction theory. *Psychological Review, 112,* 1000–1021.

Muraven, M., Tice, D. M., & Baumeister, R. F. (1998). Self-control as a limited resource: Regulatory depletion patterns. *Journal of Personality and Social Psychology, 74,* 774–789.

Nagel, T. (1974). What is it like to be a bat? *Philosophical Review, 83,* 435–450.

Nicholls, J. G. (1976). Effort is virtuous, but it's better to have ability: Evaluative responses to perceptions of effort and ability. *Journal of Research in Personality, 10,* 306–315.

Nussbaum, M. A., & Lang, A. (2005). Relationships between static load acceptability, ratings of

perceived exertion, and biomechanical demands. *International Journal of Industrial Ergonomics, 35,* 547–557.

Pinker, S. (1997). *How the mind works.* New York: Norton.

Preston, J., & Wegner, D. M. (2005). Ideal agency: The perception of self as an origin of action. In A. Tesser, J. V. Wood, & D. A. Stapel (Eds.), *On building, defending and regulating the self: A psychological perspective* (pp. 103–125). New York: Psychology Press.

Preston, J., & Wegner, D. M. (2007). The eureka error: Inadvertent plagiarism by misattributions of effort. *Journal of Personality and Social Psychology, 92,* 576–587.

Proffitt, D. R. (2006). Embodied perception and the economy of action. *Perspectives on Psychological Science, 1,* 110–122.

Pronin, E., & Wegner, D. M. (2006). Manic thinking: Independent effects of thought speed and thought content on mood. *Psychological Science, 9,* 807–813.

Reber, R., & Schwarz, N. (1999). Effects of perceptual fluency on judgments of truth. *Consciousness and Cognition: An International Journal, 8*(3), 338–342.

Rejeski, W. J. (1981). The perception of exertion: A social psychophysiological integration. *Journal of Sport Psychology, 3,* 305–320.

Riis, J., Simmons, J. P., & Goodwin, G. P. (in press). Preferences for enhancement pharmaceuticals: The reluctance to enhance fundamental traits. *Journal of Consumer Research.*

Roberson, B. F., & Wright, R. A. (1994). Difficulty as a determinant of interpersonal appeal: A social-motivational application of energization theory. *Basic and Applied Social Psychology, 15,* 373–388.

Rode, G., Rossetti, Y., & Boisson, D. (1996). Inverse relationship between sensation of effort and muscular force during recovery from pure motor hemiplegia: A single-case study. *Neuropsychologia, 34,* 87–95.

Rose, S. P. R. (2002). "Smart drugs": Do they work? Are they ethical? Will they be legal? *Neuroscience, 3,* 975–979.

Ross, H. E., & Reschke, M. F. (1982). Mass estimation and discrimination during brief periods of zero gravity. *Perception and Psychophysics, 31,* 429–436.

Schachter, S. (1964). The interaction of cognitive and physiological determinants of emotional state. In L. Berkowitz (Ed.), *Advances in social psychology* (Vol. 1, pp. 49–80). New York: Academic Press.

Schachter, S., & Singer, J. E. (1962). Cognitive, social, and physiological determinants of emotional states. *Psychological Review, 69,* 379–399.

Schmeichel, B. J., Vohs, K. D., & Baumeister, R. F. (2003). Intellectual performance and ego depletion: Role of the self in logical reasoning and other information processing. *Journal of Personality and Social Psychology, 85,* 33–46.

Schooler, J. W., & Melcher, J. (1995). The ineffability of insight. In S. M. Smith, & T. B. Ward (Eds.), *The creative cognition approach* (pp. 97–133). Bradford-MIT Press: Cambridge, MA.

Schwarz, N. (2002). Feelings as information: Moods influence judgments and processing strategies. In T. Gilovich, D. Griffin, & D. Kahneman (Eds.), *Heuristics and biases: The psychology of intuitive judgment.* (pp. 534–547). New York: Cambridge University Press.

Schwarz, N., Bless, H., Strack, F., Klumpp, G., Rittenauer-Schatka, H., & Simons, A. (1991). Ease of retrieval as information: Another look at the availability heuristic. *Journal of Personality and Social Psychology, 61,* 195–202.

Schwarz, N., & Clore, G. L. (1996). *Feelings and phenomenal experiences.* New York: Guilford Press.

Sherrington, C. S. (1900). *The muscular sense.* In E. A. Shäfer (Ed.), *Textbook of physiology* (Vol. 2, pp. 1002–1025). Edinburgh: Pentland.

Silbersweig, D. A., Stern, E., Frith, C., & Cahill, C. (1995). A functional neuroanatomy of hallucinations in schizophrenia. *Nature, 378*(6553), 176–179.

Sperry, R. W. (1950). Neural basis of the spontaneous optokinetic response produced by visual neural inversion. *Journal of Comparative Physiological Psychology, 45,* 482–489.

Stepper, S., & Strack, F. (1993). Proprioceptive determinants of emotional and nonemotional feelings. *Journal of Personality and Social Psychology, 64,* 211–220.

Stevens, J. C., & Cain, W. S. (1970). Effort in isometric muscular contractions related to force level and duration. *Perception and Psychophysics, 8,* 240–244.

Strack, F., & Neumann, R. (2000). Furrowing the brow may undermine perceived fame: The role of facial feedback in judgments of celebrity. *Personality and Social Psychology Bulletin, 26,* 762–768.

Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology, 5,* 207–232.

Unklebach, C. (2006). Learned interpretation of cognitive fluency. *Psychological Science, 17,* 339–345.

van Beilen, M., van Zomeren, E. H., van den Bosch, R. J., Withaar, F. K., & Bouma, A. (2005). Measuring the executive functions in schizophrenia: The voluntary allocation of effort. *Journal of Psychiatric Research, 39,* 585–593.

Van Roon, A. M., Mulder, L. J. M., Veldman, J. B. P., & Mulder, G. (1995). Beat-to-beat blood-pressure measurements applied in studies on mental workload. *Homeostasis, 36,* 3316–3324.

Velten, J. E. (1968). A laboratory task for the induction of mood states. *Behaviour Research and Therapy, 6,* 473–482.

Vohs, K. D., Baumeister, R. F., Twenge, J. M., Schmeichel, B. J., Tice, D. M., & Crocker, J. (2008). *Decision fatigue exhausts self-regulatory resources.* Manuscript in preparation.

von Holst, E. (1954). Relations between the central nervous system and the peripheral organs. *British Journal of Animal Behavior, 2,* 89–94.

Wegner, D. M. (1989). *White bears and other unwanted thoughts: Suppression, obsession, and the psychology of mental control.* New York: Viking/Penguin.

Wegner, D. M. (2002). *The illusion of conscious will.* Cambridge, MA: MIT Press.

Wegner, D. M. (2005). Who is the controller of controlled processes? In R. Hassin, J. S. Uleman, & J. A. Bargh (Eds.), *The new unconscious* (pp. 19–36). New York: Oxford University Press.

Wegner, D. M., Ansfield, M., & Pilloff, D. (1998). The putt and the pendulum: Ironic effects of the mental control of action. *Psychological Science, 9,* 196–199.

Wegner, D. M., & Sparrow, B. (2004). Authorship processing. In M. Gazzaniga (Ed.), *The cognitive neurosciences* (3rd ed., pp. 1201–1209). Cambridge, MA: MIT Press.

Weiner, B., & Kukla, A. (1970). An attribution analysis of achievement motivation. *Journal of Personality and Social Psychology, 15,* 1–20.

Westerman, D. L., & Greene, R. L. (1996). On the generality of the revelation effect. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 22,* 1147–1153.

Whittlesea, B. W. A., Jacoby, L. L., & Girard, K. (1990). Illusions of immediate memory: Evidence of an attributional basis for feelings of familiarity and perceptual quality. *Journal of Memory and Language, 29,* 716–732.

Zillman, D., Katcher, A. H., & Milavsky, B. (1972). Excitation transfer from physical exercise to subsequent aggressive behavior. *Journal of Experimental Social Psychology, 8,* 247–259.

CHAP
2

Karin C.A. Bo

Abstract

This cha
evidence
being aw
explores
goals. It is
accessibi
is presen
goals when
related tho

Keywords

Imagine you a
a major confe
meets with di
your jokes fall fl
ing your presen
point, some of
diately after th
about the goa
goal of making
sion on your cc
popping into c
feel foolish, de
esteem is tragic
der of the day,
keep intruding
drinks only hel

As illustrate
goals can hav