



Dynamic Associations among Somatic Complaints, Human Energy, and Discretionary Behaviors: Experiences with Pain Fluctuations at Work

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Abstract

Using data from two experience-sampling studies, this paper investigates the dynamic relationships between discretionary behaviors at work—voluntary tasks that employees perform—and internal somatic complaints, focusing specifically on a person's pain fluctuations. Integrating theories of human energy with evidence from the organizational, psychological, and medical sciences, we argue that pain both depletes and redirects the allocation of employees' energy. We hypothesize that somatic pain is associated with depleted resources and lowered work engagement, which in turn are related to ebbs and flows in discretionary behaviors, but that people will habituate to the negative effects of pain over time. Data from the two studies largely support our hypotheses. Study 1 explores the daily experiences of a sample of office workers with chronic pain, while Study 2 extends the findings to a larger non-clinical population and examines the effect of momentary pain during the workday. Our results suggest that pain fluctuations, through their effects on two forms of human energy, potential and in-use energy, are associated with increased withdrawal and a decrease in proactive extra-role behaviors at work. The results also suggest that employees who have experienced chronic pain for a longer time are less affected by the normally depleting effects of pain.

Keywords: discretionary behaviors, somatic complaints, energy regulation, work engagement, pain fluctuations, depleted resources, extra-role behaviors, work withdrawal

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People at work are not always at their best. A person may go above and beyond what is expected on some days but withdraw from work on others (e.g., Kahn, 1990; Beal et al., 2005). Recognizing these fluctuations, organization scholars increasingly use theories of variations in individual behavior to paint dynamic portraits of workplace life (e.g., Weiss, Nicholas, and Daus, 1999; Ilies and Judge, 2002; Amabile et al., 2005). For example, whereas work on discretionary role behaviors is rooted in variations between subjects (e.g., Katz and Kahn, 1978; Organ, 1988; Borman and Motowidlo, 1993), research suggests that people engage in discretionary behaviors at different times for different reasons (e.g., Dalal et al., 2009). Within-person theories reflect an essential truth of human nature: rather than acting with robotic constancy, people willfully immerse themselves in, or withdraw from, their work roles as their personal volition ebbs and flows (Kahn, 1990). The extant literature, however, has only started to identify the psychological pathways that may underlie fluctuations in discretionary behaviors.

Theories of human self-regulation suggest a range of proximal psychological mechanisms associated with fluctuations in personal volition (e.g., Carver and Scheier, 1990; Kanfer, 1990; Frijda, 1994; Baumeister et al., 1998; Kuhl, 2000). But most within-person studies of workplace behaviors have focused on just one of these mechanisms: people's affective reactions to external stimuli (e.g., Beal et al., 2005; Ilies, Scott, and Judge, 2006; Dalal et al., 2009; Scott and Barnes, 2011). These studies extend Weiss and Cropanzano's (1996) theory of "affective events" or Spector and Fox's (2002) emotion-centered model of voluntary work behavior, identifying moods and emotions that mediate the relationship between external events and workplace behaviors (Brief and Weiss, 2002; Barsade, Brief, and Sparato, 2003). Although moods and emotions are clearly important predictors of within-person behavior, they are only part of the picture when it comes to understanding the ebbs and flows of behavior at work. Another important element is human energy.

There are two broad types of energy that are likely to affect discretionary behaviors at work. "Potential energy" is energy held in reserve for future tasks (e.g., Muraven and Baumeister, 2000), while "in-use energy" is directed energy used during engagement with work tasks (e.g., Kahn, 1990; Schaufeli et al., 2002; Rich, LePine, and Crawford, 2010). Each type of energy is consumable and replenishable (Muraven and Baumeister, 2000; Sonnentag, 2003; Trougakos et al., 2014) and, we argue, will predict within-person fluctuations in proactive and withdrawal behaviors at work in similar ways. But differentiating these two pathways is critical because, despite their similar effects, they operate somewhat independently of one another. The two pathways are governed by different mechanisms and may have different theoretical and managerial implications.

The ebbs and flows of behavior at work are also affected by a person's response to internal somatic complaints. Somatic complaints are discrete physiological experiences, such as nausea or feelings of pain, that originate within a person (Pennebaker, 1982; Spector, 1987). Within-person research shows that these bodily sensations are associated with stress and mood outside of work (e.g., Clark and Watson, 1988; DeLongis, Folkman, and Lazarus, 1988; Watson, 1988). In the organizational sciences, however, researchers have traditionally studied somatic complaints by comparing effects between subjects (cf. Martocchio, Harrison, and Berkson, 2000; Ferris et al., 2009) or identified the

environmental antecedents of employees' somatic complaints (e.g., Potter et al., 2002; Meier et al., 2013). To the best of our knowledge, the only within-person research on the workplace consequences of somatic complaints has found that somatic complaints affect mood by disrupting perceptions of goal progress (Scott et al., 2010). This research suggests—but does not test—the idea that somatic complaints affect work behavior (Scott et al., 2010), though it is reasonable to expect that somatic complaints, via their effects on human energy, would relate to within-person fluctuations in discretionary behaviors.

Although a variety of somatic complaints may affect people's discretionary behaviors, we focus on one important yet understudied condition: fluctuations in pain at work. Increases in pain can affect discretionary work behaviors because pain "demands" energy; it affects both the level of energy people reserve and the direction of its use (e.g., Eccleston and Crombez, 1999; Solberg Nes, Roach, and Segerstrom, 2009). We also examine a boundary condition for these effects, which is that people may slowly habituate to their pain. Thus people who have suffered from pain for a longer period of time may become practiced at handling the regulatory demands of this somatic complaint.

We formulate hypotheses and test them by studying the daily experiences of full-time employees in a variety of industries. In our first study, we track the experiences of people with chronic pain, a potentially debilitating condition that is characterized by persistent, unrelenting fluctuations in pain (cf. Frank, 1993; Loeser and Melzack, 1999; Apkarian, Baliki, and Geha, 2009). Chronic pain provides an ideal context in which to study within-person variability in somatic experiences because people with chronic pain experience substantive daily fluctuations in pain. Studying people with chronic pain also allows us to examine the moderating effects of long-term habituation. In our second study, we track the experiences of a representative sample of U.S. workers and assess whether our findings generalize to people experiencing fluctuations in momentary pain at work and thus their discretionary behaviors.

DISCRETIONARY BEHAVIORS AND HUMAN ENERGY

Every person's work consists of both in-role tasks and discretionary behaviors. In-role tasks are the work functions people perform because of managerial decisions and job requirements (e.g., Katz, 1964). Discretionary behaviors are voluntary tasks that employees perform for themselves or their organization (e.g., Van Dyne and LePine, 1998; Bennett and Robinson, 2000; Spector and Fox, 2002). In this paper, we focus on one positive and one negative family of discretionary behaviors. Extra-role behaviors are positive discretionary behaviors that help people facilitate organizational functioning by promoting, encouraging, or causing things to happen (Van Dyne and LePine, 1998). Withdrawal behaviors are negative discretionary behaviors that help people avoid difficult aspects of their work or reduce their personal investment in a job (Hanisch and Hulin, 1990, 1991). Discretionary behaviors provide a useful context in which to study within-person theories of organizational behavior because they fall outside the normal scope of managerial attention, policies, and procedures, increasing their tendency to vary from day to day (e.g., Ilies, Scott, and Judge, 2006; Dalal et al., 2009).

A key to understanding within-person variation in discretionary behavior lies with theories of human energy, because people's work behavior depends on motivational (energetic) resources (e.g., Kanfer, 1990; Frijda, 1994; Baumeister et al., 1998; Hobfoll, 2001). Beal and colleagues (2005: 1057) argued that "in trying to model episodic performance, not only must researchers pay attention to the level of resources that people have and are able to bring to a task, they must also pay attention to whether or not they are allocating these resources to the task at hand." Quinn, Spreitzer, and Lam's (2012) integrative review of motivational theories identified two broad types of human energy—potential energy and in-use energy—that may predict how often people engage in withdrawal and extra-role behaviors at work. These two types of energy can have similar effects on people's discretionary behaviors but are independent mechanisms with different implications. Thus we must consider both pathways in order to understand how fluctuations in somatic complaints are related to within-person fluctuations in discretionary behaviors.

Potential Energy

Potential energy is the unused stock of energy resources that can be activated for future tasks (Quinn, Spreitzer, and Lam, 2012). According to the self-regulatory resource model (e.g., Baumeister, Heatherton, and Tice, 1994; Muraven, Tice, and Baumeister, 1998; Muraven and Baumeister, 2000), individuals draw on this consumable pool of energy to regulate their emotions, thoughts, and behaviors. The potential energy that determines a person's stock of resources is not domain specific; it can be applied to multiple areas of self-regulation. Drawing on energy in one domain (e.g., to regulate emotions) depletes the resources available for regulation in other domains (e.g., Vohs et al., 2008). The "regulatory expenses" of effortful decision making, acts of willpower, and emotion regulation all deplete the same pool of potential energy (for a review, see Hagger et al., 2010).

Biophysiological research affirms the connection between the concept of potential energy and the more widely known concept of self-regulatory resources. Quinn, Spreitzer, and Lam's (2012) definition of potential energy emphasizes that a person's stock of energy reflects the level of glucose and other biological resources that fuel brain functioning. Self-regulatory resources are also closely related to glucose (Gailliot and Baumeister, 2007; Gailliot et al., 2007; Masicampo and Baumeister, 2008). For example, compared with a placebo, drinking lemonade containing glucose increases people's self-regulatory strength (Masicampo and Baumeister, 2008). Researchers have also documented relationships between people's glucose metabolism rates and executive functioning in the prefrontal cortex (Fairclough and Houston, 2004), an area in the brain that governs self-regulation (e.g., Miller, 2000; Jennings, Monk, and Van der Molen, 2003). Accordingly, a resource perspective may explain—via the observed manifest variable of depletion—how changes in potential energy affect people's discretionary behaviors.

Depleted potential energy resources may reduce optimal motivational tendencies (Baumeister et al., 2006; Baumeister and Vohs, 2007), which in turn affect people's positive and negative discretionary behaviors. Lab studies suggest that people with depleted regulatory resources are more likely to choose a passive course of action over an active one (Baumeister et al., 1998), are less

likely to engage in helping behavior (DeWall et al., 2008; Xu, Bègue, and Bushman, 2012), and are less equipped to resist impulses that violate organizational norms (e.g., Thau and Mitchell, 2010; Barnes et al., 2011; Christian and Ellis, 2011; Gino et al., 2011; Welsh et al., 2014). Thus a depleted pool of regulatory resources—reduced potential energy—will tend to be associated with increased withdrawal behaviors and decreased extra-role behaviors.

In-use Energy

The second type of human energy is in-use energy, which is channeled toward a particular activity (Feldman, 2004; Quinn, Spreitzer, and Lam, 2012). Quinn and colleagues considered in-use energy to be associated with the experience of energetic activation, which people feel as part of their affective states (Russell, 1980), often “experienced as feelings of vitality, vigor, or enthusiasm” (Quinn, Spreitzer, and Lam, 2012: 6). At work, a highly relevant form of in-use energy is work engagement, the personal investment of cognitive, emotional, and physical energy in aspects of a job (Kahn, 1990; Rich, LePine, and Crawford, 2010). Work engagement describes the extent to which people direct their in-use energy toward the work itself (e.g., Christian, Garza, and Slaughter, 2011). It is a mechanism through which people allocate energetic resources to pursue a specific function, and thus we consider it to be a manifest representation of in-use energy.

Fluctuations of in-use energy will, like fluctuations in potential energy, affect discretionary behavior at work. People who disengage from their work tend to adopt a more narrow view of their work role (Kahn, 1990) and focus on required activities rather than extending their role definitions and action repertoires to include discretionary behaviors (Cacioppo, Gardner, and Berntson, 1999; Fredrickson, 2001). Conversely, individuals experiencing high work engagement are characterized by agency, volition, and proactivity (Kahn, 1990; Schaufeli et al., 2002; Rich, LePine, and Crawford, 2010). Decreasing the energy directed toward work may therefore reduce promotive extra-role behaviors that require personal volition (Marks, 1977; Thayer, 1989; Moller, Deci, and Ryan, 2006). Prior research suggests that disengaged individuals withhold personal energy, behaving in a detached, automated, and passive manner (e.g., Goffman, 1961; Hochschild, 1983; Kahn, 1990), whereas engaged employees are psychologically willing to invest personal energy in their tasks (Kahn, 1990). Thus we expect work engagement to be negatively related to withdrawal behaviors.

Our energy model suggests that discretionary behaviors vary as a function of the energy resources that people have in reserve for future efforts and as a function of the resources that they choose to invest in the performance of their work responsibilities. This distinction is critical because it implies that potential and in-use energy may operate independently of one another. Unlike in physics, potential energy does not always provide the raw materials of in-use energy. In a discussion of this point, Quinn, Spreitzer, and Lam (2012: 8) wrote that “people can feel energized without investing any effort or engage in effort that they do not feel energized about.” Research indicates that in-use energy is not limited by potential energy resources; rather, it is limited by the extent to which an individual feels energized by the tasks (e.g., Marks, 1977; Thayer, 1989; Moller, Deci, and Ryan, 2006). High potential energy does not always lead to

increased effort, just as low potential energy does not always lead people to reduce their investment in work. To the contrary, people with low potential energy may sometimes overextend their resources as they push past the point of exhaustion (Marks, 1977). Furthermore, the managerial remedies that may help people restore their potential energy (e.g., rest) may be different than the managerial remedies that help people change their allocation of in-use energy (e.g., rewards). Thus, although our predictions for potential and in-use energy are similar in direction, we distinguish these two types of energy because they have different theoretical and managerial implications. Accordingly, we propose that self-regulatory resources and work engagement are two distinct pathways through which a person's experiences may lead to changes in discretionary behaviors. The somatic complaint of daily pain is one type of experience that may trigger both of the energy mechanisms described above.

The Effects of Pain

Feelings of pain are a commonly experienced and extensively studied somatic complaint that may have consequences for organizations (Von Korff et al., 1988). In addition to costs related to absenteeism (Martocchio, Harrison, and Berkson, 2000), chronic pain is associated with increased strain (Sprigg et al., 2007), decreased in-role job performance (e.g., Byrne and Hochwarter, 2006), and decreased extra-role behaviors (e.g., Ferris et al., 2009). But the between-person focus of the extant literature obscures the fact that pain fluctuates and thus neglects its proximal effect on human energy.

Our framework addresses this gap, investigating the relationships among pain fluctuations, two forms of human energy, and discretionary behaviors at work. Biobehavioral research suggests that pain is not just a sensory experience; it also consumes cognitive energy (Turk and Rudy, 1986) and reduces cognitive functioning (e.g., Park et al., 2001; Katz, 2004). People devote emotional and cognitive resources to managing their discomfort, typically by redirecting attention, suppressing ruminative thoughts about pain, and regulating comorbid affective states such as depression and anxiety (Eccleston and Crombez, 1999). As such, an experience with pain may deplete the stock of potential energy that could otherwise be used in future cognitive, emotional, and behavioral tasks (e.g., Eccleston and Crombez, 1999; Apkarian et al., 2004a; Solberg Nes, Roach, and Segerstrom, 2009).

The conceptual relationship between pain and potential energy is consistent with evidence from neuroscience. Pain increases abnormal blood flow and brain activity in the prefrontal cortex (e.g., Staud and Domingo, 2001; Geha et al., 2007). Additionally, long-term experiences with chronic pain are associated with decreased density in the prefrontal cortex, a physiological indicator of impaired brain function (Apkarian et al., 2004b). By increasing cortisol levels, pain also inhibits the production and secretion of blood glucose and glucose metabolism in the brain (Korszun et al., 2000; Korszun et al., 2002). Thus we expect pain to affect people's regulatory capacity such that employees will draw from their energetic resources to regulate their pain, reducing the resources available for work-related tasks. Accordingly, employees without pain will have a greater stock of potential energy, resulting in a pool of freed-up resources (cf. Halbesleben and Bowler, 2007). Because pain may deplete potential energy, it may affect people's discretionary behaviors:

Hypothesis 1a (H1a): Pain has a negative indirect effect on a person's promotive extra-role behaviors, which is partially mediated by self-regulatory resource depletion.

Hypothesis 1b (H1b): Pain has a positive indirect effect on a person's withdrawal behaviors, which is partially mediated by self-regulatory resource depletion.

Pain may also affect how people direct their in-use energy because it takes priority over other competing demands, prompting people to focus on the source of their discomfort (Crombez et al., 1999). Researchers have linked pain to threat-avoidance reactions (Eccleston and Crombez, 1999) that drive people to withdraw from normal activities (Hamilton, Karoly, and Kitzman, 2004; Hamilton, Karoly, and Zautra, 2005). Pain is also considered a physiological danger signal that encourages people to retreat from otherwise valuable external goal-directed activity (Hamilton, Karoly, and Kitzman, 2004; Hamilton, Karoly, and Zautra, 2005) and inwardly direct their energy toward pain management (Eccleston and Crombez, 1999). Conversely, when pain decreases, people tend to direct their energy toward approach motives, such as seeking out personal connections, behaving proactively, and broadening their goals (Hamilton, Karoly, and Kitzman, 2004; Hamilton, Karoly, and Zautra, 2005).

The redirecting effects of pain are adaptive when it comes to pain regulation but are suboptimal for organizations. By changing where people focus their energy, variations in pain may create cycles of engagement and disengagement with their work. On high pain days, people will direct more energy inward toward pain management and less to their work roles, creating a state of low engagement. On low pain days, in contrast, people who do not have to actively manage their pain may experience higher engagement and pursue approach goals related to the work domain (Frese et al., 1997; Sonnentag, 2003; Byrne and Hochwarter, 2006). Because pain directs energy away from work, it will affect discretionary behaviors:

Hypothesis 2a (H2a): Pain has a negative indirect effect on a person's promotive extra-role behaviors, which is partially mediated by work engagement.

Hypothesis 2b (H2b): Pain has a positive indirect effect on a person's withdrawal behaviors, which is partially mediated by work engagement.

The Moderating Effects of Habituation

Until this point, we have focused on people's psychological and behavioral responses to discrete episodes of pain, but pain occurs more or less frequently in different people's lives. Long-term experiences with pain may slowly decrease the energy needed for, and redirected because of, pain regulation. People with long-term chronic pain may experience "pain habituation," a decrease in pain and pain-related responses following continuous or repetitive painful stimulation (LeBlanc and Potvin, 1966; Rennefeld et al., 2010).

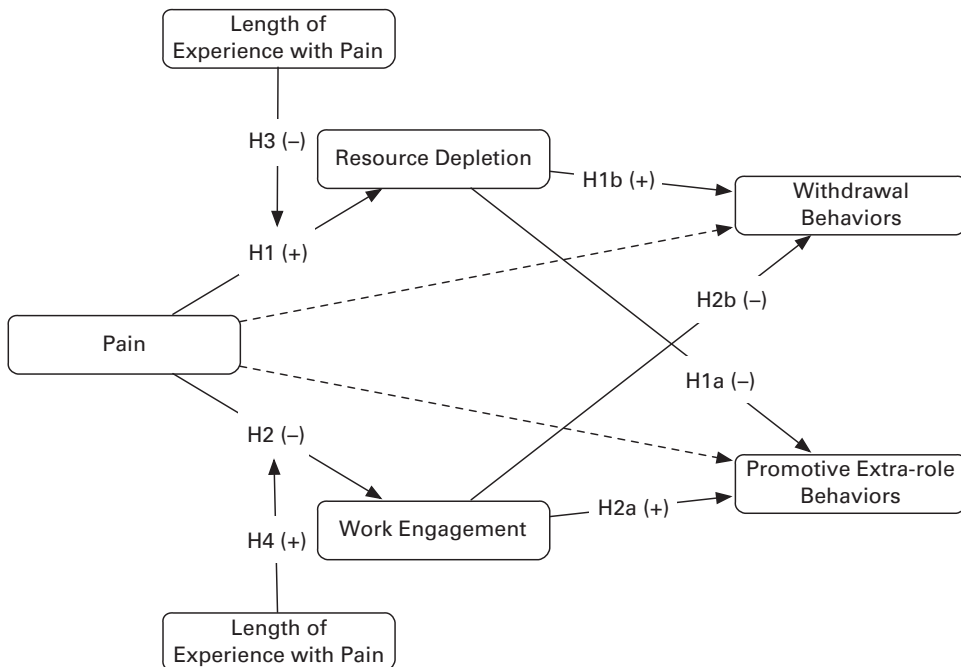
Pain habituation can be studied from either a biological or psychological perspective. From a biological perspective, researchers argue that central neurotransmitter systems may slowly reduce people's pain reactions to identical stimuli (Rennefeld et al., 2010). From a psychological viewpoint, cognitive factors such as reduced novelty and increased predictability of pain over time may create habituation (Crombez et al., 1997; Eccleston and Crombez, 1999).

Because our hypotheses are grounded in theories of psychological energy, we draw primarily on this latter perspective to understand the effects of pain habituation.

There are two psychological mechanisms that may affect the long-term relationship between pain and energy. First, pain habituation may occur as people develop increased capacity for dealing with decreasingly novel stimuli (Eccleston and Crombez, 1999). As a depleting stimulus recurs, people both increase their stock of regulatory resources and have to deploy fewer resources psychologically to manage the repeating stimuli (Muraven, Baumeister, and Tice, 1999; Baumeister et al., 2006; Gailliot et al., 2007). This effect is likened to the process whereby muscles tend to get stronger the more they are used (Muraven and Baumeister, 2000). Thus, as people practice dealing with competing work and pain demands, their energy capacity will increase, leaving them with more self-regulatory resources on high pain days.

Second, habituation may lead pain to have a less disruptive effect on the direction of people's energy allocation. Stimulus comparison theories (Sokolov, 1963; Siddle, 1991) suggest that, over time, people construct cognitive representations—schemas—of aversive stimuli. As experience brings understanding, pain may demand less attention because the experience is less novel (Eccleston and Crombez, 1999). Thus pain habituation may reduce pain's negative effects on work engagement (Chapman, 1978). In support of this idea, people who have learned to accept the "unpleasant reality" of chronic pain tend to

Figure 1. Hypothesized relationships between daily variations in within-person pain and human energy variables and workplace behaviors.*



* Dashed lines indicate relationships that we hypothesize will be partially mediated by resource depletion and work engagement.

engage more with their daily tasks than people for whom the experience is more novel (Viane et al., 2004). Therefore the hypothesized effects of daily pain on energy should be buffered by the length of time a person has lived with pain. As these moderation hypotheses focus on the first stages of indirect effects, we also expect that pain habituation will reduce the negative effect of pain on discretionary behaviors:

Hypothesis 3 (H3): The effect of pain on self-regulatory resource depletion is smaller for people who have longer experiences with chronic pain, which will reduce the indirect effects of daily pain on promotive extra-role behaviors and on withdrawal behaviors.

Hypothesis 4 (H4): The effect of pain on work engagement is smaller for people who have longer experiences with chronic pain, which will reduce the indirect effects of daily pain on promotive extra-role behaviors and on withdrawal behaviors.

Figure 1 summarizes the hypothesized relationships in our model among daily variations in a person's pain, human energy variables, and workplace behaviors.

STUDY 1

Study 1 investigates how a person's fluctuations in daily pain affect discretionary behaviors. We chose to study employees with chronic pain in this study because people with chronic pain tend to experience days of both high and low pain within a relatively short window of time. This variability let us conduct a strong test of our hypotheses, because the expected effects are easier to detect in populations that experience larger fluctuations in pain. Targeting a population with chronic pain also allowed us to test our hypotheses on pain habituation, because this population has varying levels of long-term exposure to pain.

We conducted Study 1 in two stages. During the first stage (Study 1A), we recruited participants who met our selection criteria: employees who (a) were currently employed full-time daytime office workers, (b) suffered from chronic pain for at least six months, and (c) experienced pain multiple times per week. After identifying this sample, we conducted an experience-sampling study to test our substantive hypotheses (Study 1B).

Study 1A: Screening Study

We conducted a screening study to identify potential participants for our experience-sampling study. Our participants were 384 employed American adults with chronic pain (56 percent female). We recruited this sample with the help of a company that specializes in targeting research participants with clinical profiles. All participants completed an online survey about their chronic pain, job characteristics, psychological variables, and demographics.

Measures. *Chronic pain variables.* Participants indicated the *frequency of pain* (1 = "less than once per week" to 6 = "constantly"), their *average pain intensity* (1 = "mild" to 5 = "excruciating"), and their *number of months with pain*. Participants also indicated whether they *take medication* for their pain,

whether they received *other treatments* to help manage their pain (e.g., surgery, physical therapy), and whether their *chronic pain has a known cause* (e.g., cancer, traumatic injury, multiple sclerosis). Chronic pain is associated with a range of clinical conditions, including those associated with the musculoskeletal or central nervous system (e.g., lower back pain, fibromyalgia, arthritis) and other conditions such as malignant cancer. We focused on the consequences of non-cancer pain because we were interested in the psychological effects of daily pain, not those of a sometimes-terminal illness (Dersh, Polatin, and Gatchel, 2002). Participants also provided qualitative descriptions of their pain, the medications they take, the treatments they have received, and, if appropriate, the event that caused their chronic pain.

Job characteristics. Participants indicated their average *hours worked per week*, whether they work in an *office environment*, and the extent to which their *job requires physical exertion* (1 = "very slightly or not at all" to 5 = "very much"). Participants also provided a qualitative description of their job and information about when their workday begins and ends.

Psychological covariates. We asked participants about a series of psychological variables that are theoretically linked to chronic pain. First, participants completed the Depression, Anxiety, and Stress Scale or DASS (Antony et al., 1998), which measures how much *depression* ($\alpha = .97$), *anxiety* ($\alpha = .95$), and *stress* ($\alpha = .95$) the participants experienced during a typical week in the past 12 months. Second, participants used Spector's (1988) scale to describe their *locus of control*, the extent to which individuals believe that they control events that affect them ($\alpha = .88$). Third, participants described how much *positive affect* ($\alpha = .92$) and *negative affect* ($\alpha = .97$) they experience, on average, using the Positive and Negative Affect Scale or PANAS (Watson, Clark, and Tellegen, 1988).

Demographics. Participants provided information about whether they are *female*, their *age*, their ethnicity (coded as *white* if participants described themselves as such), the highest level of education completed (coded as *college educated* if they graduated from a four-year college), and their interest and availability to participate in the experience-sampling study.

Results. Table 1 lists the descriptive statistics and bivariate correlations for the variables in the screening survey. The average respondent had suffered from pain for over four years (mean = 49.76 months, s.d. = 68.49), experienced pain daily (mean = 4.55, s.d. = 1.40, where 4 represents "Once a day, almost every day" and 5 represents "Multiple times per day"), and rated the pain intensity as between discomforting and distressing. Seventy-two percent of the respondents took pain medication, 53 percent received other treatments, and 32 percent had knowledge of an onset event. The bivariate correlations in table 1 show evidence consistent with our expectations, suggesting that our measures are valid indicators of the constructs of interest.

Study 1B: Experience-sampling Stage

After identifying a sample of participants with chronic pain, we applied our selection criteria and conducted an experience-sampling study to test our

Table 1. Descriptive Statistics and Bivariate Correlations for Study 1A: Screening Study (N = 384)

Variable	Mean	S.D.	1	2	3	4	5	6	7	8
<i>Chronic pain variables</i>										
1. Frequency of pain	4.55	1.40								
2. Pain intensity	2.70	0.91	.35***							
3. Number of months with pain	49.76	68.49	.19***	.00						
4. Take medication	0.72	0.45	.39***	.25***	.03					
5. Other treatments	0.53	0.50	.25***	.10	.19***	.16**				
6. Chronic pain has a known cause	0.32	0.47	.07	.15**	.09	.08	.15**			
<i>Job characteristics</i>										
7. Weekly hours worked	40.60	8.64	-.01	.01	-.05	-.03	.01	-.06		
8. Office environment	0.73	0.44	.09	.01	-.06	-.06	.11*	.00	.16**	
9. Job requires physical exertion	2.32	1.13	.14**	.26***	-.05	.18***	-.06	.08	.12*	-.31***
<i>Psychological covariates</i>										
10. Stress	2.18	0.72	.18***	.29***	-.05	.08	.00	.00	.02	.04
11. Depression	1.74	0.77	.13*	.29***	.00	.11*	.00	-.03	-.03	-.01
12. Anxiety	1.51	0.63	.15**	.29***	-.04	.09	-.03	.01	-.04	.05
13. Locus of control	3.56	0.64	.14**	.05	.01	.09	.03	.12*	.08	.02
14. Positive affect	3.38	0.79	.00	.03	-.06	.01	-.05	.09	.05	.04
15. Negative affect	1.97	0.81	.10*	.20***	-.03	.02	-.06	-.06	.00	-.01
<i>Demographics</i>										
16. Female	0.56	0.50	.04	.04	-.06	.00	.09	-.05	-.04	-.08
17. Age	46.12	10.68	.10*	-.07	.17**	.07	.01	.01	-.04	-.07
18. White	0.82	0.38	.05	-.10*	.03	.10*	-.02	-.13*	.09	-.07
19. College educated	0.63	0.48	-.03	-.05	-.07	.00	.15**	.02	.15**	.19***
Variable	9	10	11	12	13	14	15	16	17	18
<i>Psychological covariates</i>										
10. Stress	.18***									
11. Depression	.13*	.69***								
12. Anxiety	.08	.65***	.76***							
13. Locus of control	.12*	-.18***	-.31***	-.25***						
14. Positive affect	.14**	-.33***	-.40***	-.22***	.35***					
15. Negative affect	.11*	.72***	.75***	.73***	-.31***	-.37***				
<i>Demographics</i>										
16. Female	.02	.09	-.03	.01	-.01	-.11*	.05			
17. Age	.05	-.15**	-.08	-.16**	.12*	.06	-.17**	-.12*		
18. White	-.03	.00	.06	-.08	-.02	-.11*	-.02	-.03	.06	
19. College educated	-.12*	-.06	-.09	-.02	-.04	.14**	-.04	-.09	-.19***	-.08

* $p < .05$; ** $p < .01$; *** $p < .001$.

substantive hypotheses. The respondents in the screening study were invited to participate in the experience-sampling study if they met five criteria: they must (a) have suffered from chronic pain for at least six months; (b) experience pain at least multiple times per week; (c) work at least 36 hours per week in an office; (d) work from morning until evening (e.g., no night shift workers); and (e) have expressed that they were interested and available to participate. We invited the 102 of the 384 participants who met all of these criteria to participate. Of these, 90 completed at least one of the 30 daily surveys, but we

Table 2. Average Characteristics of Participants in Study 1A and Study 1B*

Variable	Participated in Screening Study	Experience-sampling Study	
		Invited	Participated
<i>Chronic pain variables</i>			
Frequency of pain	4.55	5.01**	5.02**
Pain intensity	2.70	2.78	2.81
Number of months with pain	49.8	74.5**	73.7**
Take medication	72%	75%	73%
Other treatments	53%	64%*	68%*
Chronic pain has a known cause	32%	36%	36%
<i>Job characteristics</i>			
Weekly hours worked	40.6	43.1**	43.0*
Office environment	73%	100%***	100%***
Job requires physical exertion	2.32	2.22	2.20
<i>Psychological covariates</i>			
Stress	2.18	2.14	2.12
Depression	1.74	1.72	1.70
Anxiety	1.51	1.46	1.43
Locus of control	3.56	3.58	3.60
Positive affect	3.38	3.35	3.39
Negative affect	1.97	1.92	1.87
<i>Demographics</i>			
Female	56%	53%	49%
Age	46.1	46.8	47.0
White	82%	86%	84%
College educated	63%	69%	69%
Number of participants	384	102	85

* $p < .05$; ** $p < .01$; *** $p < .001$.

* Bullets indicate whether there is a significant difference between participants involved with the experience-sampling stage and the population of participants in the screening stage of Study 1.

restricted our analyses to the 85 participants (49 percent female) who provided at least three days of complete observations.¹

Table 2 shows the average characteristics of the participants in the experience-sampling study compared with the respondents to the screening study. As expected, the participants in the experience-sampling study differed from the respondents to the screening study in that they had higher pain frequency, more months with pain, and worked at least 36 hours in an office. We found no differences in demographics or psychological covariates. To provide additional context regarding our participants, we provide qualitative descriptions of the participants' job titles, chronic pain, medications, and treatments in the Online Appendix (<http://asq.sagepub.com/supplemental>).

We surveyed the participants using interval-contingent experience-sampling methodology (Wheeler and Reis, 1991; Alliger and Williams, 1993), closely following the methods of studies of fluctuations in daily behavior at work (e.g., Scott and Barnes, 2011). For three weeks, we e-mailed participants links to online questionnaires every weekday morning and afternoon. The morning surveys assessed pain level and sleep deprivation; the afternoon surveys

¹ Our results do not change if we use a different participation threshold, such as two complete days or four complete days.

assessed the mediating and outcome variables. This method allowed us to assess the pain–behavior relationship on a daily basis. Participants were asked to complete the morning surveys before they began their workday and the afternoon surveys before they left work. By the time they completed the afternoon survey, participants had spent an average of 7 hours 39 minutes at work.

Participants were paid for each completed survey and a bonus for completing at least 80 percent of the surveys. The participants completed 1,012 morning surveys and 991 afternoon surveys, corresponding to a 79.3 percent completion rate for the morning surveys and a 77.7 percent completion rate for the afternoon surveys. The average participant completed 23.6 surveys (s.d. = 5.5), with 49 of the 85 participants exceeding the bonus payment threshold of 80 percent completion (24 of 30 surveys completed). As our analyses required data from both the morning and afternoon survey for a given day, we focused on the 886 observations of the participants who completed both the morning and the afternoon survey on the same day.

Measures. *Pain level.* *Daily pain* was assessed on the morning survey. In line with daily studies on chronic pain (e.g., Affleck et al., 1996; Vendrig and Lousberg, 1997; Roelofs et al., 2004), we assessed pain intensity with a single item, “How much pain are you feeling right now?,” using a 6-point scale (0 = “no pain” to 5 = “excruciating”). We chose to survey participants about their pain in the morning for four reasons. First, we hypothesized that pain is an antecedent of energy and behavior. Second, chronic pain tends to be higher in the mornings than the afternoons (Vendrig and Lousberg, 1997), so assessing morning pain should produce more variance in the independent variable. Third, for people with chronic pain, morning pain is highly correlated ($r = .87$) with pain later in the day (Holtzman, Newth, and DeLongis, 2004); thus we believed that morning pain will continue to affect this population throughout the day. Fourth, we wanted to ensure that momentary pain did not originate from the day’s work. An employee who gets hurt on the job may psychologically respond both to the perceived injustice (Sullivan, Scott, and Trost, 2012) and to the somatic experience of pain itself, potentially muddling our results.

Human energy variables. The afternoon surveys assessed two human energy variables. Our measure of potential energy depletion, *resource depletion*, asked participants about their mental exhaustion (i.e., “I feel mentally exhausted right now”) and willpower (i.e., “I feel like my willpower is gone right now”) ($\alpha = .87$). These items were adapted from the State Self-Control Capacity Scale, a measure of self-regulatory resource depletion (Twenge, Zhang, and Im, 2004). Our measure of in-use energy, *work engagement*, consisted of items regarding the participants’ emotional, physical, and cognitive engagement in their jobs ($\alpha = .89$). The three items on this scale were adapted from Rich, LePine, and Crawford (2010). The items included “I was enthusiastic in my job today” (emotional engagement), “I was absorbed by my job today” (cognitive engagement), and “I exerted my full effort on my job today” (physical engagement). We conducted a series of confirmatory factor analyses to assess the discriminant validity of our measures of energy. As expected, we found that a two-factor model fit the data better than a one-factor model

(χ^2 dif = 856.8, $p < .001$). The two measures appear to be empirically distinct.

We used different temporal anchors for our measures of depletion (“right now”) and engagement (“today”). We chose these anchors because we conceptualized depletion as a momentary state and engagement as a representation of the allocation of energy to work over the course of a day. We do not think that these anchors substantively affected how participants responded to the questions. In a separate validation study, 113 working adults (49 percent female; mean age = 32.26, s.d. = 9.6 years) completed the depletion and engagement items with both temporal anchors. The correlation between depletion “at work today” and depletion “right now” was .89 ($p < .001$), and the correlation between engagement “today” and engagement “right now” was .84 ($p < .001$). The magnitude of these correlations suggests that temporal anchors are not a significant source of variation in the participants’ responses.

Pain habituation. We assessed the duration of a participant’s pain using the number of months each participant had suffered from chronic pain, a measure from the screening study. We log-transformed this variable to reduce the potential influence of extreme values and then mean-centered the log-transformed variable to aid in interpretation.

Behavioral outcomes. We measured behavioral outcomes on the afternoon survey. *Promotive extra-role behaviors* consisted of items reflecting voice—“I developed and/or made recommendations today concerning issues that affect my work”—and helping behaviors—“I spent time today helping others with their work tasks because I wanted to” ($\alpha = .69$). These items apply across a variety of organizations, represent two common forms of promotive extra-role behaviors, and align with the conceptual definition of promotive behaviors (Van Dyne and LePine, 1998). *Withdrawal behaviors* consisted of two items: “I intentionally worked slower than I could have worked today” and “I took an additional or longer break than is acceptable at work today” ($\alpha = .80$). These items also apply across various occupations, represent two of the most common forms of production deviance (e.g., Robinson and Bennett, 1995), correspond to other measures of withdrawal (Lehman and Simpson, 1992), and align with conceptual definitions of withdrawal (e.g., Hanisch and Hulin, 1990, 1991). As with the human energy variables, we assessed whether the withdrawal and promotive extra-role behavior measures were empirically distinct. Again, a two-factor model provided a significantly better fit for the data than a one-factor baseline model (χ^2 dif = 538.4, $p < .001$). The two dependent variables appear to measure different workplace behaviors.

Control variables. We controlled for between-subject differences across the participants by centering all of the variables within-person (i.e., “group mean centering”; Hofmann and Gavin, 1998). We then controlled for day-level variables that may affect the relationships among our variables. First, we controlled for *sleep deprivation* because it affects withdrawal behaviors and self-regulation (Barnes et al., 2011; Christian and Ellis, 2011). Sleep is also a likely covariate of pain fluctuations, as pain is associated with increased levels of insomnia and vice versa (Affleck et al., 1996). Consistent with previous

research (Christian and Ellis, 2011), we coded participants as sleep deprived on days when they slept fewer than six hours the previous night.² Second, we controlled for daily mood. Daily fluctuations in mood are associated with counterproductive behaviors and extra-role behaviors (e.g., Dalal et al., 2009; Scott and Barnes, 2011), and pain is associated with emotions and moods (e.g., Zautra et al., 2001; Zautra and Smith, 2001; Hamilton, Karoly, and Kitzman, 2004). Thus to ensure that human energy variables are driving the hypothesized effects, we controlled for mood states as a potential mediating variable in our model. Following Russell, Weiss, and Mendelsohn's (1989) recommendations for assessing the entire "affective grid" with two items, we measured mood states using items that measured how the participant was feeling: one item for *pleasantness* and another for *emotional activation*, variables that correspond to the two orthogonal dimensions of affective space. The dimensions of pleasantness and emotional activation are 45-degree rotations of the better-known dimensions of positive and negative affect (Russell, 1980). Although feelings are related to in-use energy, we controlled for both dimensions of affective space because we were interested in the effects of human energy as it relates to motivation more broadly, not only energy as it relates to people's moods.

Results. Table 3 lists the descriptive statistics and bivariate correlations for the variables. Our hypotheses, however, specify a multivariate model with one independent variable (daily pain), two dependent variables (promotive extra-role behaviors and withdrawal), two mediating variables (resource depletion and work engagement), and one between-person moderating variable (months with pain). We also included sleep deprivation as an exogenous control variable and included the control variables of pleasantness and emotional activation as potential alternative mediators of daily pain's effects.

We used a two-level random-coefficient model to test our hypotheses. This multilevel random-effects path model accommodates our 886 daily observations, which came from 85 participants. In addition, our multilevel random-effects path model enabled us to simultaneously estimate the hypothesized within-person effects while also accounting for daily control variables and covariation between the outcomes and mediating variables. Finally, our multilevel random-effects model allowed us to estimate the cross-level interaction effects that correspond to our hypotheses about pain habituation.

Tables 4 and 5 show, respectively, the results of our model and the hypothesized indirect effects (CFI = .90; within-person SRMR = .02). We calculated the indirect effects of daily pain by looking at the joint significance of the paths from daily pain to the mediating variables and from the mediating variables to the outcomes. Figure 2 is a graphical summary of our results.

Hypotheses 1a and 1b focused on the behavioral effects of pain via people's potential energy. The hypotheses stated that resource depletion partially mediates the relationships between (a) promotive extra-role behaviors and (b)

² Much of the literature on sleep deprivation recommends dichotomizing at six hours (see Christian and Ellis, 2011: 918) because the effects of sleep deprivation are not linearly related to total sleep quantity. Getting less than six hours of sleep is a stronger predictor of negative effects than total sleep quantity (Pilcher and Huffcutt, 1996). Additionally, people appear to benefit from sleeping for longer than six hours a night only marginally (Ferrara and De Gennaro, 2001), indicating that the benefits of sleep are an asymptotic function (Bonnet and Arand, 1995).

Table 3. Descriptive Statistics and Bivariate Correlations for Study 1B*

Variable	Mean	S.D.	ICC	1	2	3	4	5	6	7
<i>Pain fluctuations</i>										
1. Daily pain	1.40	0.93	.42							
<i>Human energy</i>										
2. Resource depletion	2.53	1.17	.41	.41***						
3. Work engagement	3.36	1.05	.49	-.22***	-.21***					
<i>Behavioral outcomes</i>										
4. Withdrawal behaviors	1.64	0.87	.62	.15***	.27***	-.34***				
5. Promotive extra-role behaviors	2.98	1.06	.51	-.07	-.17***	.65***	-.19***			
<i>Control variables</i>										
6. Sleep deprivation	0.18	0.39	.29	.29***	.18***	-.17***	.01	-.05		
7. Emotional activation	2.86	1.19	.36	-.45***	-.40***	.40***	-.16***	.26***	-.30***	
8. Pleasantness	3.20	1.10	.40	-.50***	-.38***	.41***	-.14***	.27***	-.27***	.74***

* $p < .05$; ** $p < .01$; *** $p < .001$.

* N = 886 observations nested within 85 employees with chronic pain.

Table 4. Study 1B Within-person Results of a Two-level Random-effects Model with Two Mediators and Two Outcomes*

Variable	Mood Controls		Human Energy Mediators		Behavioral Outcomes	
	Emotional activation	Pleasantness	Resource depletion	Work engagement	Withdrawal behaviors	Promotive extra-role behaviors
<i>Control variables</i>						
Sleep deprivation	-.04*** (0.09)	-.02** (0.08)	0.26** (0.09)	-.024** (0.08)	0.02 (0.06)	-.06 (0.07)
Emotional activation					-.01 (0.03)	-.03 (0.03)
Pleasantness					0.01 (0.03)	0.00 (0.04)
<i>Pain fluctuations</i>						
Daily pain	-.064*** (0.04)	-.063*** (0.04)	0.42*** (0.04)	-.020*** (0.04)	0.09** (0.03)	0.02 (0.04)
<i>Human energy mediators</i>						
Resource depletion					0.06** (0.02)	-.02 (0.03)
Work engagement					-.10*** (0.03)	0.63*** (0.03)
<i>Cross-level moderation</i>						
Daily pain × Log (months with pain)	0.01 (0.05)	0.00 (0.04)	-.015** (0.05)	-.06 (0.05)	-.01 (0.03)	0.01 (0.04)
Pseudo-R ²	.26	.31	.15	.11	.05	.26

* $p < .05$; ** $p < .01$; *** $p < .001$.

* Standard errors are in parentheses; N = 886 observations nested within 85 employees with chronic pain.

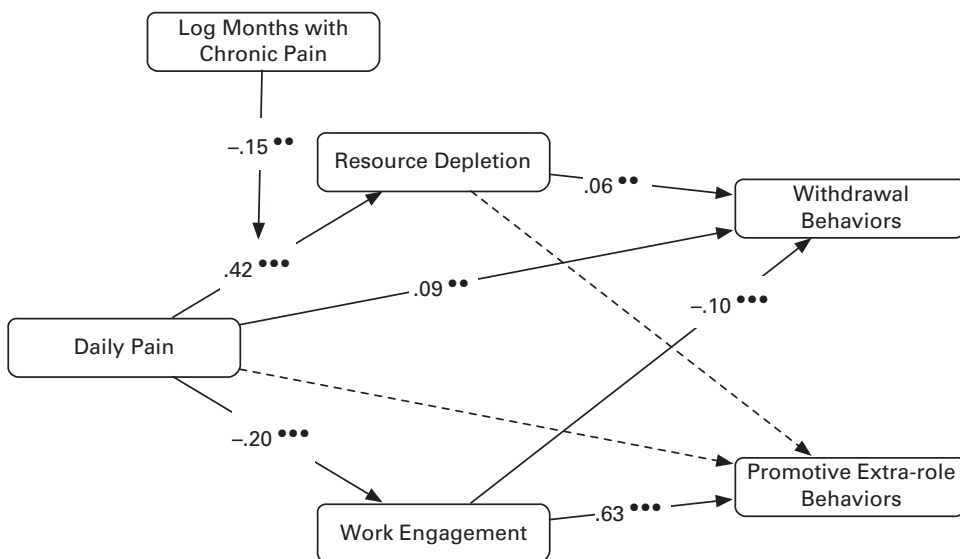
Covariances between mediators and between the outcomes are not shown. Pseudo-R² is calculated using Snijders and Bosker's (1999) formula.

Table 5. Study 1B Results of Random-effects Model of Indirect Effects of Daily Pain*

Indirect Effect	Behavioral Outcomes	
	Withdrawal behaviors	Promotive extra-role behaviors
Via resource depletion (H1a, H1b)	0.03** (0.01)	-0.01 (0.01)
Via work engagement (H2a, H2b)	0.02** (0.01)	-0.13*** (0.03)

* $p < .05$; ** $p < .01$; *** $p < .001$.

* Standard errors are in parentheses; $N = 886$ observations nested within 85 employees with chronic pain.

Figure 2. Within-person results from Study 1.

* $p < .05$; ** $p < .01$; *** $p < .001$.

* Dotted lines are non-significant paths. Non-significant cross-level interactions, effects of control variables, and correlations between outcomes are not shown.

withdrawal behaviors. The indirect effects in table 5 provide no evidence that resource depletion mediates the relationship between daily pain and promotive extra-role behaviors ($t = -0.93$, $p = .352$) but suggest that resource depletion significantly mediates the relationship between daily pain and withdrawal behaviors ($t = 2.69$, $p = .007$). Hypothesis 1a is not supported; hypothesis 1b is supported.

Hypotheses 2a and 2b focused on the mediating effects of in-use energy. These hypotheses stated that work engagement partially mediates the effects of pain and (a) promotive extra-role behaviors and (b) withdrawal behaviors. Table 5 shows support for both hypotheses. Work engagement significantly mediates the relationships between daily pain and promotive extra-role

behaviors ($t = -4.91, p < .001$) and the relationship between daily pain and withdrawal behaviors ($t = 3.04, p = .002$). Hypothesis 2a and hypothesis 2b are both supported.

Our remaining hypotheses focused on pain habituation, that longer exposure to pain would diminish the relationship between daily pain and human energy. In support of hypothesis 3—that the effect of daily pain on resource depletion will be smaller for people who have longer experiences with pain—results in table 4 show a significant negative cross-level interaction effect between log months with pain and daily pain ($t = -2.83, p = .005$), which suggests that the depleting effects of pain shrink over time but do not appear to reverse themselves. As the between-subjects variable is log-transformed, our estimate of pain habituation on resource depletion suggests that a person would have to experience chronic pain for more than 69.4 years before daily pain had zero effect on resource depletion. Hypothesis 3 is supported.

We further hypothesized that people's long-term exposure to pain would moderate the indirect effect of pain on promotive extra-role behaviors and withdrawal behaviors. As we found no evidence of a relationship between resource depletion and promotive extra-role behaviors in testing hypothesis 1a, we did not expect to find any evidence of a moderation effect. We did find, however, that the mediated path between daily pain and resource depletion and between daily pain and withdrawal behaviors is moderated by long-term exposure to pain. Comparing the indirect effects for participants who are plus and minus one standard deviation above the mean log months of pain, we found evidence of moderated mediation (short exposure: indirect effect = .033, SE = .013, $t = 2.64, p = .009$; long exposure: indirect effect = .018, SE = .008, $t = 2.36, p = .018$; difference = $-.015, SE = .007, t = 1.97, p = .049$). People who have suffered from chronic pain for longer tend to engage in fewer withdrawal behaviors than people who have more recently started to experience chronic pain, supporting hypothesis 3.

We did not find support for hypothesis 4, that exposure to pain will moderate the relationship between daily pain and work engagement, as shown in table 4's results on the cross-level interaction between log months with pain and daily pain ($t = -1.21, p = .23$). There is no evidence that people in pain will direct more of their energy toward work if they have long-term experience with pain.

STUDY 2

The results of Study 1 are largely consistent with our hypotheses that resource depletion and work engagement partially mediate the relationship between pain and withdrawal. The relationship between daily pain and promotive extra-role behaviors was mediated by work engagement but not by resource depletion, partially supporting our hypotheses. Furthermore, we found evidence of habituation in pain's effect on resource depletion. Long-term exposure to pain appears to reduce the normally depleting effect of pain on people's potential energy.

We conducted a second study to replicate our primary findings and address some of the limitations of Study 1. First, Study 1 had limited generalizability; it sampled working adults with chronic pain. Although Study 1 had the advantage of allowing us to test our hypotheses on the moderating effects of long-term

habituation, our primary hypotheses on the effects of pain on human energy and behaviors should also be examined in people without chronic conditions. To address this limitation, Study 2 explored hypotheses 1a, 1b, 2a, and 2b in a non-clinical population. We did not test the habituation hypotheses in Study 2 because the participants in this study experienced momentary pain infrequently. The data in this study were originally collected as part of Schneider and Waite's (2008) 500 Family Study on the work and home lives of dual-career American families. Although most of the participants in this study did not suffer from chronic pain, the sample may be large enough to model how infrequently experienced episodes of momentary pain (e.g., headaches) affect withdrawal and promotive behaviors at work.

Second, the participants in Study 1 were aware that we were studying the effects of daily pain. As such, demand characteristics may have led participants to consciously or non-consciously adjust their responses. We addressed this limitation in Study 2 by using archival data; the participants in the 500 Family Study were recruited because they were members of dual-career couples with children, not because they had any experience with chronic pain. Almost all previous research using the 500 Family Study data set has focused on work-family issues (e.g., Offer and Schneider, 2008). Researchers have never before used the 500 Family Study data to investigate the effects of momentary pain.

Third, although we controlled for mood states in Study 1, we wanted to replicate our findings using a different set of emotion-control variables. In Study 1, we used pleasantness and emotional activation to measure people's location within the span of the affective grid (e.g., Watson and Tellegen, 1985; Mayer and Gaschke, 1988). The participants in Study 2, in contrast, reported how much they felt discrete emotions that typify the more commonly used dimensions of positive and negative affect.

In the 500 Family Study, 675 adults (55.9 percent female) completed experience-sampling surveys while at work. The participants were recruited using local advertisements and snowball recruitment strategies (Goodman, 1961) and lived in five communities in the Midwest, one in the Southeast, one in the Northeast, and one on the West Coast. Participants were given a programmed watch that beeped at pre-scheduled times over the course of a week. Whenever the watch beeped, participants completed a 60-question pencil-and-paper survey about where they were, what they were doing, whom they were with, and what they were feeling. They responded to all questions at the same point in time on each day. Participants completed 7,862 surveys while they were at work. Our multivariate analyses focused on the 6,820 observations with no missing data (total number of participants = 650, average number of surveys per participant = 10.4, s.d. = 6.2). We were unable to compute a response rate for the subset of archival data that we analyzed, as this information was not available.

Measures

Pain level. We assessed the participants' *momentary pain* using the question "Did you feel any physical pain or discomfort as you were beeped?" The question used a 4-point scale (0 = "None" to 3 = "Severe"). Participants also gave a qualitative description of their pain.

Human energy variables. We assessed the two energy variables using questions that asked participants to reflect about their “main activity” at work as they were being beeped. We measured *resource depletion* with the question “How well were you concentrating?”—corresponding to the item “I feel ready to concentrate” from Twenge, Zhang, and Im’s (2004) State Self-Control Scale. We assessed *work engagement* with the question “Was this activity interesting?”—corresponding to the item “I am interested in my job” from Rich, LePine, and Crawford’s (2010) engagement scale. Both questions, and all of the questions discussed below, were assessed on a 4-point scale (0 = “Not at All” to 3 = “Very Much”).

Behavioral intentions. Although the experience-sampling survey did not include questions about actual behaviors, it contained two questions that captured the intent to engage in discretionary behaviors. We measured *promotive extra-role intentions* with the question “As you were being beeped, were you feeling cooperative?”—corresponding to items referring to helping others from Konovsky and Organ’s (1996) altruism measure. We measured *withdrawal intentions* with the question “Did you wish you were doing something else?”—corresponding to the item “I thought about being absent” from Scott and Barnes’ (2011) scale.

Control variables. As in Study 1, we centered the data within-person and controlled for people’s moods as a potential mediator. We used ratings of “cheerful” feelings as a measure of *positive affect* and “angry” feelings as a measure of *negative affect*. Because the experience-sampling survey did not include any questions on *sleep deprivation*, we were unable to include this control variable.

Results

Construct validity of single item-measures. Before analyzing the archival data, we conducted a small construct validity study to assess whether the single-item measures of resource depletion, work engagement, promotive extra-role intentions, and withdrawal intentions measured their respective constructs. In this validity study, 201 working adults (73 percent male, mean age = 29.6, s.d. = 8.8) completed a survey that included the four single-item measures described above and the four validated scales used in Study 1 that corresponded to our measures of interest: resource depletion, work engagement, altruistic citizenship behaviors, and withdrawal behaviors.³ These data supported the construct validity of our single-item measures in two ways. First, the single-item measures were correlated with the four published scales (resource depletion: $r = .75, p < .001$; work engagement: $r = .82, p < .001$; promotive extra-role behaviors: $r = .42, p < .001$; withdrawal: $r = .69, p < .001$).⁴ Second, a series of confirmatory factor analyses suggested that the single-item measures loaded onto the expected measures. Looking at the two

³ Details on the procedures and sample are available from the first author upon request.

⁴ The single-item measure of promotive extra-role behaviors and the validated scale is only .42. We suspect that this is because the single-item measure focuses on feelings related to “cooperation,” whereas the validated scale focuses on actual behaviors. As people do not always act on their feelings, the relationship between these measures will be lower than the relationship between two behavioral measures.

mediating variables, we found that the expected loadings had a significantly better fit than all other possible models (χ^2 dif ranges from 51.4 to 156.9, all $p < .001$). This was also true for the outcome variables (χ^2 dif ranges from 2.76 to 125.0, all $p < .001$). Considered together, these results suggest the single-item questions are acceptable indicators of the underlying constructs.

Descriptive statistics and bivariate correlations. Table 6 lists the descriptive statistics and bivariate correlations for the variables in our study. As expected, results show that the participants rarely experienced pain. They reported experiencing “no pain” on 90.3 percent of the surveys, “mild” pain on 7.5 percent, “bothersome” pain on 2.1 percent, and “severe” pain on less than one-tenth of 1 percent. The participants most frequently described their pain as soreness/aches, headaches, sore backs, and discomfort.

As in Study 1, we used a two-level random-effects model to investigate how pain affects both promotive extra-role intentions and withdrawal intentions via the mediating variables of resource depletion and work engagement. The control variables of positive affect and negative affect are also included in the model as potential mediators. Table 7 shows the results of the two-level random-effects model (CFI = 0.92; within-person SRMR = 0.01), table 8 summarizes the results of our hypothesis tests, and figure 3 is a graphical representation of our results.

Hypotheses 1a and 1b stated that resource depletion partially mediates the relationship between momentary pain and the two outcome variables. Table 8 shows that resource depletion partially mediates the effect of pain on promotive extra-role intentions ($t = 4.61$, $p < .001$) but no evidence that resource depletion mediates the relationship between pain and withdrawal intentions ($t = 0.13$, $p = .901$). The data support hypothesis 1a but not hypothesis 1b.

Hypotheses 2a and 2b stated that work engagement would mediate the proximal effects of pain on workplace behaviors. As shown in table 8, work engagement mediates both the relationship between pain and promotive extra-role intentions ($t = 4.24$, $p < .001$) and the relationship between

Table 6. Descriptive Statistics and Bivariate Correlations for Study 2*

Variable	Mean	S.D.	ICC	1	2	3	4	5	6
<i>Pain fluctuations</i>									
1. Momentary pain	0.12	0.39	.33						
<i>Human energy</i>									
2. Resource depletion	0.72	0.80	.21	.05***					
3. Work engagement	1.86	0.95	.23	-.07***	-.51***				
<i>Behavioral intentions</i>									
4. Withdrawal intentions	1.15	1.09	.27	.07***	.20***	-.43***			
5. Promotive extra-role intentions	1.68	1.03	.34	-.01	-.28***	.29***	-.11***		
<i>Control variables</i>									
6. Positive affect	1.56	0.93	.36	-.06***	-.17***	.37***	-.28***	.40***	
7. Negative affect	0.16	0.51	.13	.05***	.04**	-.16***	.23***	-.11***	-.30***

* $p < .05$; ** $p < .01$; *** $p < .001$.

* N = 6,820 observations nested within 650 employees.

Table 7. Study 2 Within-person Results of a Two-level Random-effects Model with Two Mediators and Two Outcomes*

Variable	Mood Controls		Human Energy Mediators		Behavioral Intentions	
	Positive affect	Negative affect	Resource depletion	Work engagement	Withdrawal intentions	Promotive extra-role intentions
<i>Control variables</i>						
Positive affect					-0.26*** (0.02)	0.28*** (0.02)
Negative affect					0.22*** (0.02)	-0.06** (0.02)
<i>Pain fluctuations</i>						
Momentary pain	-0.14*** (0.03)	0.05** (0.02)	0.14*** (0.03)	-0.18*** (0.03)	0.07* (0.03)	-0.01 (0.03)
<i>Human energy mediators</i>						
Resource depletion					0.00 (0.02)	-0.20*** (0.02)
Work engagement					-0.38*** (0.02)	0.10*** (0.01)
Pseudo-R ²	.62	.34	.50	.67	.54	.62

• $p < .05$; ** $p < .01$; *** $p < .001$.

* Standard errors are in parentheses. $N = 6,820$ observations nested within 650 employees. Covariances between mediators and between the outcomes are not shown. Pseudo-R² is calculated using Snijders and Bosker's (1999) formula.

Table 8. Study 2 Results of Random-effects Model of Indirect Effects of Momentary Pain*

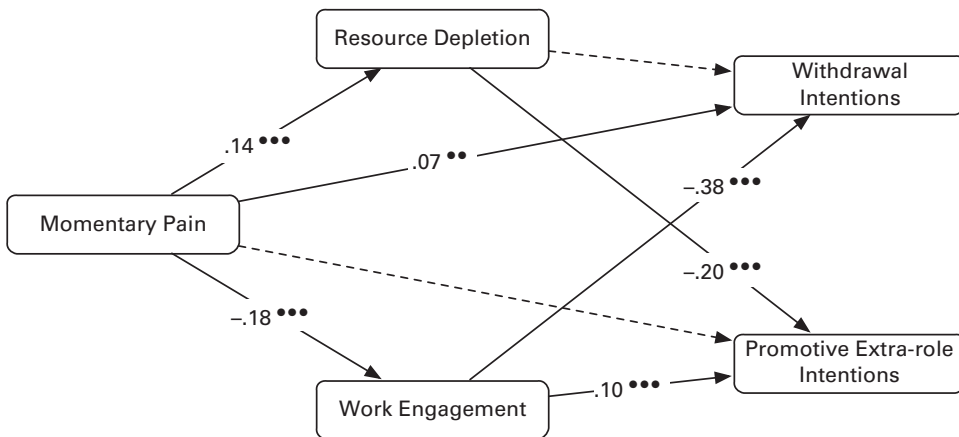
Indirect Effect	Behavioral Outcomes	
	Withdrawal intentions	Promotive extra-role intentions
Via resource depletion (H1a, H1b)	0.00 (0.00)	-0.03*** (0.01)
Via work engagement (H2a, H2b)	0.07*** (0.01)	-0.02*** (0.00)

• $p < .05$; ** $p < .01$; *** $p < .001$.

* Standard errors are in parentheses. $N = 6,820$ observations nested within 650 employees with chronic pain.

pain and withdrawal intentions ($t = 5.32$, $p < .001$), supporting both hypotheses.

The results of this study are generally consistent with the results from Study 1. Both studies found that pain affects withdrawal behaviors and promotive extra-role behaviors and that work engagement mediates these relationships. There are, however, differences across the studies in how resource depletion mediates the effects of pain. In Study 1, resource depletion mediates the relationship between pain and promotive extra-role behaviors but not between pain and withdrawal behaviors. Study 2, in contrast, found that resource depletion mediates the relationship between pain and withdrawal behaviors but not between pain and promotive extra-role behaviors. These differences are a matter of significance, however, not of sign; a positive relationship in one study is

Figure 3. Within-person results from Study 2.*

* $p < .05$; ** $p < .01$; *** $p < .001$.

* Non-significant paths are dotted lines. Effects of control variables and correlations between outcomes are not shown.

not negative in another. This discrepancy notwithstanding, the manifold similarities across the two suggest that pain fluctuations predict changes in human energy, which in turn predict employees' discretionary work behaviors.

DISCUSSION

We set out to examine the ebbs and flows in proactive extra-role and withdrawal behaviors as functions of fluctuations in human energy, arguing that daily fluctuations in pain are associated with states of depletion and disengagement at work. The results of two within-person studies largely support our hypotheses. We found that daily pain is associated with discretionary behaviors through its effects on both potential and in-use energy. We also found that people who have suffered from pain for longer may habituate to its effects on resource depletion.

Theoretical Implications

Our findings contribute to four literatures in the organization sciences. First, our research contributes to the literature on discretionary behaviors at work. To the best of our knowledge, we are the first to examine empirically the rise and fall of voluntary behaviors through human energy. Adopting Quinn, Spreitzer, and Lam's (2012) unified framework of human energy, we theorized and found that, just as potential and in-use energy ebb and flow, so do discretionary behaviors. These findings augment longer-scale models of dynamic performance, which propose that work behavior evolves as people's abilities, learning, and other individual differences slowly change (e.g., Kanfer and Ackerman, 1989; Murphy, 1989; Hofmann, Jacobs, and Baratta, 1993; Deadrick, Bennett, and Russell, 1997). Our theorizing suggests that variations in discretionary behaviors are also associated with short-term fluctuations in proximal motivational

factors such as daily energy. Identifying within-person correlates of withdrawal and extra-role behaviors is particularly important because research has traditionally focused on between-person studies of these behaviors (e.g., Dalal, 2005; Podsakoff et al., 2009).

Second, our findings help provide a more integrated picture of the predictors of within-person behavior. Our results complement the traditional focus on emotions (e.g., Beal et al., 2005; Ilies, Scott, and Judge, 2006; Dalal et al., 2009; Scott and Barnes, 2011) by discussing the construct of human energy more broadly. Controlling for mood states in both studies, we demonstrated that fluctuations in work behavior are also related to fluctuations in human energy. Our study is thus the first to answer Dalal and colleagues' (2009) call to augment research on mood with research on how regulatory resources affect discretionary behaviors. Our results suggest that theories of within-person behaviors may benefit from an expanded scope that also discusses fluctuations in human energy.

Third, our study has implications for research on human motivation. By tying together resource depletion and work engagement research within a unified energy framework, we simplified some aspects of the motivation literature. We also advanced work on self-regulatory resource depletion by moving beyond laboratory paradigms (e.g., Hagger et al., 2010) to show how potential energy fluctuates within-person in real organizational settings. Thus our research answers recent calls to investigate self-regulation within-person (Lord et al., 2010) and expands the list of exogenous factors that reduce the capacity for self-regulation. Our data suggest that people regulate pain with the same set of domain-general resources used to regulate their emotions, thoughts, and behaviors (e.g., Muraven and Baumeister, 2000).

Fourth, our findings also suggest that people improve at pain regulation over time, which has implications for research on models of self-regulatory resource expansion. This is the first study that suggests the energy capacity for pain regulation may build over time with repetition, aligning with similar propositions in the self-regulation literature (e.g., Muraven, Baumeister, and Tice, 1999; Muraven, 2010). In addition, our habituation finding emphasizes how important it is to distinguish between the two energy pathways identified in Quinn, Spreitzer, and Lam's (2012) framework. We found that pain has a less depleting effect on people who have extensive experience with chronic pain, but we did not find a similar moderating effect on the relationship between pain and work engagement.

Fifth, our research contributes to the literature on somatic complaints. Our findings suggest that somatic pain—and perhaps other somatic complaints such as illness, fatigue, or hunger—may be important antecedents or covariates of work motivation and behavior. Previous theories of somatic complaints have often focused on how stress leads to strains (e.g., Karasek, 1979; Lazarus and Folkman, 1984; LePine, Podsakoff, and LePine, 2005). By focusing on pain as an independent variable, we more closely integrated the somatic complaint literature with research on other physiological experiences. For example, research on sleep deprivation has suggested that too little sleep reduces potential energy and alters discretionary behaviors (e.g., Barnes et al., 2011; Christian and Ellis, 2011), and hunger cravings reduce people's capacity to self-regulate (e.g., Baumeister et al., 1998; Vohs and Heatherton, 2000). Thus our theoretical framework may eventually help researchers understand the

consequences of working with an array of acute or episodic illnesses (cf. Johns, 2010).

Furthermore, our study suggests that within-person investigations into bodily sensations may provide a phenomenologically appropriate level of analysis at which to study internal somatic complaints. Whereas pain research has primarily studied differences between healthy individuals and those with chronic pain (cf. Turk and Rudy, 1986; Solberg Nes, Roach, and Segerstrom, 2009; Institute of Medicine, 2011), our human energy model is dynamic and captures within-person changes. This offers significant advantages over models that rely on distal, stable characteristics that do not reflect the dynamic nature of chronic pain (Solberg Nes, Roach, and Segerstrom, 2009). By investigating phasic changes in pain, we have gathered potentially vital information about how pain affects workplace behavior (e.g., Affleck et al., 1999; Solberg Nes, Roach, and Segerstrom, 2009).

Practical Implications

Our research also has implications for managers interested in understanding and managing employee motivation. Our findings suggest that somatic complaints have workplace consequences above and beyond absenteeism and attrition. Physical health has effects that may vary from one day to the next, especially when people choose to—or have no choice but to—“work sick” (Mencimer, 2013). This is particularly true for people with chronic health conditions, a rapidly growing population in the United States (Goodman et al., 2013). Current sick-leave policies may exacerbate this problem by creating conditions in which people feel obligated to work regardless of how poorly they feel (Mencimer, 2013). Thus organizations that want to maximize their human capital should concern themselves with employee health on a daily basis.

Further, leaders and managers must recognize that increased withdrawal and decreased citizenship may be a function of an employee’s physical health rather than an indicator of an employee’s commitment to his or her job. Managers who build on our findings may look for ways to help employees replenish their resources on days when they are feeling sick. Resource-depleted employees may benefit from longer breaks or other opportunities to replenish their self-regulatory resources (Troughakos et al., 2014). Managers may also try to target human energy either by emphasizing the meaningfulness and availability of people’s jobs to promote work engagement (e.g., Kahn, 1990; May, Gilson, and Harter, 2004) or by providing positive mood inductions to increase people’s regulatory resources (cf. Tice et al., 2007).

Our study also suggests the critical importance of developing and implementing effective treatments and symptom management strategies for chronic health conditions. Even with chronic pain, employees are motivated and helpful when their pain is low but are likely to withdraw and reduce proactive behaviors when their pain is high. Thus comprehensive insurance, medical treatment, and physical wellness programs may, in addition to reducing absences, help organizations increase employees’ effort at work and promote citizenship behaviors. Even if treatment strategies are unavailable, our results suggest that companies should create sick-leave policies that better accommodate people with somatic pain or illness. Asking employees to work when they are sick results in less engaged and helpful employees.

Limitations and Future Directions

As with any empirical research, our study has limitations that future research may address. We explored the concomitant variations in daily pain, human energy, and volitional behaviors in a heterogeneous sample of white-collar workers. Focusing on two heterogeneous samples increased our external validity but also limited our ability to collect objective measures of productivity or performance. With accountants, engineers, bookkeepers, dentists, and pastors in our samples, we had to focus on workplace behaviors that are relevant across professions. Future investigations could use more homogenous samples to investigate how fluctuations in pain and energy influence the performance of individuals and units within a single organization.

Our research designs are also limited by our reliance on self-reported data. Self-reports are a standard practice in experience-sampling studies (e.g., Dalal et al., 2009; Ilies, Wilson, and Wagner, 2009) and in studies where it would be difficult for supervisors to observe the variables of interest (e.g., Berry, Ones, and Sackett, 2007). Although there is considerable evidence that self-reports of voluntary behaviors are related to the actual rate of those behaviors (Ones, Viswesvaran, and Schmidt, 1993), future research could look at the relationships between self-reported pain—a variable that observers cannot accurately assess—and supervisor or peer ratings of discretionary behaviors. Moreover, by using self-report assessments of depletion and engagement, we assumed that these manifest variables are valid indicators of potential and in-use energy, respectively. Potential energy is perhaps best measured by the physical presence of the building blocks of cellular energy such as glucose and adenosine triphosphate, but it was infeasible to conduct multiple blood tests per participant per day. Thus any confidence in our conclusions regarding the human energy framework should be tempered by the fact that our measures are imperfect. Proxy variables can provide reasonable insights into the energy pathways that connect fluctuations in pain to fluctuations in discretionary behaviors, but future efforts involving physiological tests would help validate our findings.

We conducted two studies, both of which had methodological limitations. We tried to address the limitations in each study with the other. In Study 1, for example, we used the dimensions of pleasantness and emotional activation to control for variation in people's mood. Although these variables correspond to the two dimensions of affective space (Russell, Weiss, and Mendelsohn, 1989), they are not the dimensions of positive affect and negative affect that are more commonly studied in organizational behavior. Thus, in Study 2, we used measures of positive affect and negative affect as our control variables. In Study 2, however, our measures were collected concurrently, which may have led to common-method inflations of effects (e.g., Podsakoff et al., 2003). But we attempted to separate the independent variable from its conceptual outcomes in Study 1.

Our conclusions are also tempered by the fact that the results of the two studies were not identical. Across our studies, we found similar relationships among pain, resource depletion, and work engagement. The studies also converged in the findings of effects of pain on work engagement, withdrawal, and promotive extra-role behaviors. The relationships between resource depletion and discretionary work behaviors are less consistent. We found a significant relationship between resource depletion and withdrawal behaviors in Study 1

but not in Study 2, and we found a significant relationship between resource depletion and promotive extra-role behaviors in Study 2 but not in Study 1. Although previous research suggests that resource depletion is associated with decreased helping (DeWall et al., 2008; Xu, Bègue, and Bushman, 2012) and increased withdrawal behaviors (Christian and Ellis, 2011), these inconsistencies in our findings suggest that more research is needed on the behavioral effects of resource depletion. In particular, more research is needed on how resource depletion affects people's behaviors in real-world contexts.

Future research may also investigate how managers can successfully shield their employees from the negative effects of chronic conditions. Jensen and colleagues' (1991) review of chronic pain coping strategies found that people coped better when they believed they could control their pain, avoided catastrophizing about their situation, and believed they did not have a severe disability. Although managers cannot influence when an employee's back hurts or arthritis flares up, employees experiencing pain may benefit if managers give them more control over how and when they work. Increasing employees' control over their work lives may also help them manage and reduce the negative consequences of their pain, because whether one has a chronic condition or a fleeting health problem, our work suggests that the energy-related burden associated with somatic complaints affects how people approach their work and how people treat the other members of their organizations.

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