RUNNING HEAD: Motivated Effort-Allocation

Understanding Self-Regulation Failure: A Motivated Effort-Allocation Account

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Abstract

Although enormously beneficial, self-regulation often proves to be enormously difficult. The typical explanation for such difficulty has been that people's capacity for self-regulation is limited and depletes with use, hindering sustained regulation. However, recent findings challenge this capacity view, suggesting instead that people's shifting experiences with and motivations for continued self-regulation better explain why regulation so frequently fails. This chapter integrates such findings, and several emerging theoretical perspectives developed to explain them, into an integrated model of self-regulation based on processes of motivated effort-allocation. The model incorporates three main components: (a) assessments of motives to engage in self-regulation; (b) allocations of effort and attention based on these motives; and (c) monitoring of the consequences of this allocation, which then triggers a reassessment of motives and begins the cycle anew. After presenting the details of the model, the chapter reviews its implications for capacity views of self-regulation and future research on improving regulation.

Keywords: self-control; ego-depletion; the strength model; fatigue; self-regulation capacity

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"Refrain tonight;
And that shall lend a kind of easiness
To the next abstinence, the next more easy…
– William Shakespeare, *Hamlet*

When it comes to understanding people's failure and unhappiness in many different areas of their lives, psychologists have discovered few variables as important as self-regulation. People who fail to self-regulate –are less successful at monitoring and altering their own actions, thoughts, and emotions – have less satisfying relationships, achieve less in school and in their careers, are less happy, and suffer poorer mental and physical health (de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012). Thus, simply encouraging and improving self-regulation holds the promise of ameliorating a great many personal and societal problems.

Alas, despite having identified this seemingly critical variable for improving people's lives, researchers have made limited progress in helping people initiate and sustain self-regulation over time (Steel, 2007; Wu, Gao, Chen, & van Dam, 2009). Contrary to Hamlet's suggestion above, many studies suggest that even when people do manage to exert self-regulation in one instance, this frequently does not ease their further efforts. Instead, initiating self-regulation toward one particular set of concerns often *reduces* subsequent regulation even for separate sets of concerns that demand entirely different types of thought and action (Hagger, Wood, Stiff, & Chatzisarantis, 2010). As described by Baumeister, Heatherton, and Tice (1994) using the metaphor of a muscle, exerting control over one's thoughts and actions thus generally seems as if it consumes "energy", resulting in a state of self-regulatory "depletion" that hinders further efforts toward control. That is, people behave as if they have a fixed capacity of resources available for self-regulation that are consumed when used, leading to a diminishing ability to self-regulate over time.

Although this metaphor aptly describes the observed fragility of self-regulation and the limits of its application, recently, efforts have increased to go beyond such metaphors and better understand the precise psychological mechanisms responsible when regulation fails (e.g., Baumeister & Vohs, 2007; Gailliot et al., 2007; Inzlicht, Schmeichel, & Macrae, 2014; Kurzban,

Duckworth, Kable, & Myers, 2013; Molden et al., 2012; Robinson, Schmeichel, & Inzlicht, 2010; see also Ampel, O'Mally, & Muraven, this volume; Berkman, this volume; Kotabe & Hoffman, this volume; Robinson, this volume; Francis & Inzlicht, this volume; Wagner, this volume). Several different perspectives have emerged and made some progress in this endeavor, but much uncertainty still exists surrounding the mechanisms of such failure. The present chapter thus evaluates and integrates the developing perspectives on self-regulation failure to construct a broader model of self-regulation that (a) identifies the key processes needed to explain current findings on regulation failure, and (b) highlights what research questions are most critical for finding more effective ways to successfully bolster self-regulation.

We begin by considering what defines self-regulation failure and reviewing the findings implying that such failure arises from the depletion of a broad self-regulatory capacity. We then briefly review emerging evidence inconsistent with this capacity metaphor of self-regulation and the new perspectives developed to explain such evidence. Next, we integrate these new perspectives by characterizing self-regulation as a motivated process of effort evaluation and allocation and discuss how this framework provides a more comprehensive account of regulation failure. Finally, in light of this motivated effort-allocation perspective, we reexamine whether limited capacities are still needed to explain self-regulation failure and suggest an agenda for future research.

Defining Self-Regulation Failure

In our analysis, we adopt a broad definition of self-regulation failure. We conceptualize *self-regulation* as any instance in which people attempt to monitor and alter their own thoughts and behaviors for some desired objective (Baumeister & Vohs, 2007) and define failure in terms of any disruption of this process. As detailed below, this definition of self-regulation is related to, but broader than, the concepts of either of *self-control* or *executive function*.

In both the psychological literature and popular consciousness, the concept of self-regulation is often interchangeable with *self-control*. However, some researchers explicitly distinguish the two, most often with the objective of creating narrower definitions of self-control as a subset of broader self-regulatory process. These distinctions most often conceptualize self-control

specifically as the effortful and conscious process of managing a conflict between incompatible goals or desires, such as when people are tempted by short-term impulses that interfere with their long-term goals (e.g., Baumeister, Vohs, & Tice, 2007; Fujita, 2011; Inzlicht & Berkman, 2015). Thus, whereas our definition of self-regulation includes additional processes such as choosing which goals to pursue, evaluating goal progress, and deciding whether to continue pursuit or disengage (see Carver & Scheier, 2001), these processes are seen as separate from self-control.

Because our definition of self-regulation encompasses this broad range of processes, it also captures multiple aspects of what is termed executive function. Executive function describes a specific set of psychological mechanisms, which include (a) *inhibiting* dominant responses, (b) *monitoring*, sustaining, and updating the contents of attention and working memory, and (c) *shifting* flexibly between appraisals or mindsets (Miyake & Friedman, 2012). Although these mechanisms all play a role in broader self-regulatory processes of setting and pursuing goals, researchers who study self-control often specifically focus on how self-control is primarily supported by the successful inhibition of dominant responses (Baumeister, 2014; Inzlicht & Berkman, 2015; but see Carnevale & Fujita, this volume). In contrast, we believe it is useful to consider the role of all components of executive function when examining the success or failure of self-regulation.

Thus, while we agree that self-control conflicts requiring the inhibition of immediate impulses to achieve long-term goals are prototypical cases of self-regulation failure, we regard them as only a subset of the broader processes of self-regulation. Therefore, we aspire to identify general mechanisms that explain when and why people not only fail to inhibit their impulses but also fail to sustain their effort and focus or effectively shift between appraisals when setting and pursuing their goals. Even if self-control conflicts have unique characteristics that deserve special attention (e.g., Kotabe & Hoffman, this volume), we believe that any account of self-control failure should ultimately also fit within a more general account of self-regulation failure. Consequently, as detailed below, we analyze the internal mental processes responsible for whether people succeed or fail at sustaining their motivations for dedicating effort and attention toward highly valued goals.

Capacity-Based Explanations for Self-Regulation Failure

Most people greatly value highly desirable outcomes such as forming relationships, achieving personal and professional success, and being in good health. But, if such outcomes are so highly prioritized, it seems puzzling that individuals would so often fail to sustain their motivation to achieve them or shift their attention to goals they assign less importance. Indeed, classic models of self-regulation based simply on people's expectations for and valuing of success (e.g., Feather, 1982), or their monitoring of the progress they are making toward desired outcomes (e.g., Carver & Scheier, 1982) do not provide any ready way of accounting for these types of failures.

The elegant proposal that engaging in self-regulation draws from a general, but limited, pool of mental resources (Baumeister et al., 1994), and that the consumption of these resources reduces one's capacity for further self-regulation, provides a nice solution to this puzzle. If people's broad capacity for self-regulation diminishes every time they utilize it, then it is no surprise that they often have trouble sustaining such regulation toward important goals over time. Moreover, due to the decreased amount of general self-regulatory resources that would remain available, this perspective on self-regulation failure suggests that any exertion of self-regulation toward one particular goal should also subsequently impair the exertion of self-regulation toward any other goal, regardless of how much these goals differ in their content or the behaviors they require. That is, with their metaphorical self-regulatory strength expended, people should be "too weak" to carry out further regulation without sufficient opportunity for recovery. As also noted earlier, this type of broad carryover effect – which has come to be known as *ego-depletion* – has indeed been repeatedly observed across a wide variety of circumstances and behaviors (Hagger et al., 2010).[1]

Limitations of Capacity Explanations

The idea that self-regulation relies upon some general mental capacity that depletes whenever utilized was a critical theoretical innovation; it provided a clear and parsimonious answer to the unaddressed question of why self-regulation so often fails and identified an entirely new set of phenomena involving the transfer of this failure from one endeavor to another. However, this type of capacity model, and the muscle metaphor on which it is based, does not directly specify the psychological processes involved in self-regulation failure. Thus, subsequent research has begun

to carefully examine these processes to better understand when and why carryover effects in self-regulation failure occur. Yet, instead of clarifying the mechanisms by which self-regulatory capacity depletes, the results of this research have actually raised questions about the extent to which a limited capacity really plays a role in self-regulation failure at all.

The specific programs of research that challenge the notions of a limited capacity for self-control are detailed in several other chapters throughout this volume (Clarkson, this volume; Dehan, Martella, & Ryan, this volume; Egan, this volume; Friese & Loschelder, this volume; Jia, this volume; Job, this volume), but a few findings are worth highlighting here. First, it has long been established that people's exertion of self-regulation is highly dependent upon their levels of motivation. Apparent instances of ego-depletion can be readily counter-acted if the objective toward which people are self-regulating is especially motivationally engaging (e.g., Hong & Lee, 2008; Moller, Deci, & Ryan, 2006; Muraven, Gagné, & Rosman, 2008), associated with large enough incentives (e.g., Muraven & Slessareva, 2003), or one that inspires a close monitoring of the progress being made (Alberts, Martijn, & de Vries, 2011; Wan & Sternthal, 2008).

More recent discussions of capacity models of self-regulation have thus often acknowledged that the "ego-depletion" typically observed is unlikely to be due to a completely exhausted capacity for regulation, and begun to describe carryover effects from one instance of self-regulation to another as more often reflecting motivations to preserve one's limited resources unless good reasons exist to expend them (Baumeister et al., 2007; Baumeister, 2014). That is, extending the muscle metaphor, people presumably prefer to conserve their self-regulatory strength unless some emergency or opportunity sufficiently inspires them to greater expenditures of energy. This motivational reconfiguration of carryover effects preserves the importance of limited capacity as the primary source of motivations to withdraw from self-regulation, but places it in an indirect role such that people are assumed to withdraw their effort from regulation as they sense reductions in their self-regulatory capacity and choose to conserve these limited resources.

However, other recent findings have further challenged even this more indirect role for limited capacity. Several studies have indicated that after engaging in self-regulation, people will

not show carryover effects if they (a) misattribute the effort involved in their initial regulation to an irrelevant source (Clarkson, Hirt, Chapman, & Jia, 2011; Clarkson, Hirt, Jia, & Alexander, 2010; see Clarkson, this volume) or reconstrue this effort as enjoyable (Laran & Janiszewski, 2011), (b) merely expect or imagine their capacity for self-regulation is expanded following some initial regulation (Egan, Clarkson, & Hirt, 2015; Egan, Hirt, & Karpen, 2012; see Egan this volume), or (c) simply do not believe their own self-regulation is limited in capacity (Job, Dweck, & Walton, 2010; Job, Walton, Bernecker, & Dweck, 2013; Martijn, Tenbült, Merckelbach, Dreezens, & de Vries, 2002; see Job this volume). Similarly, several studies have also shown that people will show these carryover effects without having actually engaged in any self-regulation themselves if they (a) attribute extra effort to an easy initial task (e.g., Clarkson et al., 2010, 2011), or (b) merely expect or imagine an upcoming strenuous task (e.g., Macrae et al., 2014). What's more, even in the absence of such specific attributions about or expectations of engaging in self-regulation, experiences that simply increase relaxation or boost tolerance for effort – such as watching a humorous video clip or favorite television program (Derrick, 2013; Tice, Baumeister, Shmueli, & Muraven, 2007), affirming one's core values (Brandon J. Schmeichel & Vohs, 2009), meditating (Friese, Messner, & Schaffner, 2012), or praying (Friese & Wänke, 2014), to name just a handful of examples – can eliminate carryover effects and sustain self-regulation (for recent overviews of the many factors that reduce carryover effects in self-regulation see Hirt, this volume; Friese & Loschelder, this volume; Masicampo, Martin, & Anderson, 2014).

Together, this second set of findings strongly suggests that the types of effects labeled as “ego-depletion” can arise independent of the amount of self-regulation that people have actually exerted. That is, self-regulation failures appear to depend as much on people's mere beliefs and perceptions about how much self-regulation they have already performed, how much regulation might be required in the future, or even simply how relaxed or mentally taxed they are currently feeling, as it does on the actual amount of self-regulation in which they have engaged thus far. Such findings are difficult to reconcile with any monitoring of or response to reductions in one's fixed capacity for self-regulation (see also Inzlicht & Schmeichel, in press).

Emerging Alternatives to Capacity Explanations

Thus, although explaining self-regulation failure in terms of a limited capacity for such regulation initially provided a powerful and succinct account of an impressive variety effects, after nearly two decades of further research, such explanations no longer appear to adequately capture the full range of this phenomena. Accordingly, alternative explanations of self-regulation failure have begun to appear. Space limitations prevent a detailed review of these alternatives, some of which are described elsewhere in this volume (Ampel et al., this volume; Berkman, this volume; Kotabe & Hofmann, this volume; Francis & Inzlicht, this volume), but, again, a few aspects are worth emphasizing. First, to incorporate the observed effects of people's motivations on their continued exertion of self-regulation, most updated accounts of self-regulation failure characterize this as a process of motivated allocation of attention and effort, but one that does not depend on perceptions of reduced capacity (cf., Baumeister & Vohs, 2007; Baumeister, 2014). These types of mechanisms explain how increased engagement, importance, or incentives associated with particular goals can bolster self-regulation and counteract any carryover effects of previous efforts at regulation (i.e., reduce “depletion”). Second, to incorporate the observed effects of people’s beliefs about or experiences of exerting self-regulation on their continued regulation, most updated accounts of self-regulation failure conceptualize these types of beliefs and experiences as directly influencing the motivations that determine the allocation of effort and attention. These types of mechanisms explain how factors such as beliefs about the source of one’s effort, interpretations of the experience of effort, or any additional experiences that might offset the unpleasantness of effort can also bolster self-regulation and counter carryover effects of previous regulation. Therefore, on the whole, these newly emerging perspectives on self-regulation failure do not rely on a limited capacity to explain such failure (see Masicampo et al., 2014) and some even reject the idea that such a capacity exists at all (e.g., Inzlicht & Schmeichel, in press; Kurzban et al., 2013)

For example, Kurzban et al. (2013) describe the role of motivation in self-regulation in terms of people’s desires to exert and sustain self-regulation based on the perceived opportunity costs of continued exertion. They propose that people assess whether maintaining self-regulation toward

one particular goal would interfere with allocating that regulation toward alternative goals and suggest that self-regulation failure represents a shift of effort and attention from one goal to others (see also Berkman, this volume). Similarly, Inzlicht and Schmeichel (2012, in press; Inzlicht et al., 2014) also place motivational dynamics at the center of people's choices to sustain self-regulation, but instead of focusing on perceived opportunity costs more generally, they propose that exerting self-regulation sensitizes people to specific types of opportunities that involve immediately-rewarding outcomes. From this perspective, engaging in self-regulation actually alters people's motivations and shifts their priorities and attention in ways that often undermine their continued regulation until these more immediate concerns have been addressed.

Moreover, beyond their basic grounding in motivational processes, both of these accounts of self-regulation failure also give a prominent role to people's experiences during self-regulation as activating and directing these processes. In addition to proposing that perceived opportunity costs motivate choices to engage in self-regulation, Kurzban et al. (2013) further propose that the effort experienced during regulation directly informs the calculation of these perceived costs. Drawing on recent conceptualizations of mental effort and cognitive fatigue as states that inform and direct goal pursuit (see Hockey, 2013), they argue that the greater fatigue experienced during or greater effort attributed to self-regulation, the greater the perceived opportunity costs of continued regulation, and the more likely that effort will be withdrawn. Based on the same motivational conceptualizations of mental effort, Inzlicht and Schmeichel (in press; Inzlicht et al., 2014) similarly propose that such effort is experienced as inherently aversive (Inzlicht, Bartholow, & Hirsh, 2015) and thus spurs people to shift their priorities to more enjoyable pursuits. That is, as negative feelings of exerting self-regulation accumulate, people are presumably less likely to choose to engage in further regulation and more likely to choose something that gives them pleasure or fulfills immediate desires without requiring effort (see also Ampel et al., this volume).

A Motivated Effort-Allocation Model of Self-Regulation Failure

Whatever differences exist among these emerging accounts of self-regulation failure, the growing consensus is that processes associated both with shifting motivations regarding the value

of continued self-regulation and with the perceived experience of engaging in regulation are central to such failure. Our own initial attempts to integrate all of the emerging perspectives into a more comprehensive account of self-regulation thus rest upon these two fundamental processes as well. However, in our *motivated effort-allocation* (MEA) model of self-regulation failure, we also further specify the particular mechanisms that should determine people's experiences of self-regulation and how these experiences should alter people's motivations for continued regulation. Drawing from classic models of goal selection and goal pursuit, we address some of the uncertainties remaining in the accounts described above and identify critical areas for further research.

Before we describe the MEA model further, it is important to note that although explaining self-regulation failure in terms of shifting motivations regarding the value of continued self-regulation and perceived experiences of engaging in regulation does not rely on any notion of a limited capacity for regulation, it does still prominently characterize self-regulation as difficult and requiring attention and mental effort. Indeed, although the various lines of evidence presented above challenge the notion that failures of self-regulation occur because of a depleted capacity for regulation, this evidence also clearly illustrates that people themselves often perceive limits to the levels of effort they can muster or sustain (Job et al., 2010; Martijn et al., 2002). That is, even if they are not directly sensing the approach of any true limits to their self-regulatory capacity, people tend to avoid fatigue and are motivated to conserve their expenditures of effort (Bijleveld, Custers, & Aarts, 2012; Kool & Botvinick, 2014; Kool, McGuire, Rosen, & Botvinick, 2010). Thus, any alternative perspective on self-regulation must incorporate explain such motivations in addition to all of the other mechanisms described thus far. As we discuss more fully in the final section of this chapter, while it may be tempting to assume a focus on conservation must reflect some real consumption of mental "energy", emerging perspectives on the nature of fatigue strongly question the validity of such assumptions and are completely consistent with alternative perspectives on self-regulation failure that do not rely on limited capacities for regulation (see Hockey, 2013).

The broad structure of the MEA model is presented in Figure 1. This model involves a cyclical process with three main components: (a) the *assessment* of how strongly one is motivated

to engage in self-regulation, (b) the *allocation* of effort and attention to self-regulation produced by this assessment, (c) the *monitoring* of the consequences and experiences of this allocation, which then spurs a reassessment of one's motivations to continue self-regulation.

[Insert Figure 1 about here]

Our account of self-regulation failure thus places experiences of engaging in self-regulation and motivations for continued regulation within the context of cybernetic control theories of this process (see also Robinson et al., 2010; Robinson, this volume). Control theories are defined by a continuous feedback loop that functions to assess and respond to discrepancies from a desired state (Carver & Scheier, 2001).[2] In the MEA model, we propose that people first assess whether engaging in self-regulation is indeed likely to produce this type of desired state. This assessment defines their motivation to engage in regulation and results in an allocation of attention and effort to pursuing appropriate actions proportional to that motivation. We further propose that, following this allocation, people monitor whether self-regulation is effectively bringing about the desired state by evaluating the costs and benefits of their current level of regulation and whether it is worth continuing. This monitoring defines their perceptions and experiences of pursuing such regulation. At any point, if these experiences suggest that current levels of self-regulation will not produce the desired state without the costs outweighing the benefits, then regulation will diminish or cease altogether. Thus, the MEA model also borrows extensively from Kurzban et al.'s (2013) perspective, but, as detailed below, also expands upon it in several important ways.

In the following sections, we elaborate more on how we conceptualize each of these processes and their ongoing interactions, but some general considerations are worth noting at the outset. Although the assessment, allocation, and monitoring processes in the MEA model may often involve conscious deliberation and intentional action, in contrast to some other emerging accounts of self-regulation failure (Inzlicht & Schmeichel, in press; Inzlicht et al., 2014), this need not be the case. Accumulating evidence suggests that self-regulation can be initiated and pursued outside of intention and awareness (see Gillebaart & De Ridder, 2015; Wieber, this volume). Thus, in the MEA model, awareness and intention is conceptualized as potentially altering when and how

people may engage in self-regulation but not the types of evaluations and experiences that guide regulation. Instead, we assume that the assessments of perceived ability, assignments of value, and monitoring of effort and progress displayed in Figure 1 and detailed below can all both occur outside of awareness or intention and be guided by conscious deliberation (see Bijleveld, Custers, & Aarts, 2012; Marien, Custers, Hassin, & Aarts, 2012). That is, although conscious attention to these processes may change how their specific outputs are weighted or interpreted during self-regulation, generating and integrating these outputs is not presumed to require such attention.

Another general consideration worth noting is that the monitoring and assessment processes describe by the MEA model in Figure 1 concern people's motivations to engage in self-regulation toward some objective, but are not necessarily equivalent to their overall motivations to accomplish that objective itself. That is, the MEA model specifically describes the proximal regulation of effort or attention directed toward some goal rather than the ultimate engagement in the goal itself. Thus, if motivations for self-regulation shift and wane, people may temporarily cease actively pursuing a particular goal in the moment, but not disengage from this goal overall (e.g., choosing to end a workout early does not mean that one has abandoned the goal to get in shape). This hierarchical distinction is essentially equivalent to one made by Duckworth and Gross (2014) between sustained goal pursuit in the moment (what they label *self-control*) and sustained goal pursuit over an extended period of time (what they label *grit*), and the MEA model primarily explains self-regulation failure of the former rather than the latter variety.

Assessing Motivations for Self-Regulation

The MEA model places emerging insights on the mechanisms of self-regulation failure within the motivational context of control theories of regulation, but it also integrates important features of other broad models of self-regulatory processes as well. First, as Figure 1 illustrates, our specific account of people's assessments of whether to initiate, continue, or withdraw from self-regulation incorporates longstanding theories on the role of expectancy and value in goal-setting and goal-pursuit (Feather, 1982). That is, we conceptualize these assessments as depending upon both people's expectations concerning their ability to muster the effort and attention they

believe self-regulating toward some outcome will require, and the total value they believe regulation will have for producing this outcome versus any alternative outcome to which such regulation might be dedicated. Also similar to traditional motivational theories of expectancy and value, the MEA model assumes a multiplicative relationship between these two factors, such that as either expected ability to engage in the self-regulation required or perceived value of what this regulation would accomplish becomes increasingly low, then the actual self-regulation allocated to some objective will rapidly diminish as well (but see Shah & Higgins, 1997).

However, the MEA model also extends traditional considerations of expectancy and value by including not only evaluations of the self-regulation they are currently pursuing, but also the potential regulation they believe they might pursue in the near future (see also Ampel et al., this volume). To capture the influence of people's perceptions of limited capacity, and the concerns with conservation this may produce (see Job, Bernecker, et al., 2015), the MEA model proposes that motivations for allocating self-regulation depend on their assessment of both the outcomes they could currently pursue and any outcomes they might want to pursue in the immediate future (or of just the possibility of immediately pursuing non-specified future outcomes in general). As Figure 1 further illustrates, we conceptualize this assessment of potential future outcomes as again relying both on the expected ability to summon whatever effort and attention such outcomes might be expected to demand and the value they believe this future regulation would contribute toward accomplishing them. The MEA model assumes some inverse multiplicative relationship between these factors, such that as either anticipated ability to exert additional self-regulation toward future objectives becomes increasingly low or perceived value of what regulation would contribute to these future rather than the current objectives becomes increasingly high, then the self-regulation allocated to the current objective will, again, rapidly diminish.

Thus, overall, according to the MEA model, people's motivation to engage in self-regulation arises from their assessments of what this regulation can accomplish. This assessment depends on the combination of the expected ability for engaging in and the value placed on self-regulating toward the various objectives one might pursue in the present and, at the same time, on the

combination of the expected ability for engaging in and the value placed on potentially self-regulating toward whatever objectives one might anticipate pursuing in the immediate future. In this way, the assessment stage of the MEA model captures the dynamic influence of both people's motivations to sustain effort on the current focus of their self-regulation and their motivations to conserve effort for any important demands for future regulation that might subsequently arise.

Monitoring the Consequences and Experiences of Self-Regulation

Once the assessment process activates motivations to engage in self-regulation toward a desired outcome, and these motivations evoke the allocation of effort and attention toward pursuing the outcome, the MEA model proposes that this then also activates a monitoring process to evaluate how effectively the current level of self-regulation is producing the desired outcome. As shown in Figure 1, drawing heavily on control theories of self-regulation, we conceptualize the first major component of the monitoring process as an evaluation of the progress made toward the desired outcome. This evaluation includes not only how close one is to successfully achieving the outcome but also how quickly one is progressing in pursuit of the outcome (Carver & Scheier, 2001). This aspect of the monitoring process thus captures the perceived consequences of self-regulation and involves judgments of whether these consequences match what was intended.

Yet, once again, the MEA model extends traditional control theories by also including in the monitoring process evaluations of effort as well as progress. Drawing upon recent reconceptualizations of experiences of effort and mental fatigue as part of a motivational signaling process (Hockey, 2013; Kurzban et al., 2013), we propose that the second major component of the monitoring process is an evaluation of the effort required to self-regulate toward the desired outcome. This aspect of the monitoring process captures perceptions of the varying costs defined by the amount of effort and attention required to achieve different levels of progress.

Furthermore, as also shown in Figure 1, although evaluations of effort and progress are independent, the MEA model proposes that these two evaluations are integrated during the monitoring process. The output of this integration is defined as a weighting of the benefits of perceived progress achieved through self-regulation by the costs of perceived effort required to

sustain this level of progress. That is, monitoring processes produce a combined evaluation of the *worth* of maintaining current levels of self-regulation, which we suggest is based on the ratio of progress to effort. Thus, as the perceived progress produced by self-regulation becomes increasingly small or the perceived effort required to sustain self-regulation becomes increasingly large, then the overall worth of continued regulation will rapidly diminish as the costs of further self-regulation are perceived as quickly overwhelming the benefits.

As in Kurzban et al.'s (2013) opportunity cost perspective on self-regulation, the MEA model assumes judgments of worth that occur during monitoring produce specific phenomenological experiences of mental fatigue. As the judged worth of continuing self-regulation diminishes, experiences of mental fatigue grows. Note that we are conceptualizing such fatigue as distinct from mere effort. Whereas we define effort as arising from perceptions of the amount of attention and focus required by current acts of self-regulation, we define fatigue as arising from the accumulated effects of this effort on the judged worth of continued regulation (see Hockey, 2013).

Another important assumption of the MEA model is that even if effort and progress during self-regulation remain constant, over time the judged worth of self-regulation will decrease and mental fatigue will increase. Much research has shown that on tasks requiring sustained effort and attention, performance steadily declines and reported fatigue increases (e.g., Wascher et al., 2014). Although these effects are somewhat offset by introducing additional incentives for sustained performance after some time period, neither performance nor fatigue typically return to their original levels (e.g., Lorist et al., 2009). Also, people evaluate engaging in the effort of self-regulation and cognitive control as inherently costly; they will forgo greater rewards and even spend more time performing a task in order to reduce the acute cognitive effort they must exert (Kool & Botvinick, 2014; Kool et al., 2010). Therefore, as effort toward engaging in self-regulation continues, this effort should be perceived as increasingly more costly (see also Inzlicht et al., 2014; Kurzban et al., 2013), fatigue should accumulate, and judgments of worth should decrease.[3]

Thus, according to the MEA model, people's evaluations of the consequences of engaging in self-regulation arise from their monitoring of what this regulation is worth. Judgments of worth

depend on the ratio of the perceived benefits of the progress being made toward through self-regulation and the perceived costs of the effort required to sustain the amount of regulation producing this progress. Moreover, judgments of worth are assumed to directly affect experiences of mental fatigue, which progressively accumulate over the course of self-regulation due to the inherent perceived costs of continued effort. Thus, when the perceived progress produced by self-regulation outweighs accumulated experiences of the effort required to attain this progress, judged worth will be higher and experienced fatigue will be lower. However, once accumulated experiences of effort begin to outweigh perceived progress, judged worth will be lower and experienced fatigue will be higher. However, as noted earlier, although experiences of effort and fatigue are critical components of the monitoring process, the basic computations of worth during monitoring and the subsequent effects of this judged worth need not be conscious or intentional and may result from more implicit and spontaneous evaluations (Bijleveld et al., 2012; Marien et al., 2012; see also Kool et al., 2010; Ampel et al., this volume). In this way, the monitoring stage of the MEA model captures how online evaluations of momentary fluctuations in the experiences of engaging in self-regulation, as well as how these experiences progress over time, dynamically affect ongoing impressions of whether regulation is producing desirable effects.

Reassessment and Reallocation

Following the initial assessments that motivate self-regulation and the monitoring of whether the attention and effort then allocated has proven worthwhile, the MEA model finally proposes a cyclical reassessment of whether sufficient motivations still exist to continue regulation. As Figure 1 illustrates, the judged worth of sustaining self-regulation that emerges from evaluations of effort and progress reengages the assessment process detailed above and updates present motivations for regulation. That is, the experiences of fatigue emerging from judged worth function as motivational signals that may alter the perceived ability for and value of continued self-regulation (see also Hockey, 2013; Kurzban et al., 2013). If judged worth is high and fatigue is low, perceptions of ability and value for continued self-regulation should also generally remain high and produce sufficient motivations for sustaining regulation versus conserving effort for the future (or, if

the judged worth is high enough, motivation for current regulation could even increase). But, if judged worth is low and fatigue is high, perceptions of either ability for or value of continued regulation, or both, should decrease and motivations to continue self-regulation versus conserve effort for the future should diminish (see also Jia, this volume).

In summary, the MEA model explains self-regulation failure as a disruption of motivations to exert this regulation toward valued goals. That is, even if overall motivations to accomplish some objective remain high, when the judged worth of continuing self-regulation to pursue this goal is currently diminished, such regulation may fail (cf. Duckworth & Gross, 2014). Furthermore, because the perceived costs of effort and experienced fatigue of self-regulation accumulate, after completing or withdrawing from self-regulation toward one objective, motivations to pursue regulation on subsequent tasks may still be diminished. Such motivational disruptions can thus explain not only failures to sustain self-regulation toward current goals, but also carryover effects of exerting regulation in one domain to subsequent self-regulation failures in another (see also Kool & Botvinick, 2014; Kurzban et al., 2013). Thus, in the MEA model, the carryover effects that capacity models of self-regulation define as "ego-depletion" are a general motivational consequence of sustained self-regulation (see also Inzlicht & Schmeichel, in press; Francis & Inzlicht, this volume).

Additional Influences on Monitoring and Assessment

The MEA model presented in Figure 1 incorporates the two fundamental processes identified as important for understanding when and how self-regulation failure occurs by newly emerging accounts of this phenomena: motivations for and experiences of engaging in self-regulation. It also extends these emerging accounts by further specifying the critical components of these motivations and experiences and integrating elements from classic models of goal selection and goal pursuit. But, we believe the true value of the MEA model is how it incorporates and explains the effects on self-regulation of all the diverse incentives, attributions, lay theories, or subjective experiences reviewed above (see also Clakson, this volume; Friese & Loschelder, this volume, Hirt, this volume; Job, this volume; Masicampo et al., 2014). As illustrated in Figure 2, additional variables arising from (a) the objectives toward which people are self-regulating, (b) how

they represent or experience these objectives, or (c) whatever additional opportunities are present affect self-regulation by altering the final output of both monitoring and assessment processes.

[Insert Figure 2 about here]

Monitoring. Many variables could affect the monitoring of the consequences of self-regulation by altering either the experiences of effort during regulation or the evaluations of the progress this regulation produces. Actions or environments that increase experiences of relaxation, tranquility, engagement, or just broad positive affect; such as taking a short rest (Tyler & Burns, 2008) or any of the other activities like meditation, or prayer reviewed earlier; should help sustain self-regulation by counteracting the experiences of effort and fatigue associated with regulation (see also Dehan et al., this volume). Furthermore, as also reviewed earlier, what is most critical for these influences on monitoring processes is not the experiences themselves, but people's interpretations of how these experiences may offset the effortful costs of engaging in self-regulation (see Egan, this volume; Hirt, this volume; Job, this volume). In addition, circumstances that enhance attention to how well one is achieving a desired objective, such as the cues or expectations that encourage the monitoring of current task performance or boost the importance or self-relevance of this task, as reviewed earlier, should prolong regulation. Similarly, expectations or lay theories about how fast progress should occur or the amount of effort it should require could also affect these types of evaluations; beliefs that progress should be fast and easy may more quickly result in lower judgments of worth and reduced motivations for self-regulation if substantial effort is required, whereas beliefs that progress will not only demand effort but can also be measured by the effort expended may sustain judged worth and motivations for regulation (Labroo & Kim, 2009; Miele & Molden, 2010; see Molden, 2013). Thus, overall, any variables that independently alter how people either experience the act of engaging in self-regulation or evaluate the progress that regulation produces should also moderate the total judged worth of self-regulation produced by the monitoring process and, in turn, motivations for continued regulation.

Assessment. Beyond indirectly influencing motivations to continue self-regulation through effects on judged worth during monitoring, many variables could also directly affect the

assessment of motivations to sustain self-regulation. For example, even if monitoring of progress and effort indicates low judged worth for continued self-regulation, as reviewed above, increased incentives associated with the personal importance of or the motivational engagement produced by the outcome of current regulation could still directly enhance the perceived value of this regulation and bolster assessed motivations to continue.. Furthermore, high perceived efficacy for sustaining self-regulation or attributions of fatigue to motivationally irrelevant features of the environment could directly counteract effects of experienced fatigue and low judged worth of regulation on expected ability to sustain regulation, which could again independently bolster assessed motivations to continue (Chow, Hui, & Lau, in press; Clarkson, this volume).

In contrast, even if the monitoring of progress and effort indicate high judged worth for sustained self-regulation, perceived opportunities to pursue alternative highly-valued goals or to obtain immediately desirable rewards could directly undermine the perceived value of the current regulation and independently impair assessed motivations to continue. Furthermore, beliefs that one's mental capacities are limited and quickly depleting or attributions of fatigue to one's capacity to continue could directly counteract high judged worth for regulation by undermining expected ability to sustain regulation in the present or to reinitiate regulation in the near future and again undermine assessed motivations to continue.. Thus, overall, variables that independently affect any of the components of the assessment process in Figure 2 should also moderate the ultimate impact of the motivational signals produced by monitoring processes on cumulative motivations to engage in self-regulation and allocations of effort and attention to sustain such regulation.

Other Important Features of the Motivated Effort-Allocation Model

Some additional implications of the expanded MEA model in Figure 2 are also worth noting. First, any variable may conceivably inhibit or bolster self-regulation through both the monitoring and assessment processes. For example, the autonomy of the objective toward which people are self-regulating can bolster regulation both by increasing experiences of subjective vitality (e.g., Muraven et al., 2008; see Dehan et al., this volume), which would improve the judged worth during monitoring, and by independently bolstering the personal importance of and engagement with this

objective (e.g., Moller et al., 2006). Thus, as Masicampo et al. (2014) noted, many variables may have the same effects on self-regulation whether they are introduced before any regulation has begun, thus potentially altering subsequent assessment of motivations for regulation, or only after some initial regulation, thus potentially altering subsequent monitoring and reassessment of motivations for continuing regulation toward the same or different objectives. However, some variables could have different effects on self-regulation depending upon which process they most directly affect; concrete, low-level mental construals may sustain regulation when they bolster the monitoring of progress toward maintaining a desired standard (Schmeichel, Vohs, & Duke, 2010), but hinder regulation when they increase the focus on immediate judgments of diminishing worth during assessment of motivations to continue and undermine a focus on broader, abstract values that may still support these motivations (Fujita & Carnevale, 2012). Thus, the MEA model emphasizes the importance of considering multiple routes through which various factors may affect the self-regulation process, and whether these effects will be complementary or offsetting.

Another important aspect of the MEA model worth noting is that, in Figure 2, the variables that affect monitoring and assessment processes (which are not meant to represent a comprehensive list) are roughly divided into a set of more cognitive influences, such as expectations, attributions and lay theories, toward the top of the figure and more motivational influences, such as incentives, engagement, and the value of alternative pursuits, toward the bottom. However, this is not intended to imply that the former variables are only expected to affect more cognitive processes such as perceptions of effort and expectations of ability to engage in self-regulation whereas the latter are only expected to affect more motivational processes such as evaluations of progress and the value of present or future efforts at regulation. It is likely that variables such as engagement or importance affect experiences of effort and expectations about abilities to sustain regulation, and variables such as lay theories and attributions affect variables such as perceived progress and the value placed on future progress. Thus, the MEA model incorporates the many known interactions between motivational and cognitive processes (see Molden & Higgins, 2005, 2012), and when one is applying this model to investigate the

mechanisms by which a particular variable affects self-regulation, it is important to consider and empirically test all of the possible routes of this influence (cf. Chow et al., in press; vanDellen, Shea, Davisson, Koval, & Fitzsimons, 2014).

A final feature of the MEA model worth nothing is that, although we have portrayed it as a series of separate stages, we assume that processes of assessment, allocation, monitoring, and reassessment are dynamically updated and can occur in parallel (e.g., Ehret, Monroe, & Read, 2015). For example changes in the judged worth of self-regulation during monitoring may instantaneously spur the online reassessment of motivations to continue, which in turn alters the allocation until an equilibrium is again reached and the current level of self-regulation stabilizes.

Advantages of a Motivated Effort-Allocation Model

Our MEA model of self-regulation failure builds upon, and thus highly overlaps with, other recent perspectives (e.g., Inzlicht et al., 2014; Inzlicht & Schmeichel, in press; Kurzban, 2010). However, we believe that, because it integrates several key aspects of these other models, along with other classic perspectives on self-regulation, the MEA model has several unique advantages.

Common Mechanisms for Different Types of Self-Regulation Failure

The first advantage of the MEA model is its generality. As noted at the outset, many other accounts (e.g., Inzlicht & Schmeichel, in press; Kotabe & Hoffman, this volume) focus only on explaining specific instances of conflict between short-term desires or temptations and long-term goals, which are typically labeled as involving self-control. The MEA model also captures these conflicts between incompatible desires or goals in that alternative priorities (or temptations) that arise can both temporarily increase the effort experienced while regulating toward the current focal goal and reduce the perceived value of sustained regulation toward this goal (see Figure 2). However, within the same general framework, our model also describes (a) failures to muster sufficient effort or attention to attain desired levels of performance, in that any factors highlighting accumulating experiences of effort or perceptions of reduced progress undermine the judged worth of continued regulation, and (b) failures to optimally shift regulation between different objectives, in that any factors reducing experiences of effort or enhancing experiences of progress increase the

perceived value of continued regulation toward one pursuit at the expense of other important goals. Thus, the MEA model encompasses the full range of phenomena related to the deployment, maintenance, and withdrawal of effort and attention toward valued goals.

Another benefit of the generality of MEA model is that it need not distinguish conflicts involving short-term desires and long-term goals from other instances of competing motivations. Because some perspectives define only the former as involving self-control (Inzlicht & Schmeichel, in press; Kotabe & Hoffman, this volume), precise classification of what constitutes *desires* versus *goals* or what span of time counts as "short-term" versus "long-term" is ultimately required. Indeed, accumulating evidence suggests that people may often redefine what they have previously considered to be distracting temptations or desires as valued goals (see De Witt Huberts, Evers, & De Ridder, 2013), making such distinctions problematic. The MEA model avoids these problems by assuming that any alternative desires or objectives that might interfere with self-regulation toward a particular goal will affect this regulation through the processes outlined in Figures 1 and 2.

Expanded Specification of Phenomenological and Motivational Processes

Elaborating on the opportunity costs model. Because Kurzban et al.'s (2013) opportunity-costs perspective on self-regulation failure is also a general model of motivated engagement and withdrawal of effort, the MEA model shares the same basic structure and many similar features. However, our model goes beyond an opportunity-costs perspective in several important ways. Opportunity costs are presumed to motivate effort toward self-regulation through a simple utility calculation based on the anticipated costs and benefits of various actions requiring such effort. Moreover, experiences of effort and fatigue during self-regulation are presumed to be a direct signal of opportunity costs. We agree that considerations of alternative costs and benefits, as well as experiences of effort and fatigue are important for understanding self-regulation and the MEA model features them prominently. However, our model provides a more elaborate analysis of the phenomenological and motivational processes of engaging in self-regulation.

First, we further specify what the relative costs and benefits people experience during self-regulation entail: the effort of sustaining regulation versus the amount and rate of progress toward

a valued goal that this regulation produces, respectively. In addition, we distinguish between the experience of *effort* during self-regulation and the experience of *fatigue*. In our view, whereas the former directly represents the perceived costs that regulation entails, the latter reflects the progress effort produces, as well as how long this effort has continued, and constitutes the primary motivational input for assessing whether self-regulation should continue (cf. Hockey, 2013).

Furthermore, rather than assuming that the motivational signals produced by effort and fatigue are uniform, the MEA model specifies several variables that may modify these signals. As discussed above, people's expectations, attributions, and lay theories may influence how they interpret their experiences of effort as related to the progress they are making; when individuals view effort as non-diagnostic of progress (Clarkson et al., this volume), or even as a signal that they are creating opportunities for increased progress (Labroo & Kim, 1999; Miele & Molden, 2010), then experiences of mental fatigue no longer lower judgments of the worth of self-regulation or motivations to continue regulation, and in some cases can even increase it (see Molden, 2013).

Finally, beyond treating experiences of mental effort and fatigue simply as a signal for the utility of continued self-regulation, the MEA model places this signal in the broader motivational context of principles of goal selection and pursuit. That is, our model considers the effects experiences of mental fatigue may have on both expected abilities for and the value placed on sustained regulation, and for both present and future objectives. In this way, the MEA model captures the dynamics of people's separate motivations to continue self-regulation in the present and beliefs they might need to conserve "mental energy" for the future. Therefore, overall, the MEA model does not contradict the core principles of Kurzban et al.'s (2013) opportunity costs perspective, but it does specify additional mechanisms that explain a greater range of phenomena.

Clarifying the shifting priorities perspective. In addition to elaborating upon opportunity costs perspectives, the MEA model expands and clarifies Inzlicht and Schmeichel's (in press) shifting priorities account of self-regulation failure. First, as discussed above, the shifting priorities account focuses on a narrower range of self-regulation failures involving conflicts between short-term desires and long-term goals. Also, as it has developed, the shifting priorities account has

absorbed the basic structure of the opportunity costs perspective regarding how experienced effort alters motivations to exert self-regulation. Thus, the relative advantages we have already outlined for the MEA model regarding these two issues apply to the shifting priorities account as well.

However, the novel feature of the shifting priorities account is that it too goes beyond the simple utility calculation of the opportunity costs perspective by describing how experiences of effort and fatigue shift motivations away from (a) *exploiting* known incentives to *exploring* new incentives, (b) *laborious* pursuits that demand effort to *leisurely* pursuits that are free from effort, and (c) what people feel they *have* to do to what they feel they *want* to do (Inzlicht et al., 2014; Francis & Inzlicht, this volume). Furthermore, whereas increased concerns with exploration versus exploitation and leisure versus labor represent broader, ultimate causes of self-regulation failure, their effects are proposed to be mediated through the proximal cause of focusing on what one wants versus what one has to do. Thus, experiences of effort and fatigue shift attention and motivation toward alternative objectives that are perceived as more enjoyable and rewarding.

The MEA model is certainly consistent with both of these ultimate and proximal motivational consequences of self-regulation, but it clarifies what we see as important distinctions between the processes involved. As detailed above, we agree that exerting effort is experienced as unpleasant and costly (Inzlicht et al., 2015; Kool et al., 2010) and that carryover effects of self-regulation essentially reflect a reduced willingness to bear the perceived costs of further effort. However, we do not agree that this motivational process is equivalent to, or its effects directly mediated by, increased desires for immediate rewards (Inzlicht & Schmeichel, 2012) or for pursuing objectives people feel they want to rather than have to (Inzlicht et al., 2014).

Both immediate rewards and objectives people want to achieve can require high or low effort to realize, and thus these two priorities are conceptually independent of motivations to exert effort. Indeed, although accumulating evidence suggests that engaging in self-regulation does increase attention to the possibility of reward (see Berkman, this volume; Schmeichel, this volume; Wagner & Heatherton, this volume), some research has suggested that the diminished motivations for effort that also follow self-regulation have priority such that people only increase reward-seeking

behavior if little effort is required (Giacomantonio, Jordan, Fennis, & Panno, 2014). Thus, the MEA model provides separate pathways for the motivational influences of reward and effort. Perceived costs of effort and labor are defined as an inherent feature of the monitoring process, which is consistent with the argument of the shifting priorities account that these costs are a general product of human evolutionary history (Inzlicht et al., 2014). However, as shown in Figure 2, other motivations concerning how people construe the importance, personal relevance, or autonomy of a particular objective are not an inherent part of the monitoring process and affect continued self-regulation through their own pathways. Thus, in the MEA model, although feeling one wants to self-regulate rather than one has to should certainly affect experiences of fatigue through the influence of these feelings on monitoring processes, the overall effects of such feelings will also depend upon their direct effects on assessments of the expected ability to and the perceived value of engaging in both current and future self-regulation. In this way, motivations concerning willingness to exert effort and engage in "labor" and motivations concerning what one wants to and has to do may still be related and interact, but the processes through which they affect continued self-regulation remain separate and their independent influences can be evaluated.

Implications of a Motivated Effort-Allocation Model for Capacity Explanations of Self-Regulation Failure

On the whole, the MEA model of self-regulation failure incorporates the host of newly emerging lines of research on the different perceptions, experiences, and motivations that can help or hinder self-regulation. It also integrates, extends, and refines other recent attempts to bring together this new literature. But, beyond this, one of the most important aspects of the MEA model is its implications for capacity explanations of self-regulation failure.

In their own reconceptualization of "depletion" effects in which an initial instance of self-regulation reduces subsequent efforts at regulation, both Kurzban et al. (2013) and Inzlicht et al. (2014) suggest that the original capacity explanations of this reduction are no longer tenable. They argue that given the many factors moderating whether one act of self-regulation affects those that follow and the sufficiency of motivational mechanisms for explaining how and when this occurs,

there is little evidence or theoretical justification for continuing to consider limited capacity as an important aspect of these effects. However, Baumeister (2014) has countered that, although the emerging evidence clearly reveals the influence of motivation on carryover effects of engaging in self-regulation, the concept of a limited resource is still required to explain the full range of related phenomena. Based on the MEA model, we agree with the former argument that, despite the critical role of capacity models in advancing research on self-regulation, the current evidence no longer justifies retaining the idea of limited self-regulatory resources when explaining, predicting, or attempting to improve such regulation. Indeed, we believe that the MEA model can explain the types of evidence that Baumeister cites as still demonstrating limited self-regulatory capacity within the framework of the monitoring and assessment processes displayed in Figure 2.

Explaining Increases in Self-Regulation from Practice

The first type of evidence frequently cited to support the continued role of a limited capacity in carryover effects of self-regulation is that practicing acts of regulation over time appears to build this capacity (i.e., in terms of the guiding strength metaphor of capacity models, it "strengthens the self-regulation muscle"). That is, people who engaged in small, regular actions of self-regulation, such as not eating sweets or using their non-dominant hands for everyday tasks, later sustained higher levels of regulation on unrelated tasks than people who monitored, but did not regulate their behavior (e.g., Muraven, 2010; Oaten & Cheng, 2007). Moreover, these findings were not explained by expectancies about whether the practice would work, global self-efficacy, or emotional distress, which seems to support a broader capacity explanation.

Putting aside for the moment questions about how robust these types of practice effects are (see Inzlicht & Berkman, 2015), other findings do highlight the relevance of other cognitive processes included in the MEA model that could explain such effects. Although practicing self-regulation might not increase global self-efficacy, it could increase expectations about abilities to sustain regulation both now and in the future when assessing motivations for continued regulation. Once recognizing that small efforts they are making to change their behavior are both possible and do not greatly interfere with self-regulation toward other important goals, people could develop

increased efficacy for such regulation more specifically, which would then support motivations for sustained regulation. Indeed, a recent study has shown the direct role of these more specific perceptions of efficacy in continued self-regulation (Chow et al., in press). Following difficult acts of sustained self-regulation, participants reported specific reduction in efficacy for performing a new task that also required regulation, and this reduction mediated decreases in subsequent regulation.

Explaining Effects of "Severe Depletion"

Another set of findings often cited to illustrate the continued need for limited capacity in explaining carryover effects in self-regulation is two studies by Vohs, Baumeister, and Schmeichel (2013), in which participants either initially performed a single self-regulation task or an extended series of several self-regulation tasks before completing the same final task. When participants performed only one initial task, increasing incentives for sustained self-regulation or instilling lay theories that mental capacity for such regulation is not limited did eliminate carryover effects from this initial task to the final task, as in other studies (e.g., Job et al., 2010; Muraven & Slessareva, 2003). However, when participants performed an extended series of tasks, increasing incentives or instilling non-limited lay theories did not eliminate the carryover effects to the final task. Vohs et al. thus argued that this latter finding demonstrates that enough self-regulation does stretch resources for regulation to their capacity and produces severe enough depletion that the processes outlined in the MEA model (and other alternative perspectives reviewed here) will no longer apply.

Although this is one logical interpretation of such findings, a closer examination raises questions that participants must truly be exhausting their capacity for continued self-regulation. First, the incentive manipulation used to potentially counteract "severe depletion" was neither particularly direct nor strong. Participants learned that the research in which they were participating was generally important and would "…aid consumer welfare, happiness, and health" (Vohs et al., 2013, p. 186). Thus, their efforts in the study did not promise immediate benefits to themselves (cf. Muraven et al., 2003) and could only eventually help society at large (and perhaps the experimenters) some time in the future. Thus, although participants were more likely to be motivated in this condition than the no-incentive condition, as manipulation checks and

performance following the single self-regulation task showed, their motivation likely waned as they performed the extended series of initial self-regulation tasks, which could explain the lack of sustained regulation in this condition. That is, the MEA model predicts that people continually monitor their effort and progress and reassess the value of sustained regulation; therefore it seems highly plausible that by the time participants reached the final task, it was the perceived value of any additional progress participants felt they could make in helping the experimenter relative to their continued effort – not their capacity for self-regulation – that was severely diminished.

Similarly, the expectations and beliefs created by the specific manipulation of lay theories used in these studies to counter-act "severe depletion" were again not likely strong or lasting. As in previous studies of such theories (e.g., Job et al., 2010), to instantiate the belief that "mental energy" is or is not a limited resource, Vohs et al., (2013) had participants rate their agreement with a short series of statements worded in a biased way to elicit agreement with one viewpoint or the other, and manipulation checks again indicated that moderate agreement with either theory was created, at best. Given this mild inducement – the success of which itself is an indication that people's lay theories of self-regulation can be rather dynamic and fluid – it again makes sense that such a shift in beliefs could encourage sustained effort following a single self-regulation task. However, when induced beliefs that exerting mental effort can be energizing were countered by the experiences produced by a series of seemingly unimportant tasks that required self-regulation, such experiences should have had at least as strong an effect on participants' beliefs as the original manipulation, and thus eliminated its influence. That is, as illustrated in Figure 2, the MEA model suggests not only that expectations and beliefs influence experiences of self-regulation, but that these experiences can update beliefs and expectations. Thus, because they were in possession of only moderate theories about self-regulation that were recently formed, it is likely that participants' experiences of engaging in extended regulation were strong enough to counter whatever influences these initial beliefs might have had (see also Hirt, this volume).

Beyond these specific critiques based on the MEA model, perhaps more problematic for the idea that exerting continued self-regulation over time will produce more and more severe depletion

as the limits of capacity are reached are the variety of directly contradictory findings. Some studies have shown that performing several self-regulation tasks in succession (e.g., Converse & Deshon, 2009; Dewitte, Bruyneel, & Geyskens, 2009), or extending the time spent on one of a series of self-regulation tasks can actually lead to enhanced rather than reduced self-regulation (see Dang, Xiao, & Dewitte, 2014). Furthermore, other studies have shown that performing multiple self-regulation tasks simultaneously, which should also be more "severely depleting", can similarly facilitate self-regulation (Tuk, Zhang, & Sweldens, 2015). It is extremely difficult to reconcile these results with Vohs et al.'s (2013) claim that their findings reflect an exhausted capacity for regulation, but they are readily explainable by shifts in people's expectations for or the value they place on continued regulation, and their experiences of engaging in self-regulation, as outlined by the MEA model.

Explaining the Role of Glucose

Perhaps the biggest challenge for any model of self-regulation that questions whether there is a fixed capacity for self-regulation would be to address evidence of an actual physiological resource that both (a) is consumed during regulation and, (b) can restore regulation when replenished. Initial findings by Gailliot et al. (2007) appeared to indicate that circulating levels of glucose in the bloodstream met both of these criteria, suggesting that glucose directly fuels self-regulation just as it does muscle function (see also Bushman, DeWall, Pond, & Hanus, 2014). However, these findings have subsequently been undermined in multiple ways. Regarding the physiological consumption of glucose during self-regulation, reanalyses of the original Gailliot et al. data by Kurzban (2010) suggests that these data do not actually provide good support for such an effect (see also Lange & Kurzban, 2014; Schimmack, 2012), and further studies testing this claim in the most precise manner possible failed to replicate it (Molden et al., 2012). Indeed, Baumeister (2014) now acknowledges that "…it seems unlikely that ego depletion's effects are caused by a shortage of glucose in the bloodstream" (p. 315).

Regarding the restoration of self-regulation by ingesting additional glucose, several other findings beyond the original Galliot et al. (2007) studies have supported the idea that ingesting glucose can reduce carryover effects of exerting self-regulation and bolster continued regulation

(DeWall, Baumeister, Gailliot, & Maner, 2008; Masicampo & Baumeister, 2008; McMahon & Scheel, 2010; Wang & Dvorak, 2010). However, whereas Baumeister (2014) argues that this is sufficient evidence to still regard glucose as a critical resource fueling self-regulation, further research has undermined this claim as well. Several independent replications have confirmed that the effects of glucose on improved self-regulation do not depend upon its metabolization and conversion to energy, but may instead rely on perceptual and motivational processes (Hagger & Chatzisarantis, 2013; Molden et al., 2012; Sanders, Shirk, Burgin, & Martin, 2012). These studies all showed that merely rinsing one's mouth with, but not ingesting, glucose-flavored drinks has the same bolstering effects on self-regulation. Furthermore, these effects are found not only for short-lived cognitive tasks, but also on tests of athletic endurance that require sustaining maximum effort for up to 1 hour (a "severely depleting" circumstance if ever one existed; for recent reviews and meta-analyses see e Silva et al., 2014; Jeukendrup, Rollo, & Carter, 2013).

Research is still ongoing concerning the mechanisms of these mouth-rinsing effects, but the MEA model points to several possibilities. First, when glucose is detected in the mouth, this could influence monitoring processes by altering perceptions of effort. Fares and Kayser (2011) provided preliminary support for this idea by showing that people perceived the same amount of physical work as less effortful when rinsing their mouths with carbohydrate solutions. Alternatively, the presence of glucose in the mouth could directly affect expected ability for or the value placed on self-regulation, and thus could alter assessments of motivations to continue. Neuroimaging findings showing that carbohydrate mouth-rinses selectively engage dopaminergic pathways in the striatum, which are closely associated with responses to reward, provided preliminary support for this idea as well (Chambers, Bridge, & Jones, 2009). In addition, the presence of glucose in the mouth could also influence assessments of motivations to continue by affecting expectations about ability for future self-regulation. That is, because detection of carbohydrates in the mouth suggests imminent ingestion and an increase in the energy soon available, another function of the neurological signals initiated by this detection could be to offset motivations for conservation that might otherwise arise from prolonged self-regulation (cf. Baumeister, 2014).

In summary, engaging in self-regulation does not appear to physiologically consume glucose and the positive effects of ingesting glucose on self-regulation do not appear to depend on the energy produced by its metabolization. Thus, at present, there is little remaining evidence to claim that glucose functions as a resource that places a capacity on self-regulation. Instead, as with the findings involving building self-regulatory "strength" and "severe depletion," even these effects can be explained equally well by the psychological processes outlined by the MEA model.

Explaining Perceptions of Limited Resources and Motivations to Conserve

One final argument often offered to support capacity models of self-regulation is that they most accurately represent how people experience and respond to exerting regulation. That is, because people often believe they have a limited capacity for self-regulation (Job et al., 2010; Job, Walton, Bernecker, & Dweck, 2015; Martijn et al., 2002) and behave as if they are conserving and allocating these resources carefully (Muraven et al., 2006; Tyler & Burns, 2009), this is a strong sign that there must be some actual limits to which they are responding (Baumeister, 2014).

Putting aside that people's introspections are typically not optimal foundations for determining what psychological mechanisms are operating, we believe that the MEA model can explain these typical patterns of thought and behavior as well. First, we agree with Kurzban et al. (2013) that the actual psychological limits people do face are they cannot simultaneously (a) consciously process and attend to every piece of information in their environment, and (b) engage in every behavior currently possible. Therefore, people must constantly prioritize their concerns and objectives, which involves difficult tradeoffs requiring sophisticated evaluations of when to engage or disengage in a variety of actions. We also broadly agree with Kurzban et al. and others (Hockey, 2013; Inzlicht et al., 2014) that experiences of mental fatigue function to facilitate such evaluations. As outlined above, the MEA model proposes that rising fatigue signals that the relative worth of the effort and attention devoted to self-regulation toward one objective is diminishing and indicates that a reevaluation of priorities is necessary. Moreover, the MEA model further proposes that to adequately guard against perseveration and missed opportunities, and balance attention between making continued progress toward attaining known objectives versus

detecting new objectives that are worthy of pursuit (Cohen, McClure, & Yu, 2007), experiences of fatigue typically accumulate and increase over time (see Wascher et al., 2014).

In the MEA model, the primary function of fatigue is thus to ensure a motivational homeostasis between sustained self-regulation toward currently important goals and pauses in self-regulation to reassess what alterative goals might deserve attention and effort. Maintaining such a homeostasis requires a conservative system of effort allocation in which fatigue grows progressively more intense over time and can extend beyond task completion, which then triggers a break from self-regulation and ensures a more optimal distribution of effort overall. However, the immediate phenomenological experiences of rising intensity and extended duration that such a system of mental fatigue creates are readily appraised as feeling that one's "mental energy" is "depleted" and must be "conserved" for later use. Interestingly, some have even suggested that one reason for the frequency of these particular appraisals is that experiences of mental fatigue originally evolved out of the more basic phenomenology of physical fatigue, where a maximum capacity for energy expenditure does indeed exist (see Evans, Boggero, & Segerstrom, in press). Nevertheless, whatever the reason for the frequency of such appraisals, the critical point is that a wealth of evidence reviewed throughout this chapter suggests that experiences of "depletion" are merely appraisals that may be altered by a variety of other factors. That is, on the whole, if common experiences of self-regulation are to be offered as evidence for an actual capacity of such regulation, the malleability of these experiences must then also be acknowledged as seriously challenging the idea that such a capacity plays a critical role in self-regulation failure.

Summary and Conclusions

We began this chapter by noting that self-regulation is both enormously beneficial and enormously difficult. The primary challenge of research on self-regulation is thus to understand this difficulty and to find ways to ameliorate it. For quite some time, because capacity explanations have been the primary source of understanding self-regulation, few possible options for facilitating regulation and allowing people to better realize its benefits have seemed to be available. That is, other than suggestions for a regular program of "exercise" to build this capacity (e.g., Muraven,

2010) or vague recommendations to set aside time for regular periods of relaxation or to eat healthy, glucose-rich snacks to keep one's existing capacity as full as possible (e.g., Baumeister, 2014), no other good means of sustaining self-regulation would have seemed to be viable.

However, the MEA model of self-regulation, and all of the other emerging perspectives that it integrates and extends (Ampel et al., this volume; Berkman, this volume; Kurzban et al., 2013; Francis & Inzlicht, this volume; Dehan et al., this volume), forcibly redefine the challenge of facilitating self-regulation as a motivational problem. If failures of self-regulation arise from motivational deficiencies and misalignments, they may then potentially be solved by altering incentives, increasing engagement, eliminating distracting alternatives, or reinterpreting and reappraising the experiences that guide such regulation. Thus, transcending the notion of limited capacity offers a host of new psychological mechanisms as possible targets for interventions intended to bolster self-regulation and a wealth of promising avenues for future research.

Yet, by rejecting a fixed capacity for self-regulation, the MEA model does not necessarily make solving the existing challenges of self-regulation failure easier. Even if such regulation does not consume some specific resource, this does not mean that the motivations instead driving self-regulation are themselves unlimited. People must regularly manage a wide variety of motivational conflicts based on the dynamic opportunities, temptations, and obstacles they encounter, and the experiences of fatigue that accompany self-regulation accumulate and create their own powerful disincentives. Yet, by better defining the psychological processes that contribute to frequently observed instances of self-regulation failure, the MEA model creates a clearer path forward for studying attempts to overcome such failure. Further research may ultimately provide more compelling evidence that self-regulation does indeed have its own special limited capacity and force further reconceptualizations. But, until then, it will be much more fruitful to for research on self-regulation to move beyond such theoretical limits. Thus, although Hamlet may have been mistaken about the typical consequences of self-regulation, perhaps research inspired by the MEA model and other new perspectives will help teach us how to encourage restraint and abstinence in a way that indeed grows progressively easier with their continued application.

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Footnotes

[1]A more recent meta-analysis examining carryover effects only in the context of well-validated indices of executive function found similar support for these effects (Carter, Kofler, Forster, & Mccullough, 2015). However, this analysis also noted that when newly developed statistical tools designed to correct for publication bias were applied, there appeared to be no cumulative evidence for carryover effects. Yet, concerns have arisen that these new statistical tools often severely underestimate meta-analytic effect sizes and inappropriately suggest the absence of cumulative meta-analytic effects (Reed, Florax, & Poot, 2015). Thus, any conclusions that evidence for the interference of one act of self-regulation on subsequent acts of self-regulation in a different domain is generally lacking seem premature (see also Inzlicht & Berkman, 2015).

[2]As Carver and Scheier (2001) have noted, control-theory accounts of self-regulation include goals that involve both reducing discrepancies with desired end-states and increasing discrepancies with undesired end-states. Although, for simplicity, we describe the assessment and monitoring processes of the MEA model as they apply to desired end-states, these processes are proposed to operate the same way with undesired end-states. That is, in the MEA model, the critical variables that determine motivations to engage in and sustain self-regulation and the mechanisms for monitoring this regulation are identical in either case; however, the unique cognitions and emotions arising from the assessment and monitoring of progress toward a desired end-state versus progress away from an undesired end-state (e.g., Carver, Lawrence, & Scheier, 1999) should still affect the output of these mechanisms and the course of self-regulation overall.

[3]Vohs, Glass, Maddox, and Markman (2011) showed that whereas engaging in an initial self-regulation task reduced subsequent self-regulation in the form of aggression following provocation, sleep-deprivation did not. Although Vohs et al. have argued that these findings demonstrate carryover effects in self-regulation distinct from experiences of fatigue, sleep deprivation creates a unique state that is not equivalent to mental fatigue (Hockey, 2013; Hossain, Reinish, Kayumov, Bhuiya, & Shapiro, 2003). Thus, such findings do not conclusively undermine the proposed role of experiences of fatigue in self-regulation failure (see Inzlicht & Berkman, 2015).

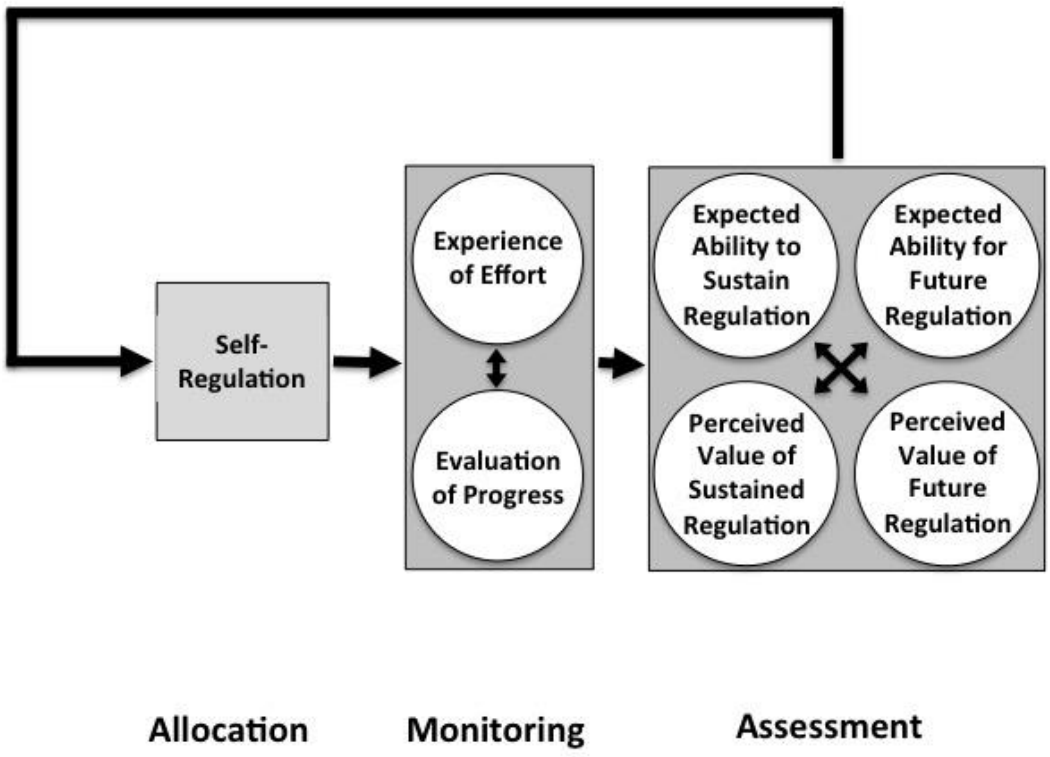

Figure 1. A Motivated Effort-Allocation model of self-regulation. Assessments of motivations to exert self-regulation produce allocations of effort and attention to engage in regulation. The consequences of self-regulation are then monitored and motivations to continue regulation reassessed.

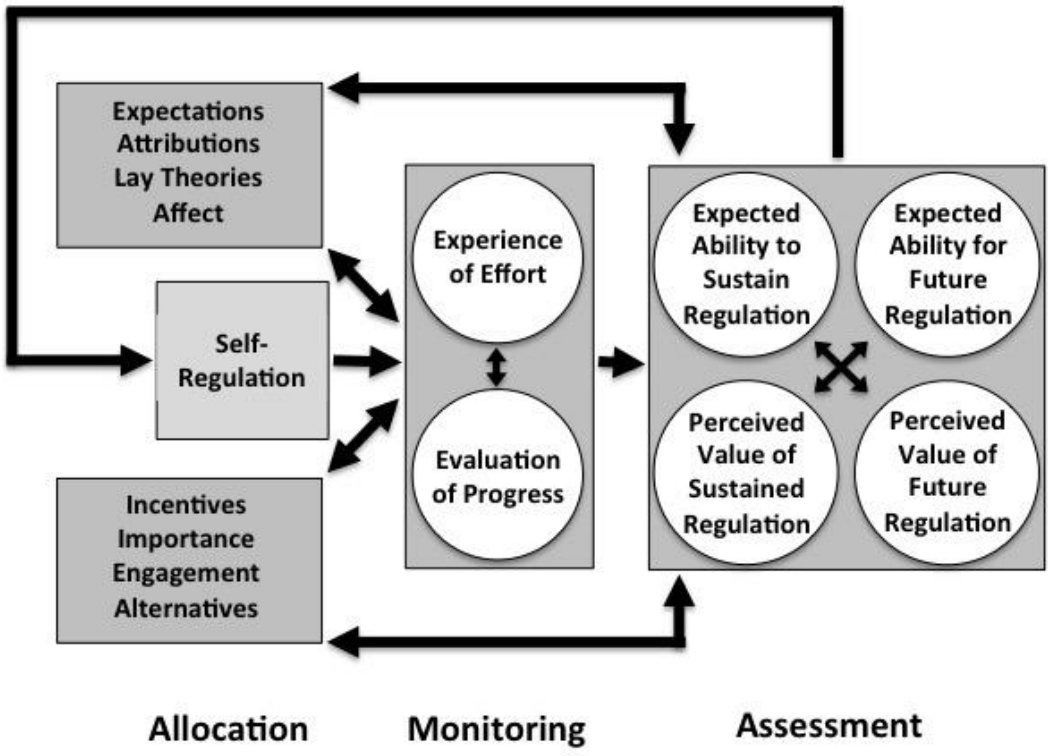

Figure 2. Examples of additional influences on motivated effort-allocation during self-regulation. A variety of cognitive and motivational processes can alter and interact with both the assessment of motivations for self-regulation and the monitoring of the consequences of the attention and effort allocated to regulation.