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Explorations of Perceived Product Efficacy

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EXPLORATIONS OF PERCEIVED PRODUCT EFFICACY

by

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ABSTRACT

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Prior research has largely treated perceived product efficacy as a one-dimensional construct. This research uniquely demonstrates that perceived product efficacy is comprised of several dimensions and focuses on one previously unexplored dimension that has significant implications for consumption frequency: perceived *duration* of product efficacy. The current research shows that consumers make biased duration judgments of product efficacy: consumers make shorter (vs. longer) duration judgments when they perceive a concurrent task to be relatively difficult (vs. easy). The effect of perceived task difficulty on duration judgments of product efficacy is (1) established with energy-enhancing products and medication, (2) shown to be driven by an intuitive belief that the efficacy duration of products is context-dependent, and (3) attenuated when this intuitive belief is challenged via priming or the presentation format of manufacturers' suggested consumption instructions. The impact of the documented intuitive belief on consumer health and well-being, along with the implications for marketers and the public health community, are discussed.

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I dedicate this dissertation to my father and my biggest supporter, Vladimir Ilyuk.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

Recently on the online forum *RealSelf.com* where medical professionals answer various consumer questions, one person asked: "Will the product [Dysport, a botox-like substance used to eliminate wrinkles] wear off faster since I practice Bikram Yoga?... It is a very strenuous activity." Fourteen licensed doctors replied to the post, all in consensus that the longevity of the product is independent of the activity one performs; they agreed that the substance "irreversibly binds to neuromuscular junctions and "wears off" only when the body produces new ones, typically in 3-4 months." Importantly, the duration of efficacy of many products[1]—such as caffeinated beverages and medication containing acetaminophen (e.g., Tylenol)—is determined primarily by the dose of the active ingredient and individual-level factors such as age, disease, liver functioning, weight, and use of other medications rather than by the physical or cognitive tasks that consumers perform (Baca and Golan 2012; Karan, McCance-Katz and Zajicek 2009; Chikhani and Hardman 2011; Juliano, Ferre, and Griffiths 2009; Winston, Hardwick and Jaberi 2005; Benowitz 1990). The pharmacokinetics of caffeine and acetaminophen, for example, are unaffected by concurrent task difficulty (e.g., physical activity; Haller et al. 2008; McLean and Graham 2002; Graham 2001; Loniewski et al. 2001; Sawrymowicz 1997). It appears that consumers may intuit otherwise.

Duration judgments of product efficacy, the focus of the present research, are important for several reasons. As illustrated by the example, consumers care about duration of product efficacy: it is a product attribute that can influence purchase and satisfaction. It is also an attribute, however, on which firms often do not provide precise information. Thus, one's own

[1] In the current research, "products" refer to pharmacological products: efficacious substances that are consumed for the purpose of experiencing a physiological effect (e.g., increased energy and alertness, decreased pain and anxiety, etc.)

judgments and those of other consumers can be an important source of decisions. Further, duration judgments of product efficacy impact intake frequency which ultimately determines the level of consumption (e.g., under- or overuse) within a given time period. Indeed, frequency of consumption is important commercially and also a key concern in product/drug adherence; in many settings consumers take an other-than-suggested amount of a product, resulting not only in waste, but also potentially in more detrimental consequences (National Council on Patient Information and Education 2007; Diener and Limmroth 2004; Pohler 2010). Despite the importance of perceived duration of product efficacy, research to date has not examined this variable. This work is the first to document a systematic consumer belief that affects duration judgments of product efficacy.

More specifically, this research demonstrates that consumers hold an intuitive belief that duration of product efficacy is dependent on the difficulty level of the tasks they perform, such that relatively difficult (vs. easy) concurrent tasks result in shorter (vs. longer) efficacy duration. That is, similar to placebo studies (Shiv, Carmon, and Ariely 2005; Irmak, Block, and Fitzsimons 2005; Stewart-Williams and Podd 2004) in which consumers infer efficacious outcomes regardless of actual metabolic effects, the present research finds that consumers report feeling the effects of a product for a shorter duration—and increase consumption frequency—when tasks are perceived as difficult despite the fact that task difficulty should have no such effect. It is also shown that when the intuitive belief is challenged, either by an experimental priming procedure or a manipulation taken from a naturalistic setting (i.e., manufacturers' suggested intake instructions), duration judgments do not vary as a corollary of difficulty.

CHAPTER 2: THEORETICAL BACKGROUND

2.1 Product Efficacy Inferences

There is much evidence in the marketing literature that in the wake of incomplete knowledge, consumers rely on both external and internal cues to make inferences about products. For example, consumers may rely on intuitive theories, their overall evaluations, and observable attributes to infer the values of missing, or unobservable, product attributes (Kardes, Posavac, and Cronley 2004). Deval et al. (2013) show that consumers may hold several even discrepant naïve theories about product attributes and various marketplace phenomena, and that consequent inferences and evaluative judgments may depend on which theory is active. However, much of inference-making research has been outside the health domain and the literature on efficacy-specific inferences—about a product's capacity to deliver a desired result—is sparse.

The limited body of research on product efficacy (i.e., of medication, functional foods and beverages) does suggest, however, that consumers may also rely on intuitive beliefs about observable product attributes to make efficacy inferences. For example, price has been shown to affect self-risk judgments and perceptions of need for a drug (Samper and Schwartz 2013), along with perceived product efficacy (e.g., pain relief; Waber et al. 2008) and actual behavioral outcomes (e.g., task performance; Shiv, Carmon, and Ariely 2005). Similarly, the product's origin may be used to infer product efficacy. Wang, Keh, and Bolton (2010) find that Eastern medications are presumed to be more efficacious when there is high diagnosis uncertainty whereas Western medications are inferred to be more efficacious when attributing a particular cause to symptoms is easy (i.e., diagnosis certainty is high).

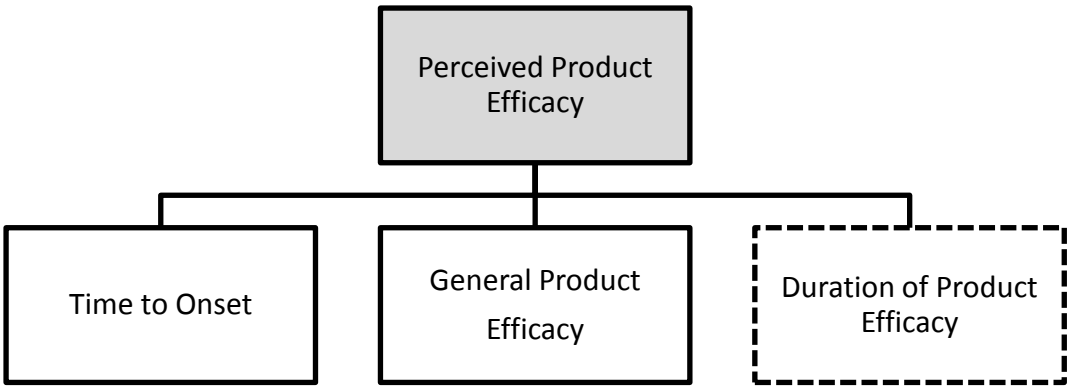
Other factors, such as a firm's profitability information, packaging, and negative product attributes also affect efficacy expectations (Wright et al. 2013; Kramer et al. 2012; Posavac et al. 2010). Wright and colleagues (2013) show that negative associations between taste and quality lead consumers to experience increased efficacy (e.g., task performance) after consuming a substandard (vs. superior) tasting drink thought to enhance mental acuity. Indeed, intuitive beliefs about "no-pain, no-gain" yield inferences that negative personal consequences (e.g., experiencing a product's side effects) are required for experiencing health benefits, particularly for products that have been on the market for a long time (Kramer et al. 2012). Furthermore, intuitive beliefs about other product attributes, such as its perceptual properties, have also been shown to elicit various efficacy expectancies. The color of product packaging (Roullet and Droulers 2005) and the size, color, and form of medicines have been shown to affect efficacy inferences; capsules are perceived to be more efficacious than pills, and larger pills are perceived to be more efficacious than smaller ones perhaps due to a "bigger-is-better" lay theory (Buckalew and Coffield 1982; Buckalew and Ross 1991).

Importantly, this past work has focused almost exclusively on product- and firm-specific characteristics as determinants of perceived efficacy. However, people may hold naïve theories about how efficacy, and the duration thereof, "behaves" in light of other factors, such as the context in which consumption occurs. Moreover, extant research has largely studied various factors that affect inferences regarding general product efficacy. Although it is not contested that the study of general product efficacy is important, it is proposed in the present research that investigating other facets of efficacy may offer additional insight. Perceived product efficacy appears not to be a monolithic construct but rather to be comprised of several dimensions, including time to onset (Faro 2010), general efficacy (Shiv, Carmon, and Ariely 2005; Wright et

al. 2013; Kramer et al. 2012), and duration of action, each with potentially unique antecedents and consequences (see Figure 1). For example, whereas perceptions of general product efficacy (i.e., "How powerful is this product?") may affect factors such as product evaluations, preference, choice, or decisions to consume a product in the first place, perceptions of product efficacy duration uniquely affect consumption frequency or, in other words, consumption quantity within a given time period. In the current research, it is suggested that duration judgments of product efficacy may be affected by factors that feature in people's naïve theories about duration of product efficacy and concurrent tasks—namely the difficulty of the task for which the product is used.

FIGURE 1

DIMENSIONS OF PERCEIVED PRODUCT EFFICACY



2.2 Task Difficulty and Duration of Product Efficacy

Human cognition can be understood by viewing knowledge about physical, biological, and social processes as an organization of intuitive theories (Nisbett and Ross 1980). These intuitive theories often rely on knowledge about one domain to make sense of other less familiar domains. For instance, intuitive grasp of causal process in the physical environment later acts as a basis for reasoning about other domains, even when such generalizations may not be appropriate, leading people to believe in relationships which may not exist (Griffiths and Tenenbaum 2009; Faro, McGill, and Hastie 2010). In the present research, it is suggested that the proposed effect of task difficulty, with more difficult tasks being judged as leading to faster wear-off and shorter duration of efficacy, is an instance of such generalization.

More specifically, one potential source of the proposed belief that the duration of product efficacy depends on task difficulty may stem from people's naïve understanding of physical phenomena. Naive physics entails an intuitive grasp of notions such as momentum and friction. For example, people learn or observe that an object that is parted with a causal force (e.g., a billiard ball that is hit with a cue) can have momentum and impact (e.g., make another ball move), but its force is subject to friction (McCloskey 1983). As noted, people generalize such notions from naïve physics to reason about other domains (Heider 1958). For instance, researchers have drawn a parallel between the notion of momentum from Newtonian physics and its psychological analogue in settings such as goal completion (e.g., writing a paper) and social relations (e.g., running a political campaign; Markman and Guenther 2007; see also Chae, Li, and Zhu 2013; Faro, McGill, and Hastie 2010). In a similar vein, if as proposed in the present research people view a substance as working to counter effects triggered by a task, task difficulty

may be psychologically analogous to a physical source of friction. As a result, just as a greater source of friction would result in a quicker halt of a moving object, a product may be judged to lose its efficacy faster when faced with a difficult task.

A related source that may underlie the belief that the duration of product efficacy depends on task difficulty comes from naïve theories of biology (Siegal and Peterson 1999). Here, an image of a battle is often employed in illustrations of the theory of the germ and other biological processes for children. The body's immune system or a medical substance is often shown "fighting" (sometimes literally with soldier characters) external forces such as viruses. The image of a battle suggests that the stronger the external threat or influence—or in this case the more difficult the task—the greater the challenge to the forces (internal or external) that counter it, and the faster they may lose their efficacy over time.

A final noteworthy idea linked to the current prediction concerns people's expectancies that there would be resemblance in magnitude or size between a disease and the remedy to that disease (Rozin and Nemeroff 2002). Similarly, there is a general expectation that large-scale consequences arise from large causes (LeBoeuf and Norton 2010). Such reasoning may sometimes be appropriate but often is not. Big problems can have simple solutions (e.g., a simple prescription of washing hands solves many health problems; small nudges such as changing the default have a dramatic effect on donations and savings; Thaler and Sunstein 2008). And similarly, small and seemingly fragile causes can have dramatic effects (e.g., the relatively fragile HIV virus and the AIDS epidemic). Critically, this type of reasoning about problems and solutions may trigger inferences about aspects of the solution, including its duration of impact. In particular, if the problem the consumer is facing is big (i.e., difficult), it may be seen to require a

big solution, and holding the size of the solution constant, the solution may be thought to wear off faster.

The current research focuses on task difficulty as a contextual factor that can affect efficacy duration judgments for several reasons. First, it is a common variable in consumption settings. People perform some kind of activity during and after product consumption, and such activities fall on a spectrum from relatively strenuous to relatively effortless. For example, a student might consume a cup of coffee while reading a fairly difficult textbook or he/she might have the same cup while leisurely reading a glossy magazine. Task difficulty may also be interesting to examine because consumers' perceptions of task difficulty are known to be context-dependent and highly malleable (Burson 2007). Thus, people's judgments of product efficacy duration might be affected not only by actual but also by perceived difficulty, a possibility that is tested in the current work. Perhaps most important, however, is the physiological fact that even if actual difficulty varies across consumption settings, the length of time a given product remains active and has impact is often not affected by such variation, especially when it comes to cognitive tasks. This suggests that, if efficacy duration judgments are affected by task difficulty, the resulting increased consumption for difficult tasks is unjustified. Next, the growing body of evidence that implicates product efficacy duration to be independent of concurrent tasks is discussed.

2.3 Metabolism of Ingested Substances

The length of time an ingested substance remains active—a function of its half-life, the amount of time over which the drug concentration decreases by one-half of its original value in

the plasma—depends on physiological and pathological factors that affect (1) the volume of distribution and (2) the clearance of the substance; an increase in the volume of distribution or a decrease in clearance results in prolonged half-life (Baca and Golan 2012). Factors that affect the volume of distribution and clearance include age, weight, disease, and the level of enzymes in the liver necessary for metabolism of the substance (Baca and Golan 2012; Karan, McCance-Katz and Zajicek 2009; Chikhani and Hardman 2011; Juliano, Ferre, and Griffiths 2009; Winston, Hardwick and Jaberi 2005; Benowitz 1990). Research shows that the biological half-life of caffeine, for example, varies by factors such as liver function, smoking, pregnancy, and concurrent medication (Juliano, Ferre and Griffiths 2009; Benowitz 1990); it does not depend on physical and/or cognitive activity. As such, many pharmaceutical products and the active ingredients in many "functional" foods and beverages (Thomasson 2012) do not "work" as a function of concurrent tasks but depend primarily on individual-level factors.

Notably, however, glucose metabolism has been a source of debate in the literature. It was previously suggested that tasks that require exertion of mental effort (e.g., self-control) lead to resource depletion (e.g., decrease in glucose levels; Gailliot et al. 2007). However, a growing body of research now provides evidence that does not support the energy depletion model. That is, there appears to be no increased energy utilization during tasks that require more versus less cognitive effort (Kurzban 2010; Clarke and Sokoloff 1999; Gibson and Green 2002; Lennie 2003; Gibson 2007). Even very different computational tasks have been shown to yield very similar glucose consumption by the brain (Kurzban 2010). Most recently, in a series of experiments, Molden and colleagues (2012) demonstrated that exerting cognitive effort—performing tasks that require self-control or executive function—did not increase carbohydrate metabolization or reduce blood glucose (for a conceptual replication, see Sanders et al. 2012). In

fact, depletion effects are now primarily attributed to motivation (Molden et al. 2012), lay theories of willpower (Job, Dweck, and Walton 2010), and people's perception of depletion (Clarkson et al. 2010) rather than to any actual metabolic or energetic changes. Thus, emerging research supports the idea that differences in cognitive exertion do not result in different levels of resource depletion, implying that consumption of products containing glucose should be unaffected by levels of concurrent cognitive task difficulty.

Nonetheless, in the three experiments of the present research involving actual consumption, metabolic changes and energy depletion are controlled for in several ways. First, products with a 30-minute onset time are utilized as stimuli. Duration judgments of glucose-containing product efficacy after product consumption but prior to the product's onset time must be based exclusively on intuitive beliefs about such processes. Secondly, not only actual but also perceived task difficulty is manipulated. The next chapter features an overview of the experiments and the conceptual framework.

CHAPTER 3: THE CURRENT RESEARCH

3.1 Overview of Experiments and Conceptual Framework

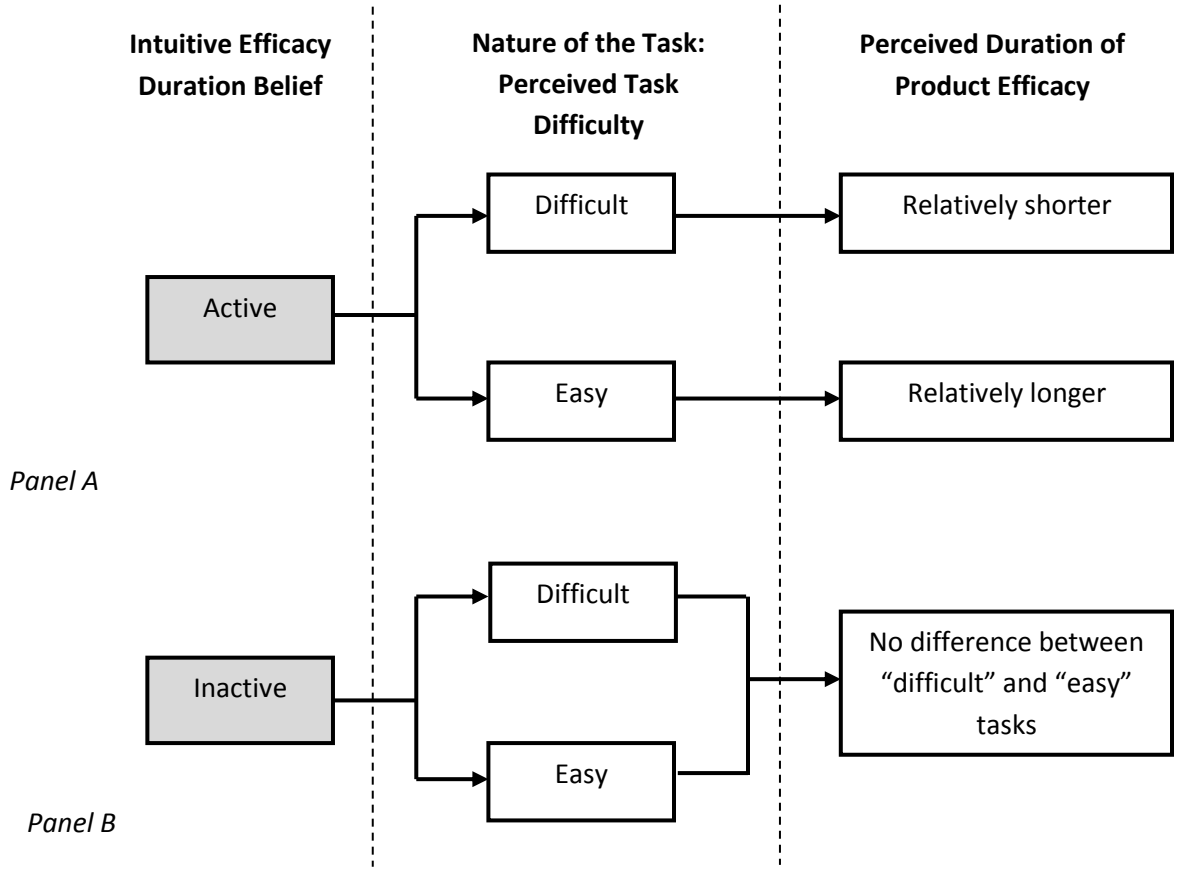
Four experiments test the hypothesized effects of perceived task difficulty on duration judgments of product efficacy with energy enhancing products (experiments 1-3) and medication (experiment 4). Experiments 1 and 2 explore the intuitive "malleable" efficacy duration belief (Figure 2, panel a). In experiment 1, a cognitive task is administered. The experiment reveals that perceived duration of product efficacy—manifested by actual consumption frequency during the time interval—is shorter for participants in the difficult (vs. easy) condition. As a follow-up, experiment 2 demonstrates that this effect is indeed driven by perceptions of product wear-off rather than by inferences about the overall quantity of a substance needed to perform the task. This is shown by having all participants consume a fixed, as opposed to a variable, amount of product.

The subsequent two experiments manipulate the salience of the intuitive belief that is hypothesized to drive the effect (Figure 2, panel b). Experiment 3 shows that when the belief is challenged (vs. reinforced) via a priming technique, the effect of task difficulty on duration judgments of product efficacy is muted. This experiment also holds actual task difficulty constant across conditions and manipulates perceived difficulty. The final experiment varies the salience of the intuitive belief of efficacy context-dependence with a manipulation borrowed from a naturalistic setting. The manufacturer's intake frequency instructions are presented in the interval (vs. absolute) format to signal efficacy duration malleability (vs. fixedness); the results replicate those of the previous experiment. As the English proverb says, "All good things must

come to an end." It appears that consumers believe that some "good things" come to an end more quickly depending on what they do during and after product consumption.

FIGURE 2

CONCEPTUAL FRAMEWORK



3.2 Experiment 1

The purpose of experiment 1 was to obtain preliminary support for the hypothesis that task characteristics—namely difficulty or ease—affect perceived duration of product efficacy. Jelly Belly® Sport Beans®, energizing jelly beans formulated with carbohydrates, electrolytes, and vitamins B and C, were selected as the target product to maintain experimental credibility and feasibility. First, it is a real product but with limited retail distribution. Secondly, package instructions specify that Sport Beans® can be consumed as needed, ensuring that participants would not overdose (as could be the case with heavily caffeinated products or pharmaceuticals). Thirdly, the product has a 30-minute onset time (approximately at the completion of the task) which experimentally controls for any actual energetic changes. Intake instructions that specify that the product should be consumed 30 minutes prior to activity were concealed with small labels on the back of the packets.

In the present study, participants performed a reading task in which they were asked to identify vowels in reading passages. Task difficulty was manipulated by using a degraded font style for the difficult condition and a standard font for the easy condition (Novemsky et al. 2007).

3.2.1. Method

Participants and Design. One hundred and thirty participants (68% female, M_{age} = 22.62) were recruited for this experiment. Participants were randomly assigned to one of two conditions: difficult task versus easy task.

Stimuli. A survey booklet and a 1 oz (29g) packet of orange flavored Jelly Belly® Sport Beans® were placed at each computer workstation. Each survey booklet began with four reading passages about the history of the first four U.S. presidents. Task difficulty was manipulated via a degraded font technique used in literature (Novemsky et al. 2007). Participants in the easy condition received the text in a standard black, Times New Roman, size 11 font. Those in the difficult condition received the same text in a light gray, italicized, Times New Roman, size 11 font, with center-page shadowing. The first page of the booklet contained the instructions. A battery of questions about the product and the task followed the reading passages.

DirectRT was used to record consumption. This software provided the ability to compute how long participants worked on the task and how many Sport Beans® they consumed during the experiment. It also provided the ability to display experimental instructions on the computer screen to act as a reminder to participants throughout the length of the study.

Procedure. Prior to beginning the study, participants read a description of the experiment (the first page of the aforementioned booklet). Participants read that they would be asked to evaluate the product and that although it is marketed as a source of energy during physical exercise, it is helpful when performing a variety of activities given its active ingredients. They were given the product description detailed above (excluding the information about the 30-minute onset time) and the tasks they would perform, which they were instructed to do to the best of their ability. They were also told that they should read the passages carefully since they may be asked questions about the reading afterward. Ostensibly to minimize distraction, participants were asked to remove all mobile devices and watches during the experiment; this

was done to ensure that participants relied on their own experience and impressions to make duration judgments of product efficacy, rather than relying on any external source. All clocks were removed from the laboratory.

Immediately before they began the reading task, which entailed identifying vowels in the reading passages, participants were instructed to open the packet of Sport Beans®, eat one, and press the [SPACE BAR]. The instructions also stated that to ensure a fair product evaluation, participants should continue eating the Sport Beans® as needed to experience the effects of the product throughout the entire study; they were told to eat another Sport Bean® whenever they felt the effects wearing off and to press [SPACE BAR] each time they did so. Participants were asked to work on the reading passages in their entirety and to indicate completion by pressing the "S" key.

In between each of the four passages (i.e., presidents), there was a reminder to continue eating the Sport Beans® as needed and to press the [SPACE BAR] to indicate consumption. On the computer screen, participants read: "Remember to press [SPACE BAR] when you eat another Sport Bean®" to serve as an additional reminder of the instructions.

Measures. As noted, participants were explicitly asked to consume an additional Sport Bean® when they felt that the effects of the one previously consumed were wearing off. Thus, one measure of perceived efficacy duration was operationalized as the time participants spent on the task (the duration between the first [SPACE BAR] click and "S," indicating task completion) divided by the number of Sport Beans® consumed during that interval (as recorded by the [SPACE BAR] clicks). A second measure was participants' retrospective duration judgments of product efficacy. To assess this, participants responded to the following four questions: "For how

long did each Sport Bean® increase your mental acuity?" (1 = Not long at all, 7 = Very long time), "How long-lasting is the product?" (1 = Not long at all, 7 = Very long), "How quickly did the effects of the Sport Beans® wear off?" (1 = Not quickly at all, 7 = Very quickly, RC), and "For how much time did each Sport Bean® enhance your performance?" (1 = Very short time, 7 = Very long time). They also provided their perceptions of time to onset (i.e., "How quickly did you start feeling the effects after taking a Sport Bean®?"; 1 = Not quickly at all, 7 = Very quickly).

To gauge perceptions of *general product efficacy*, the following questions were asked: "How effective is this product?" (1 = Not effective at all, 7 = Very effective), "How powerful is this product?" (1 = Not powerful at all, 7 = Very powerful), "How much do you think this product increases energy?" (1 = Not much at all, 7 = A great deal), "How much do you think this product increases mental acuity?" (1 = Not much at all, 7 = A great deal), "How would you rate the quality of this product? (1 = Very poor quality, 7 = Very high quality), "How disappointing is this product?" (1 = Not disappointing at all, 7 = Very disappointing, RC), "How much did this product enhance your performance?" (1 = Not at all, 7 = Very much), "How much did this product exceed your expectations?" (1 = Did not exceed at all, 7 = Greatly exceeded), "How much did this product increase your energy?" (1 = Not at all, 7 = Very much), and "How much do you think this product does what it claims?" (1 = Not at all, 7 = Very much). As a manipulation check, participants completed scales regarding the difficulty of the task (α = .93). Accuracy was coded as the percentage of vowels identified correctly (number of vowels recognized divided by the total quantity) across the four reading passages.

Measures to address several potential alternative explanations were also included. Participants were asked to complete the PANAS scale (Watson and Clark 1994) to gauge

whether consumption was driven by negative affect in the difficult (vs. easy) condition, rather than by the proposed intuitive belief about product efficacy duration. For example, it is possible that participants may experience more negative affect when performing a relatively hard task and consume more of the product to fix their mood. Thus, participants were asked to indicate the affect they experienced when working on the task. Participants also indicated their level of motivation, involvement, engagement, commitment, attentiveness, perceived performance, and confidence when performing the task. Moreover, considering the time perception literature, it is possible that task difficulty may affect general perception of time (for a review, see Block, Hancock and Zakay 2010), which in turn may affect efficacy duration inferences. That is, participants may rely on general time perception (e.g., feelings of how much time has passed) rather than feelings of efficacy wear-off to infer the duration that a product remains effective. They may reason, for example, that if it feels as if not much time has passed, the product should "still be working." Thus, participants were asked about their general time perception ("I felt as though time was passing by quickly when I was working on the reading tasks" anchored at 1 = Strongly disagree, 7 = Strongly agree). They also responded to whether they remembered to eat the Sport Beans® when needed (1 = No, I never remembered, 7 = Yes, I always remembered). Lastly, participants provided demographic information and general use of energy-enhancing products.

3.2.2 Results

Participants who consumed only the first, mandatory Sport Bean® (n = 7) were excluded because their judgments of efficacy duration could not be interpreted. That is, for these

participants, it could not be ascertained whether the product "stopped working" prior to task completion but participants chose not to take another for various reasons or if the Sport Bean® was still "working" after task completion. Data for 6 participants was unusable (e.g., participants exited the system/had incomprehensible key presses). Participants whose responses were 3+ SD from the mean of the perceived duration of product efficacy measure (n = 2) and who explicitly expressed reservation/fear and preferred not to consume the product (n = 3) were excluded. There were 112 data points for subsequent analyses.

Manipulation Check. An ANOVA revealed a main effect of task difficulty such that participants rated working on the passages with adjusted font as more difficult ($M_{difficult}$ = 4.40) than working on the passages with standard font (M_{easy} = 2.57; $F(1, 110) = 40.64$, $p < .001$). Participants performed worse (i.e., identified fewer vowels) in the difficult condition than in the easy condition ($M_{difficult}$ = 72.34% vs. M_{easy} = 86.50%; $F(1,110) = 23.81$, $p < .001$).

Duration of Product Efficacy. There was no difference in time spent on the task (in minutes) between the difficult and easy conditions ($M_{difficult}$ = 33.75 vs. M_{easy} = 32.06; $F(1, 110) = 1.27$, $p = .26$). An ANCOVA was performed on the perceived duration measure captured by DirectRT (reflecting actual consumption) with age, gender, how often the participant uses energy enhancers, and whether the participant remembered to eat the Sports Beans® when needed during the experiment as covariates (note that these covariates are included in all analyses involving measures of actual consumption (i.e., intake frequency in experiments 1 and 3) since these variables were hypothesized to potentially affect consumption quantity). As hypothesized, the analysis revealed a significant main effect of task difficulty on perceived efficacy duration

($F(1, 101) = 5.19$, $p < .05$). Perceived duration of product efficacy was shorter for those in the difficult font condition ($M_{difficult} = 5.99$ minutes) than for those in the easy, standard font condition ($M_{easy} = 7.66$ minutes). As reflected in the degrees of freedom, five participants who had incomplete data on any of the covariate measures were eliminated from the analysis. Running a model without the aforementioned covariates yielded analogous results ($F(1, 110) = 5.43$, $p < .05$): perceived efficacy duration was shorter for those in the difficult condition ($M_{difficult} = 5.94$ minutes) than for those in the easy condition ($M_{easy} = 7.58$ minutes). Given that none of the aforementioned covariates were significant, they were not included in subsequent analyses.

As hypothesized, an ANOVA also revealed a significant effect of task difficulty on the composite measure of participants' retrospective duration judgments of product efficacy ($F(1, 110) = 4.30$, $p < .05$). Those in the difficult font condition judged the Sport Beans® to have a shorter duration of product efficacy than those in the easy font condition ($M_{difficult} = 2.90$ vs. $M_{easy} = 3.41$).

General Efficacy and Time to Onset Judgments. To determine whether judgments of general efficacy, duration of efficacy, and time to onset represent separate dimensions of perceived product efficacy, a factor analysis was performed. A varimax rotation to examine the factor loadings was conducted and, indeed, the solution generated three components explaining 73.56% of the variance, wherein the time to onset, duration-specific items, and the general efficacy items loaded on three separate factors. Hence, the duration-specific items were combined into one measure of retrospective duration judgments of product efficacy ($\alpha = .81$) and the items relating to general efficacy were combined into a composite measure ($\alpha = .96$). As

reported above, there is a significant effect of task difficulty on the duration measure. However, ANOVAs on the general efficacy measure and the time to onset measure revealed no significant differences between the two task difficulty conditions (Fs < 1).

Affect. The PANAS scale was administered to rule out the potential alternative explanation that the results might be due to task-related affect. However, ANOVAs on composite PANAS items reflecting positive and negative mood, tiredness, alertness, strength, fear, and nervousness (based on factor loadings from a factor analysis with varimax rotation) were nonsignificant (Fs < 1).

Other Task-Related Measures. ANOVAs revealed no significant effect of task difficulty on how motivated, engaged, involved, committed, attentive, and confident participants were while performing the task, or on how well they believed they performed (Fs < 1). There was also no effect of the manipulation on participants' perception of how quickly time passed during the experiment ($F(1, 110) = 1.85$, $p = .18$).

3.2.3. Discussion

The results from this experiment confirm the hypothesis that perceptions of product efficacy duration are shorter (vs. longer) when consumers perceive performing a difficult (vs. easy) task. This pattern was shown through participants' overall consumption, as well as through their retrospective judgments. Participants who perceived the task as difficult increased intake frequency more so than those who perceived the task as easy. Importantly, this experiment also

provides evidence that efficacy duration and general efficacy reflect different dimensions of a broader, product efficacy construct. As speculated in the theoretical development, and empirically shown in this experiment, there may be situations in which judgments of general product efficacy are equivalent across consumers, but judgments of efficacy duration differ. Consequently, this reinforces the importance of studying perceived duration of product efficacy—a dimension that has been previously neglected in the literature but one that uniquely relates to consumption quantity.

Additionally, since there are no differences in positive and negative mood, alertness, and fatigue, the results appear to be driven by an intuitive belief about product efficacy duration rather than by differences in affect experienced during the task. Also, participants' perceptions of how quickly time passed in general while they worked on the task were not significantly different between the difficult and easy conditions. Thus, the results cannot be attributed to general time-based inferences (e.g. "If the task makes time feel like it is passing slowly, then the product should still be working"). Lastly, since motivation and analogous measures did not differ between conditions, this experiment rules out the possibility that differences in consumption of Sport Beans® are due to differences in motivational constructs (i.e., motivation, engagement, involvement, commitment, attention, and confidence) across conditions.

3.3 Experiment 2

One additional potential alternative explanation for greater consumption in the difficult (vs. easy) condition in experiment 1 is that these participants consumed for a reason other than experiencing faster product wear-off per se. That is, while it is evident that these participants

consumed more of the product, it is possible that they did so because they felt that they did not have enough of the product to cope with the task (e.g., "The Sport Bean® *didn't wear off,* but I probably need another one since the task is hard"). Although the experimental instructions clearly asked participants to have another Sport Bean® when they felt the effect of the previous one wearing off, and there are no differences in perceptions of general product efficacy, the purpose of this experiment was to rule out this alternative explanation and to test whether the focal effect is indeed due to experiences of "wear-off": shorter efficacy duration. Thus, to further disentangle the subtle distinction between experiencing product wear-off and simply needing more, this follow-up experiment controlling for total consumption was conducted. Replicating the results of experiment 1 while having all participants consume a fixed amount of Sport Beans® would confirm that the active belief concerns duration of product efficacy rather than mere need for additional product.

3.3.1 Method

Forty-eight participants (50% female, M_{age} = 22.52) were recruited for this experiment. The same task materials were used as in experiment 1; half of the participants were randomly assigned to the difficult task condition, in which they identified vowels in passages with a degraded font, whereas the other half performed the same task in a standard, easy-to-read font. However, rather than allowing consumption throughout the length of the task, each participant was given only five Sport Beans® and instructed to eat all of them *before* he/she began working on the task. In this way, the total amount available and consumed by each participant was controlled for. As noted, if participants judge the duration of a fixed product quantity to be

shorter while performing a more difficult task, this would show that the examined effect indeed concerns product wear-off and duration of efficacy.

Extreme Sport Beans®—a new caffeinated addition to the Jelly Belly® Sport Beans® product line—were used in this experiment. Given the well-established effects of caffeine (e.g., independence of concurrent activity and an onset time of approximately 30 minutes), this product was selected for a more stringent test of the "wear-off" hypothesis.

After participants finished performing the task, they were asked to complete the four-item retrospective duration of product efficacy scale used in experiment 1 (α = .84): "For how long did the Sport Beans® increase your mental acuity?", "How long-lasting is the product?", "How quickly did the effects of the Sport Beans® wear off?"(RC), and "For how much time did the Sport Beans® enhance your performance?" They also completed scales to gauge perceived task difficulty (α = .91), motivation, involvement, engagement, commitment, attention, perceived performance, and confidence in performance on the task. Finally, they provided demographic information and general use of energy-enhancing products.

3.3.2 Results

As expected, an ANOVA revealed a main effect of task difficulty such that participants rated working on the passages with adjusted font as more difficult ($M_{\text{difficult}}$ = 5.44) than working on the passages with standard font (M_{easy} = 2.24; $F(1, 46) = 79.62$, $p < .001$).

Importantly, an ANOVA revealed a significant main effect of task difficulty on retrospective duration judgments of product efficacy ($F(1, 46) = 6.70$, $p = .01$). That is, duration judgments were shorter in the difficult font condition ($M_{\text{difficult}}$ = 2.52) than in the easy, standard

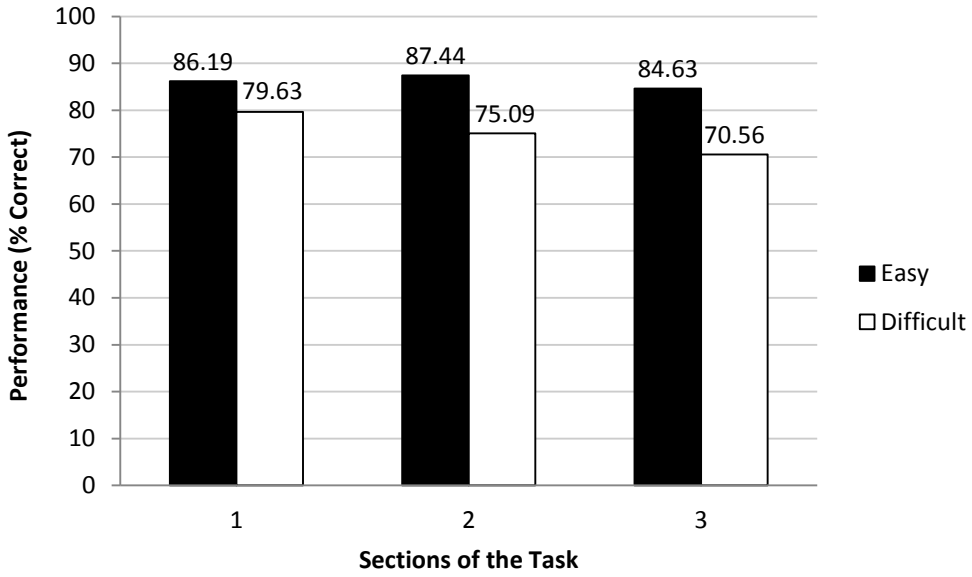
font condition (M_{easy} = 3.40). Age, gender, and how often the participant uses energy enhancers were not significant covariates when included in the model (all Fs < 1).

Furthermore, there were no differences in self-reported motivation, involvement, engagement, commitment, and attention (all *p's* > .16). However, perceived performance was lower in the difficult font condition than in the easy font condition ($M_{difficult}$ = 4.54 vs. M_{easy} = 5.54, $F(1, 46) = 6.58$, $p = .01$) and confidence in performance was marginally lower in the difficult font condition than in the easy font condition ($M_{difficult}$ = 4.63 vs. M_{easy} = 5.38; $F(1, 46)$ = 3.73, $p = .06$).

Given that participants consumed a fixed (vs. different) amount of product, unlike in the previous experiment, analysis of actual task performance (number of vowels identified) across conditions would provide additional insight into the consequences of experienced product wear-off. One participant did not complete the task correctly and was excluded for this analysis. The task (text that participants worked on) was divided into three sections of approximately equal length (Section 1 = 14 paragraphs; Section 2 = 16 paragraphs; Section 3 = 14 paragraphs). Each subsequent section was used as a proxy for time (e.g., time period 1, 2, and 3). Interestingly, while the difference in performance was marginally significant for section 1 ($M_{difficult}$ = 79.63% vs. M_{easy} = 86.19%; $F(1, 45) = 3.01$, $p = .09$), the difference was significant for section 2 ($M_{difficult}$ = 75.09% vs. M_{easy} = 87.44%; $F(1, 45) = 5.20$, $p < .05$) and for section 3 ($M_{difficult}$ = 70.56% vs. M_{easy} = 84.63%; $F(1, 45) = 5.64$, $p < .05$; see Figure 3). In other words, the difference in task performance between those in the difficult and easy conditions increased over time, in line with the finding that those in the difficult condition reported experiencing product wear-off more quickly as the task progressed. This suggests that the intuitive efficacy duration belief can also manifest in differential performance on a task.

FIGURE 3

TASK PERFORMANCE WITH FIXED PRODUCT CONSUMPTION



3.3.3 Discussion

The results of experiment 2 suggest that, as hypothesized, consumers hold an intuitive belief that products lose their effectiveness at a faster rate depending on concurrent task difficulty and report experiencing shorter efficacy duration in light of a difficult cognitive task. Thus, it appears that consumption frequency in experiment 1 is driven by a naïve theory about product wear-off rather than by inferences about the overall quantity of a substance needed to perform a task. To provide stronger support for the intuitive belief explanation for the observed perceptions of product efficacy duration, the strength of the intuitive belief is manipulated in experiment 3. Further, the target task is kept completely constant and perceived, rather than actual, task difficulty is varied.

3.4 Experiment 3

The goal of experiment 3 was to provide evidence that the observed effect is driven by a belief that duration of product efficacy is context-dependent. If the intuitive belief is indeed the underlying mechanism, as the previous experiments suggest, then the effect should depend on the strength of the belief (e.g., Mukhopadhyay and Johar 2005; Mukhopadhyay and Yeung 2010; Tsai and Zhao 2011; Igou 2004). Providing a counter-belief should mute the existing effect while providing a supportive belief should make it persist. As such, in experiment 3, efficacy duration beliefs were manipulated by either reinforcing (or debunking) the intuitive belief.

As in experiment 1, using actual consumption, duration judgments were assessed as participants performed a task that they perceived to be difficult or easy. A reading comprehension task from the GMAT examination was administered. However, to further show that efficacy duration judgments arise from mere perceptions of task difficulty, the task was kept completely constant across conditions; that is, all participants read the same passages and answered the same questions. Perceived difficulty was manipulated by framing the upcoming task as difficult or as easy.

3.4.1 Method

Participants and Design. One hundred and ninety-seven participants (56% female, M_{age} = 26.76) were recruited for this experiment. Participants were randomly assigned to one of four conditions based on a 2(Perceived Task Difficulty: Difficult vs. Easy) x 2(Efficacy Prime: Malleable vs. Fixed) between-subject design.

Stimuli and Procedure. The stimuli (orange flavored Jelly Belly® Sport Beans® with the onset information concealed on the back of the packets with small labels) and procedure were identical to experiment 1. As in experiment 1, ostensibly to minimize distraction, participants were instructed to remove all mobile devices and watches during the experiment.

Each booklet contained twenty-one reading comprehension questions based on six reading passages (about social, physical, or biological sciences) taken from a Practice GMAT study guide. However, a "practice" reading comprehension passage with several questions before the twenty-one actual GMAT questions was included. Although seemingly part of the overall task, the "practice" passage was actually a prime for either the intuitive (or counter) belief. All participants read that many people believe that the amount of time a substance has an effect depends on the situation and context (e.g., allergy sufferers often report that the beneficial effects of their medication wear off more quickly with changes in humidity). Those in the malleable condition then read that researchers and medical professionals have evidence that supports such beliefs: the actual effectiveness of medication and other ingested products is typically malleable and that the ingredients found in such products remain active in the system for some time period but that time period depends on the context or the activities people engage in after consuming the product. Those in the fixed condition read that researchers and medical professionals have evidence that does not support such beliefs: the actual effectiveness of medication and other products is typically of fixed time length and that ingredients found in such products remain active in the system for a specific time period, regardless of the context or the activities people engage in after consuming the product. At the end of both passages, a concluding line that summarized the finding was included.

After participants answered the "practice questions" about this first passage, they then moved on to the actual task. At the top of the page, the difficulty manipulation was included. Those in the difficult condition saw: "Difficulty Rating: High" with a picture of four mountain-shaped icons shaded in with the notation "(4 out of 5)." Those in the easy condition saw: "Difficult Rating: Low" with a picture of two mountain-shaped icons shaded in with the notation "(2 out of 5)." As mentioned previously, the actual passages and questions were identical across conditions.

Measures. As in experiment 1, perceived duration of product efficacy was assessed in two ways. First, the time participants spent on the task (the duration between the first [SPACE BAR] click and "S," indicating task completion) divided by the number of Sport Beans® consumed during that interval (as recorded by the [SPACE BAR] clicks) was assessed. Second, the four-item scale capturing retrospective duration judgments of product efficacy that was used in the previous two experiments was administered (α = .79).

Participants answered four items gauging the difficulty of the task as a manipulation check (e.g., "How difficult was it to do the tasks?"; α = .87). They also indicated how motivated they were to be accurate, how well they thought they performed the task, how confident they were in their performance, and whether they remembered to eat the Sport Beans® when needed. They then provided demographic information and general use of energy-enhancing products.

3.4.2 Results

As in experiment 1, participants who consumed only the first, mandatory Sport Bean® (n = 8) were excluded given that perceived efficacy duration could not be accurately interpreted.

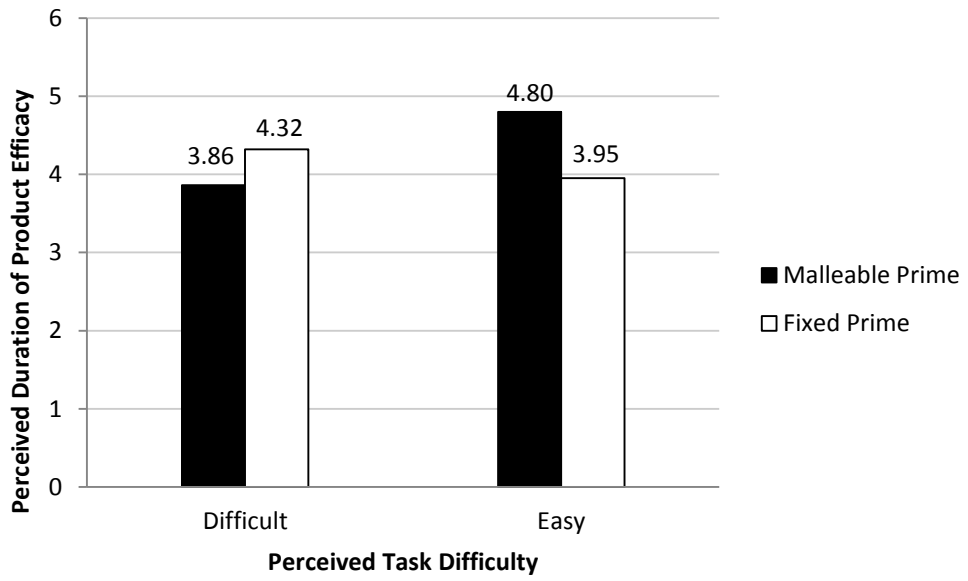
Participants who had missing data/incomprehensible key presses (n = 5) and participants whose responses were 3+ SD from the mean of the perceived duration of product efficacy measure (n = 7) were also excluded. There were 177 data points for subsequent analyses.

Manipulation Check. An ANOVA revealed a main effect of task difficulty such that participants in the difficult condition rated the GMAT questions as more difficult ($M_{difficult}$ = 5.05) than those in the easy condition (M_{easy} = 4.57; $F(1, 173) = 5.89$, $p < .05$). Neither the main effect of efficacy prime nor the interaction was significant.

Duration of Product Efficacy. As in experiment 1, there was no difference in time spent (in minutes) on the task between the difficult and easy conditions ($M_{difficult}$ = 23.51 vs. M_{easy} = 24.71; $F(1, 175) = 1.08$, $p = .30$). Age, gender, how often the participant uses energy enhancers and whether the participant remembered to eat the Sports Beans® when needed during the experiment were included as covariates. As predicted, an ANCOVA revealed a significant interaction between perceived task difficulty and efficacy prime ($F(1, 169) = 3.90$, $p < .05$). Contrast analysis indicated that in the malleable prime condition, perceived duration of product efficacy (in minutes) was shorter when the task was perceived as difficult ($M_{difficult}$ = 3.86) than when it was perceived as easy (M_{easy} = 4.80; $F(1, 169) = 4.03$, $p < .05$; see Figure 4). However, in the fixed prime condition, there was no difference in perceived duration of product efficacy between the difficult and easy conditions ($F < 1$). Only age was a significant covariate and was retained in subsequent analyses ($F(1, 169) = 6.93$, $p < .01$). No other effects were significant.

FIGURE 4

THE INFLUENCE OF EFFICACY PRIME AND PERCEIVED TASK DIFFICULTY ON PERCEIVED DURATION OF PRODUCT EFFICACY



An ANCOVA on the retrospective duration measure revealed a nonsignificant interaction of task difficulty and efficacy prime ($F(1, 172) = 2.02$, $p = .16$). Despite the overall interaction not reaching significance, contrast analysis supports the theorizing. In the malleable efficacy prime condition, perceived duration was shorter when the task was perceived as difficult than when it was perceived as easy ($M_{difficult} = 2.82$ vs. $M_{easy} = 3.38$; $F(1, 172) = 4.58$, $p < .05$), but in the fixed efficacy prime condition, there was no difference in perceived efficacy duration across the difficulty conditions ($M_{difficult} = 2.81$ vs. $M_{easy} = 2.84$; $F < 1$). The difference between malleable and fixed efficacy primes was significant in the easy task condition ($F(1, 172) = 4.23$, $p < .05$) but not in the difficult task condition ($F < 1$). Age was not a significant covariate ($F < 1$).

Motivation, Perceived Performance, and Confidence. ANCOVAs revealed nonsignificant main effects of perceived difficulty and efficacy prime (*Fs* < 1) and a nonsignificant interaction on the motivation measure ($F(1, 172) = 1.99$, $p = .16$), on the perceived performance measure ($F < 1$), and on the confidence measure ($F < 1$). Age was a significant covariate only for the motivation measure ($F(1, 172) = 4.58$, $p < .05$).

3.4.3 Discussion

This experiment replicates the findings of the previous two experiments and shows that when the intuitive belief is salient, efficacy duration judgments are shorter when consumers perceive performing a difficult task than an easy task. Given that the actual task was held constant, and the same pattern of results emerged, this provides evidence that mere perceptions of task difficulty drive the emanating efficacy duration inferences. Most importantly, however, experiment 3 provides support for the hypothesis that when the counter-belief (fixed efficacy) is primed, perceptions of product efficacy duration do not differ between consumers who perceive performing a difficult task and an easy task. When participants are cognizant that efficacy duration is not dependent on contextual factors, they do not exhibit the pattern of results found in experiments 1 and 2; when participants' intuitive belief is reinforced—that efficacy duration is indeed dependent on contextual factors—they do. To further study the nature of the interactive effects of efficacy duration beliefs and contextual tasks, the next experiment uses another product (medication) and primes fixed- and malleable-efficacy duration beliefs via intake instructions.

3.5 Experiment 4

Manufacturers often provide product intake instructions either in an absolute format (e.g., "Take one pill every 3 hours") or in an interval format (e.g., "Take one pill every 2-4 hours"). While the provision of intake instructions is done primarily to prevent overdosing, the presentation mode might yield differential efficacy duration inferences. Research suggests that people make inferences depending on the format in which information is conveyed. For example, prior research has shown that people respond differently to gain-framed and loss-framed messages (Cox, Cox, and Zimet 2006), frequency versus probability terms (Siegrist 1997), verbal versus numerical information (Berry, Knapp, and Raynor 2002; Knapp, Raynor, and Berry 2004), day versus year format (Chandran and Menon 2004), and the granularity of quantitative expressions (Zhang and Schwarz 2012).

In the present research, it is hypothesized that when a manufacturer's suggested intake frequency is expressed in interval terms (e.g. "Take one pill every 2-4 hours"), consumers might interpret this information as a signal that efficacy duration is indeed malleable—in line with the default, context-dependent, efficacy duration belief. Consumers may show the focal effect and infer, for example, that efficacy duration is closer to the lower end of the range when they perform difficult tasks and closer to the higher end when they perform relatively simple tasks. However, when a manufacturer's suggested intake frequency is expressed in absolute terms (e.g., "Take one pill every 3 hours"), this information might elicit the fixed duration of efficacy belief and, in turn, not affect duration estimates depending on the nature of concurrent tasks. The goal of experiment 4, as such, was to replicate the results of the previous experiment through a manipulation that taps a common manufacturer practice; that is, to identify a condition in which

the proposed intuitive efficacy duration belief may be accentuated (or attenuated) in the marketplace. A well-known OTC medication was employed as the target stimulus: Advil®.

3.5.1 Method

Participants, Design, and Stimuli. One hundred and seventy participants (47% female, M_{age} = 21.25) were recruited for this experiment. They were randomly assigned to one of four conditions based on a 2(Task Difficulty: Difficult vs. Easy) x 2(Suggested Intake: Interval vs. Absolute) between-subjects design.

All participants read a short scenario in which they were asked to imagine an upcoming day: "Imagine that you wake up in the morning with a strong, painful headache. It is the end of the semester and you have a full 10-hour day of classes ahead of you: from 9:00 AM to 7:00 PM. There is no way that you can be absent because you have to take exams in several classes."

Those in the difficult condition read: "You anticipate that all of these exams will be very difficult; the course material is very challenging." Those in the easy condition read: "You anticipate that all of these exams will be very easy; the course material is very simple." Participants in both the difficult and easy conditions then read that "You decide to take medication (see below) to help you get through the day. You take one pill before leaving home, and bring the bottle with you to school." Below the scenario was a statement about the manufacturer's suggested consumption instructions. Those in the interval (i.e., malleable efficacy duration) condition read: "The intake instructions state: 'Take one pill orally every 2-4 hours, as needed.'" Those in the absolute (i.e., fixed efficacy duration) condition read: "The intake

instructions state: ‘Take one pill orally every 3 hours, as needed.’” An image of the product was featured below the aforementioned text, followed by survey questions.

Measures. The main dependent variable for experiment 4 was an estimate of efficacy duration. Participants indicated their response to the following question: "In hours and minutes, how long do you think each pill will work for you?”

Furthermore, participants indicated how many pills they anticipate taking at school. They also indicated how much effort they would put into the exams to gauge motivation (1 = No effort at all, 7 = A lot of effort), how well they think they would perform on the exams to gauge confidence (1 = Not well at all, 7 = Very well), and how painful they imagined their headache to be (1 = Not painful at all, 7 = Very painful). As a manipulation check, they answered “How difficult did you imagine your exams to be?” (1 = Not difficult at all, 7 = Very difficult).

3.5.2 Results

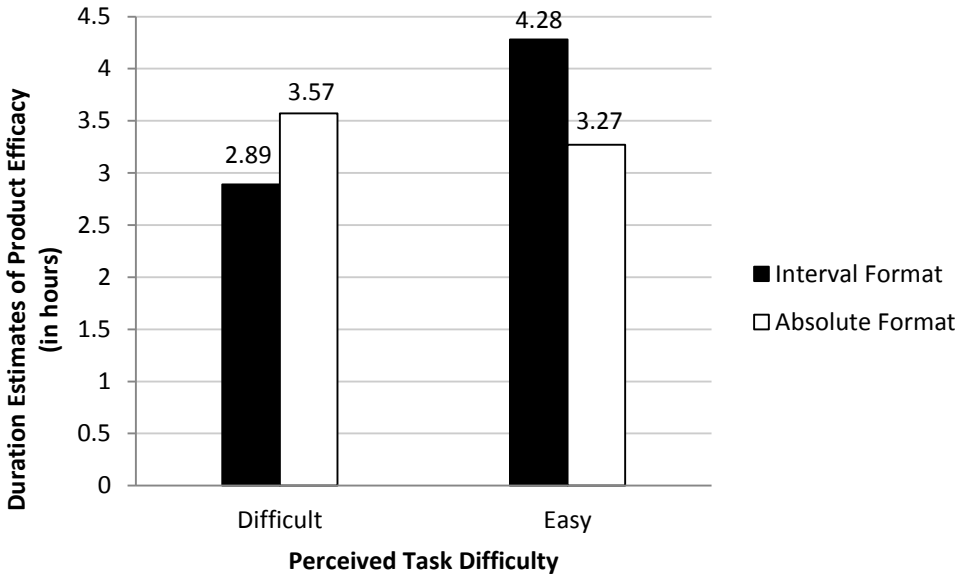
Manipulation Check. An ANOVA revealed a main effect of task difficulty on the perceived difficulty measure ($F(1, 166) = 26.02$, $p < .001$), confirming the manipulation. That is, participants who were asked to imagine a day filled with difficult exams rated imagining the exams as significantly more difficult ($M_{\text{difficult}} = 5.81$) than those who were asked to imagine a day filled with easy exams ($M_{\text{easy}} = 4.77$). Neither the main effect of suggested intake instructions nor the interaction was significant.

Duration of Product Efficacy. Duration judgments of product efficacy were measured by estimates, in hours and minutes, of how long each pill would work for participants. As predicted,

an ANOVA on the log transformed duration measure revealed a significant interaction between perceived difficulty and suggested intake instructions ($F(1, 166) = 5.74$, $p < .05$). Contrast analysis indicated that when participants were given the suggested intake instructions in an interval format, duration estimates of product efficacy were shorter when the task was expected to be difficult ($M_{difficult} = 2.89$) than when it was expected to be easy ($M_{easy} = 4.28$; $F(1, 166) = 7.07$, $p < .01$; means reported in hours for ease of interpretation; see Figure 5). However, when participants were given the instructions in an absolute format, there was no difference in duration estimates of product efficacy between the difficult and easy conditions ($M_{difficult} = 3.57$ vs. $M_{easy} = 3.27$; $F < 1$). In the difficult task condition, the difference between the interval and absolute format conditions was significant ($F(1, 166) = 3.89$, $p = .05$). No other effects were significant.

FIGURE 5

THE INFLUENCE OF THE MANUFACTURER'S SUGGESTED INTAKE FORMAT AND TASK DIFFICULTY ON DURATION ESTIMATES OF PRODUCT EFFICACY



Anticipate Taking. Participants were asked to indicate how many pills they anticipate taking at school. An ANOVA revealed a marginally significant interaction between perceived difficulty and suggested intake instructions ($F(1, 166) = 3.34$, $p = .07$). Contrast analysis showed that when participants were given the 2-4 hour interval (i.e., the malleable condition), they anticipated taking more pills when the task was expected to be difficult ($M_{difficult} = 2.30$) than when it was expected to be easy ($M_{easy} = 1.66$; $F(1, 166) = 4.86$, $p < .05$). However, when participants were given a specific efficacy duration (i.e., the fixed condition), there was no difference in the number of pills they anticipated taking between the difficult and easy conditions ($M_{difficult} = 1.93$ vs. $M_{easy} = 2.05$; $F < 1$). No other effects were significant.

Other Task-Related Measures. ANOVAs revealed a nonsignificant interaction between task difficulty and intake instructions on the motivation measure ($F < 1$) and on the confidence measure ($F(1, 166) = 1.97$, $p = .16$). There was also no difference between conditions in how painful participants imagined the headache to be ($F < 1$). Thus, it appears that expectations about the difficulty of concurrent tasks, rather than characteristics of the person, account for the resultant pattern of expected product efficacy duration.

3.5.3 Discussion

Experiment 4 corroborates the finding that consumers infer product efficacy duration to be shorter (vs. longer) when they expect to perform a task that is difficult (vs. easy). With a non-energy enhancing product (i.e., medication), this experiment shows that the intuition is prevalent across different product categories. This experiment also demonstrates an environmental cue by

which the intuitive belief can be accentuated (or attenuated) in the marketplace: product intake instructions. The interval format elicits the intuitive, malleable efficacy duration theory whereas the absolute format attenuates it.

Together, experiments 3 and 4 demonstrate that the observed effect of task difficulty persists when consumers are cued to the notion that duration of product efficacy may be context-dependent. Marketing-related factors like advertisements that emphasize usage during activities that vary in level of difficulty (e.g., strenuous activity vs. leisure) may reinforce the intuitive belief. Likewise, consumption instructions presented in an interval format may also reinforce the intuitive belief. When the notion of context-dependence is put into question, however, the effect is attenuated. Therefore, providing explicit information about duration of product efficacy via advertisements and product labeling, and providing consumption instructions in an absolute format, may be potential means of mitigating the judgment bias.

CHAPTER 4: CONCLUSION AND GENERAL DISCUSSION

4.1 Summary of Main Findings

Four experiments demonstrate that perceived duration of product efficacy—a previously unexplored aspect of product performance—is based on the difficulty of tasks and activities that consumers perform during and after product consumption. This effect is shown with both actual and hypothetical consumption, with energy-enhancing products and medication, and with anticipatory, on-line, and retrospective duration judgments of product efficacy.

Experiment 1 demonstrates that consumers increase their consumption frequency, and report feeling the effects of a product for a shorter duration, when they perceive a concurrent cognitive task to be difficult (vs. easy). This experiment also validates the notion that perceived product efficacy is a multi-dimensional construct, comprised of perceptions of (1) efficacy duration, (2) general product efficacy, and (3) time to onset. Of these dimensions, only perceived efficacy duration is shown to be systematically affected by concurrent task difficulty. Experiment 2 provides further evidence that task difficulty indeed affects perceptions of how quickly a product wears off and rules out the alternative explanation that increased consumption in the prior experiment was due to inferences about the quantity of a product needed to handle a difficult task. This experiment also demonstrates that such intuitions about product wear-off can affect actual performance on a task.

Experiment 3 shows that even when the actual task is held completely constant, mere perceptions of task difficulty yield shorter efficacy duration judgments of product efficacy. It also provides support for the hypothesis that perceptions of efficacy duration are driven by an

intuitive belief about the effects of concurrent tasks on efficacy duration (i.e., efficacy context-dependence); when this intuitive belief is challenged (vs. reinforced), the placebo-like effect is muted. In the final experiment, it is shown that the documented belief can be accentuated (or attenuated) in the marketplace via manufacturers' intake instructions. When the suggested intake instructions are provided in an interval format, estimates of efficacy duration are shorter when consumers expect to perform a difficult (vs. easy) task, in line with the default, context-dependent intuitive belief. However, when the instructions are provided in an absolute format, estimates do not vary as a function of concurrent tasks.

4.2 Theoretical and Practical Contributions to the Field

The findings of the current research make several important theoretical contributions. Prior research has focused almost exclusively on general product efficacy (e.g., Shiv, Carmon and Ariely 2005; Wright et al. 2013; Kramer et al. 2012). The present research introduces a previously unexplored variable: perceived duration of product efficacy. It uniquely shows that that consumers hold an intuitive belief that duration of product efficacy—how long the effects of products last—is dependent on the difficulty level of the tasks they perform, such that relatively more difficult concurrent tasks lead to shorter efficacy duration. By demonstrating that concurrent tasks affect efficacy duration judgments, this research identifies a critical input in consumers' product inference-making.

This work also adds to extant research on placebo and placebo-like effects. Researchers from diverse fields have documented the extraordinary effects of expectancies on well-being and performance for both traditional placebos (Stewart-Williams and Podd 2004) and efficacious

products that should not yield differential efficacy (e.g., energy drink efficacy depending on price; Shiv, Carmon, and Ariely 2005). The present research documents a condition when substances' efficacy appears to come to a halt. The documented intuitive belief about a substance's power in light of concurrent activity leads not only to inferences and expectations about how it is "diminished" (i.e., duration of efficacy), but also to changes in actual product experiences.

This research has significant implications for actual consumption behavior. Given that duration estimates ultimately determine intake frequency, excessive consumption or inadequate intake of beneficial products—leading to prolonged ailment—may result in negative and potentially injurious health effects for consumers in both the short and long term. While this current research does not study over- or under-consumption per se, biased judgments of product efficacy duration suggest the possibility that consumers may misuse products (e.g., consume at their own discretion). The World Health Organization (WHO) estimates that globally only about half of consumers take their medicines as prescribed, translating into 125,000 annual deaths in the United States alone (Loden and Schooler 2000).

An article on the "About Kids Health" website highlighted the concern about youth consumption of energy drinks; estimates suggest that that over half of the energy drink market consists of people under the age of 25. And although much of energy drink consumption occurs during sports activity, young adults are now using the products at all times: "This should come as no surprise since these drinks are advertised to be used in any type of situation. For instance, the popular energy drink Red Bull lists times to use their drinks, with "on the road, during lectures and study sessions, at work, while doing sports, while playing video games, and while going out day and night" as recommended options. So, according to the manufacturers, they are suitable to

drink pretty much anywhere" (Elliot 2011). Thus, given the salience of different consumption contexts in product advertisement, it becomes crucial to educate consumers about the efficacy-context independence for many activities (e.g., study sessions) to limit overuse.

Furthermore, this research also has significant implications for pharmaceutical marketers and food and beverage companies entering the market of "functional foods" (Thomasson 2012). Successful performance in this domain requires that consumers realize the expected benefits of a product; ensuring proper consumption frequency becomes crucial. As such, product labeling that elicits accurate expectations of product efficacy duration (e.g., absolute vs. interval format intake instructions), along with advertising claims that convey efficacy duration "fixedness" and reinforce the driving factors of efficacy (e.g., individual-level factors) may be beneficial for such firms.

4.3 Future Research Opportunities

The goal of the present research was to study a previously unexplored dimension of efficacy: perceived duration of product efficacy. This dimension was found to have unique antecedents (i.e., consumption context, namely, concurrent task difficulty) and consequences (i.e., consumption frequency). Indeed, the results of experiment 1—which provide support for the conceptualization of efficacy duration as distinct from general efficacy—reinforce that perceived efficacy duration is important to both acknowledge and measure. This current research identifies a situation in which judgments of general product efficacy are equivalent across consumers, but perceptions of efficacy duration differ. Although beyond the scope of the present research, an exploration of conditions under which perceptions of general efficacy and

perceptions of efficacy duration co-vary, and conditions under which they diverge, would contribute to the understanding of consumers' perceptions of product efficacy. That is, a fruitful avenue for future research would be to delineate situations when perceived efficacy duration and general efficacy exhibit similar (vs. different) patterns and to investigate the relationship between these and other efficacy-related dimensions (e.g., time to onset; Faro 2010).

Future research would also benefit from the identification of other antecedents of efficacy duration judgments. Would previously documented antecedents of general product efficacy, such as marketing variables, also affect judgments of product efficacy duration? Might a discounted energy drink (Shiv, Carmon, and Ariely 2005) affect not only general efficacy expectancies but also expectancies about its efficacy duration? Furthermore, while the present research explored the effects of concurrent task difficulty, it would be interesting to study what effect, if any, other task characteristics may have on perceived duration of product efficacy.

In addition, future research may also address other moderating factors of the documented effect, including product experience, expertise, severity of excessive consumption, and individual differences such as people's implicit theories about willpower (e.g., limited vs. nonlimited-resource)—namely whether difficult tasks result in depletion or energization (Job, Dweck, and Walton 2010). It would also be interesting to delineate which products, perhaps those that vary in their results' visibility or tangibility (e.g., energy boost vs. elimination of an observable rash), are more (vs. less) likely to yield the focal effect.

Finally, it would be important to explore additional potential antecedents of perceived general efficacy and time to onset—the other dimensions of perceived product efficacy. One such marketing variable, for example, may be packaging format (i.e., single-serve vs. multi-serve packaging). Without doubt, identifying the contextual-, marketing-, and consumer-related factors

(e.g., lay theories) that uniquely affect the different dimensions of perceived product efficacy would greatly contribute both theoretically and practically to the field of marketing.

4.4 Concluding Remarks

Whereas many factors that affect perceived product efficacy are at least in part controllable by marketers, such as a product's price and perceptual properties, the consumption context is rarely, if ever, one such factor. Consequently, educating consumers—via advertisement, product labeling, or public policy initiatives including public service announcements—about the driving factors of product efficacy duration becomes crucial. Accurate information about, and use of, ingested products would benefit many constituents of the value chain, from product marketers to end users. For the former, consumers' satisfaction derived from witnessing the beneficial effects of the product inevitably corresponds to downstream effects such as increased sales, brand loyalty, and positive word-of-mouth. For the latter, making valid efficacy duration judgments allows for proper consumption frequency which, in turn, directly affects health and well-being.

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