CHAPTER FOUR

Transcending the "good & bad" and "here & now" in emotion regulation: Costs and benefits of strategies across regulatory stages

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Abstract

The scientific study of emotion regulation is flourishing, providing fundamental insights to our understanding of human functioning. While clearly important, in this chapter I zoom in on two major challenges in current theorizing and in existing empirical evidence. The "good & bad" problem refers to the categorization of regulatory strategies as being either adaptive or maladaptive. The "here & now" problem refers to concentration on a single regulatory stage that involves the actual execution or implementation of regulatory strategies. To transcend the "good & bad" problem, I provide a conceptual account, highlighting the underlying mechanisms of implemented regulatory options that yield a clear differential cost-benefit strategy profile. To transcend the "here & now" problem, I present a broad conceptual framework that views emotion regulation as a multistage phenomenon that includes important stages that precede and follow regulatory implementation. A central focus is given to a preimplementation *regulatory selection* stage, which involves choosing between available regulatory options in a manner that is sensitive to differing situational demands. Specifically, I review affective-cognitive-motivational determinants, underlying mechanisms, neural correlates, individual-social-cultural moderators, and developmental and clinical implications, of regulatory selection. I end by highlighting the importance of transcending the regulatory selection stage, by describing a postimplementation *regulatory monitoring* stage that involves deciding if and how to adapt actively implemented regulatory strategies, by describing a pre-implementation *regulatory identification* stage that involves deciding whether to regulate one's emotions in the first place, and by linking regulatory stages together.

1. Emotion regulation is here, there and everywhere

"This thing of yours that you study… What's it called? Ah yes, 'emotion regulation'. I keep seeing it all the time".

The above comment, made by a highly respected (die-hard) cognitive psychology emeritus colleague of mine, resonated with me. It was not the thin layer of implicit sarcasm in his tone, rather the fact that for some time it does seem that emotion regulation is here, there and everywhere!

The interest in emotion regulation is anything but new, dating back to seminal philosophical observations about complex relationships between emotion and reason made by Aristotle and Plato. Centuries later, during the early days of psychology, Freud (1894/1962, see also Cramer, 2015 for a modern view) artfully portrayed a flexible unconscious defensive apparatus that wards off negative experiences, unacceptable drives and threats

from conscious awareness. Yet later the fundamental study on stress and coping (e.g., Carver & Scheier, 1994; Folkman & Lazarus, 1985) emphasized the role of conscious emotion focused coping, that involves efforts to manage the distress caused by affective events.

Despite this long-lasting interest, only two decades ago emotion regulation re-emerged as an independent field of empirical study within affective science (Gross, 1998, 2007, 2015). During this short time, however, the magnitude of this renaissance has been quite remarkable. Emotion regulation is now an integral research topic across all major psychology areas including biological, cognitive, social, developmental, clinical, and health branches (see Gross, 2014 Handbook of Emotion Regulation for a review). Looking at its impact, annual citation rates increase exponentially (see Gross, 2015), and outside academia emotion regulation is regularly consumed by the public (e.g., Friedman, 2018).

Based on this state of affairs, is it accurate to conclude that the future of emotion regulation is so bright we gotta wear shades (Gross, 2010)? In what follows, I begin by describing two central challenges of the vibrant field of emotion regulation. Then, to address the first challenge, I present a novel conceptual framework. To address the second challenge, I describe an account that views emotion regulation as composed of four central regulatory stages. The main part of the paper elaborates on multiple dimensions of one regulatory stage that receives increasing empirical support. I end this manuscript describing the remaining regulatory stages and by linking regulatory stages together.

2. Challenges of emotion regulation

2.1 The "good & bad" problem

In order to simplify an overly complex world, individuals group different objects to discrete categories. A fundamental "good & bad" categorization is prominent across various contexts, including Biblical contexts that contrast the good god from the nemesis devil, historical contexts differentiating his holiness the Dalai Lama from monstrous Adolph Hitler, and cultural contexts distinguishing superheroes like Batman from villains like the Joker.

The (in)famous "good & bad" distinction has not escaped the field of emotion regulation, with a categorization of certain regulatory strategies as inherently adaptive and other strategies as inherently maladaptive (see Aldao, Nolen-Hoeksema, & Schweizer, 2010 for a meta-analysis summarizing a decade of work, and Bonanno & Burton, 2013 for a review).

Specifically, utilizing a central regulatory classification (e.g., Parkinson & Totterdell, 1999; Roth & Cohen, 1986; Thayer & Lane, 2000), it has been repeatedly argued that regulatory strategies that involve *engagement* with emotional information processing or meaning making are adaptive, and other regulatory strategies that involve *disengagement* from emotional information processing or meaning avoidance are maladaptive (e.g., Janoff-Bulman, 1992; Silver, Boon, & Stones, 1983. See Bonanno, 2013 for a review).

The categorization of disengagement strategies as all bad and engagement strategies as all good has also been dominant outside the basic science realm in applied clinical settings. One example pertains to the classic view of the formation and treatment of post-traumatic stress disorder (PTSD). Specifically, it has been suggested that engagement with traumatic information processing reduces fear responses, whereas escape or avoidant coping induces and maintains anxious responses to trauma (Foa & Kozak, 1986 for review). Accordingly, classic clinical PTSD interventions teach patients to replace their avoidant coping away from trauma materials, with prolonged exposure and engagement coping (Foa, Hembree, & Rothbaum, 2007 for a review).

While intuitive and parsimonious, studies with strikingly opposite findings began to emerge. Specifically, there have been cases where disengagement from stressful and traumatic events was associated with adaptive outcomes, whereas engagement with emotional information processing was maladaptive (e.g., Bonanno, Keltner, Holen, & Horowitz, 1995; Chapman, Rosenthal, Dixon- Gordon, Turner, & Kuppens, 2017; Coifman, Bonanno, Ray, & Gross, 2007. See Park, 2010 for a review). As will be elaborated below, these conflicting findings suggested a more complicated and nuanced view of regulatory strategies is needed.

2.2 The "here & now" problem

The digital age we live in, involving instantaneous and massive information transmission, strongly imposes a "here & now" focus. With emails that are not immediately responded to quickly reaching inbox bottom, and posts not instantly seen on social media vanishing from one's feed, "yesterday's news" occurs much faster than 24 h pass.

Within the field of emotion regulation, the "here & now" focus is manifested in an almost exclusive concentration on studying strategy *implementation*—a single regulatory stage denoting the *online* execution and *immediate* consequences of different strategies (Gross, 2015). Strategy implementation studies (see Fig. 1C for a typical experimental trial sequence) involve exposing participants to a series of emotional events

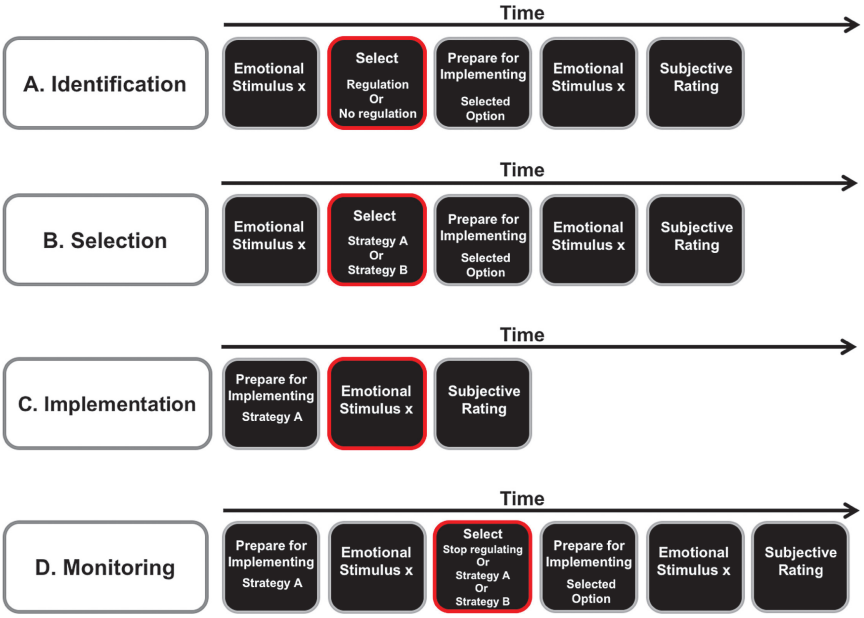

Fig. 1 Schematic trial structures of lab paradigms that measure four core regulatory stages. (A) Regulatory Identification: An emotional stimulus is presented, followed by making a choice between regulation or no regulation, followed by preparing to execute the chosen option, followed by actually implementing the chosen option on the emotional stimulus, followed by providing subjective rating. (B) Regulatory Selection: An emotional stimulus is presented, followed by making a choice between different regulatory options, followed by preparing to execute the selected option, followed by actually implementing the selected option on the emotional stimulus, followed by providing subjective rating. (C) Regulatory Implementation: Preparing to execute a regulatory instruction, is followed by actually implementing the instructed option on the emotional stimulus, followed by providing subjective rating (D), Regulatory Monitoring: Preparing to execute a regulatory instruction is followed by actually implementing the instructed option on the emotional stimulus, followed by a making a choice between stopping, maintaining or switching the instructed option, followed by preparing to execute the selected option, followed by actually implementing the selected option on the emotional stimulus, followed by providing subjective rating. Note that in each regulatory stage, a red frame highlights where a central outcome is extracted from. For identification, selection and monitoring the central outcome is the regulatory decision, and for implementation the central outcome occurs when the instructed strategy is implemented on the emotional stimulus.

(e.g., affective images), and instructing participants on each trial to employ different regulatory strategies (e.g., disengagement or engagement strategies). Implementation studies focus on measuring strategies' online underlying operation (e.g., measuring changes in physiological responding when participants disengage from a negative image), and immediate

emotional modulation outcomes (e.g., measuring subjective reports of negative experience at the end of each trial).

The study of regulatory implementation provided invaluable understandings regarding underlying mechanisms of regulatory strategies (e.g., McRae, 2016; Sheppes & Gross, 2011 for reviews), their neural underpinnings (e.g., Buhle, Silvers, Wager, et al., 2014; Hajcak, MacNamara, & Olvet, 2010 for reviews), and immediate consequences (e.g., Gross, 2014; Webb, Miles, & Sheeran, 2012 for reviews). While being clearly important, as will be elaborated below, emotion regulation is a multi-stage phenomenon that includes important stages that precede and follow instantaneous regulatory implementation.

3. Transcending the "good & bad" problem

3.1 Conceptual framework

Accumulating evidence, showing that the implementation of regulatory strategies that prove adaptive in some contexts are maladaptive in other contexts, suggests that the "good & bad" distinction represents a fundamental fallacy (Bonanno & Burton, 2013 for a review). Accordingly, a growing consensus calls for a nuanced yin & yang understanding of regulatory strategy implementation efficacy (e.g., Aldao, 2013; Aldao, Sheppes, & Gross, 2015; Bonanno & Burton, 2013; Folkman & Moskowitz, 2004; Gross, 2014; Sheppes & Gross, 2011; Troy & Mauss, 2011).

Our conceptual efforts to transcend the "good & bad" distinction emphasize that understanding the underlying mechanisms of implemented regulatory options yields a clear differential cost-benefit strategy profile (Sheppes & Gross, 2011, 2012). This account focuses on the aforementioned engagement-disengagement regulatory strategy distinction (Parkinson & Totterdell, 1999; Roth & Cohen, 1986), with a special emphasis on cognitive regulatory strategies (McRae, 2016; Ochsner & Gross, 2005 for reviews).

To explain underlying mechanisms, our account draws from major information processing theories (e.g., Hubner, Steinhauser, & Lehle, 2010; Pashler, 1998) and the process model of emotion regulation (Gross & Thompson, 2007). Specifically, we suggest that the implementation of disengagement and engagement cognitive regulatory strategies (Parkinson & Totterdell, 1999) involves recruiting differential executive control mechanisms that modify emotional information processing at two central sequential cognitive stages: attentional selection and semantic meaning.

The underlying mechanisms of a first family of cognitive regulatory strategies involves early *attentional disengagement* from emotional information

processing before information is represented in working memory and undergoes elaborated meaning processing. A classic early selection disengagement strategy is attentional distraction. Distraction involves diverting attention from emotional information processing by producing neutral thoughts that are independent from, and not in conflict with, emotional information (e.g., van Dillen & Koole, 2007). For example, distracting via focusing attention on ones' daily chores provides early attentional disengagement that is semantically independent from an emotional image of a crying baby.

The underlying mechanisms of a second family of cognitive regulatory strategies involves early *engagement* with emotional information that includes attending to emotional information, representing it in working memory and appraising it affectively, prior to a late modulation at a *semantic meaning* stage (Sheppes & Gross, 2011). A classic engagement meaning change regulation strategy is reappraisal (Gross, 1998). In reappraisal, the early attentional engagement with and appraisal of emotional information, function as the building blocks of the neutral reinterpretation of emotional information that follows. Specifically, one has to attend and appraise a crying baby as such, in order to form a neutral reinterpretation that crying is a vital communication signal for caregivers to provide help. Accordingly, in reappraisal neutral reinterpretations are by definition semantically dependent and in direct conflict with the original emotional information.

According to our conceptual framework (Sheppes & Gross, 2011, 2012), the divergent underlying mechanisms of implementing attentional disengagement and engagement meaning change regulatory strategies yield a differential affective, cognitive and motivational cost-benefit tradeoff (see Table 1). Specifically, the benefits of early attentional disengagement from emotional information via non-conflicting contents are strong *affective* modulation of high intensity emotional information and minimal *cognitive* resource expenditure. Nevertheless, the *motivational* long-term cost of early attentional disengagement is that emotional information that is not processed remains unchanged upon reencounter, having a lingering negative influence.

The underlying characteristics of engagement meaning change result in a mirror image set of costs and benefits. Specifically, the major costs of attentionally engaging and appraising emotional information prior to a late formation of semantically conflicting reinterpretations are weak affective modulation of high intensity emotional information and substantial cognitive resource expenditure. However, the motivational long-term benefit of engagement meaning change is that the negative influence of reencountered emotional information that has been processed and altered can gradually subside.

Table 1 Schematic representation of major costs and benefits of Attentional Disengagement (i.e., directing attention away from emotional information) and Engagement Meaning Change (i.e., engaging attention and appraising emotional information, prior to semantic meaning modulation). For each of these regulation options, affective, cognitive and motivational consequences are presented.

	Attentional disengagement Emotional event ↛ Attention → Meaning → Response	**Engagement meaning change** Emotional event → Attention → Meaning ↛ Response
Affective	Effective with high intensity information ✓	Less effective with high intensity information ✗
Cognitive	Low resource expenditure ✓	High resource expenditure ✗
Motivational	Ineffective in the long-term ✗	Effective in the long-term ✓

3.2 Empirical evidence

Direct empirical support for differential underlying mechanisms of attentional disengagement and engagement meaning change strategies comes from multiple sources. Specifically, behavioral studies show that attentional disengagement that does not involve emotional information processing impairs memory of emotional contents, relative to engagement meaning change (e.g., Richards & Gross, 2006; Sheppes & Meiran, 2007, 2008). High temporal resolution electrophysiological studies show that attentional disengagement is associated with an early modulation of attention processing (i.e., reduced *early*-Late Positive Potentials amplitudes), and engagement meaning change is associated with a late modulation of meaning processing (i.e., reduced *late*-Late Positive Potentials amplitudes, Paul, Simon, Kniesche, Kathmann, & Endrass, 2013; Schönfelder, Kanske, Heissler, & Wessa, 2014; Shafir & Sheppes, 2018; Thiruchselvam, Blechert, Sheppes, Rydstrom, & Gross, 2011). High spatial resolution neuroimaging studies show that attentional disengagement recruits a neural network associated with attentional control, and engagement meaning change recruits a neural network associated with affective meaning (Kanske, Heissler, Schönfelder, Bongers, & Wessa, 2011; McRae et al., 2010).

Together with divergent underlying processes, there is considerable empirical support for the differential cost-benefit profile of attentional disengagement and engagement cognitive change strategies. Affectively, the benefits of attentional disengagement (relative to engagement meaning change) are stronger affective modulation of high intensity events, as manifested in reduced subjective negative experience (e.g., Sheppes & Meiran, 2007), reduced peripheral physiology (e.g., Sheppes, Catran, & Meiran, 2009), reduced neural amplitudes of an electrocortical marker of intensity (reduced LPP amplitudes, Shafir, Schwartz, Blechert, & Sheppes, 2015), and stronger amygdala modulation (Kanske et al., 2011; McRae et al., 2010). Cognitively, the benefits of attentional disengagement (relative to engagement meaning change), are minimal cognitive resource expenditure especially during high intensity situations, as manifested in lower effort ratings (Sheppes, Brady, & Samson, 2014), reduced pupil dilation (Strauss, Ossenfort, & Whearty, 2016), reduced behavioral resource depletion (Sheppes & Meiran, 2008), reduced electrocortical activity associated with effort (frontal LPPs, Shafir et al., 2015), and reduced executive prefrontal activity (Silvers, Weber, Wager, & Ochsner, 2014). Motivationally, the long-term benefits of meaning change (but not attentional disengagement), include successful affective modulation of reencountered emotional events (Kross & Ayduk, 2008; Thiruchselvam et al., 2011; see also Blechert, Sheppes, Di Tella, Williams, & Gross, 2012; Denny, Inhoff, Zerubavel, Davachi, & Ochsner, 2015).

To recap, our conceptual account (Sheppes & Gross, 2011, 2012) demonstrates that focusing on divergent underlying mechanisms of regulatory strategies yields a clear cost-benefit profile for implemented strategies that transcends the "good & bad" distinction. Importantly, as will be elaborated below this conceptual account proves useful in explaining regulatory stages that precede and follow regulatory implementation, thus transcending the "here & now" focus.

4. Transcending the "here & now" problem

4.1 Background

In recent years, there is a growing conceptual agreement that emotion regulation does not amount to regulatory implementation, rather it includes several key iterating regulatory stages (Bonanno & Burton, 2013; Gross, 2015; Ochsner & Gross, 2014; Sheppes, Suri, & Gross, 2015; Webb, Schweiger Gallo, Miles, Gollwitzer, & Sheeran, 2012). A central defining

characteristic of stages that precede and follow regulatory implementation involves making central emotion regulation-related decisions (Gross, 2015; Gross, Uusberg, & Uusberg, 2019; Sheppes et al., 2015).

Decision making has been traditionally studied outside of affective science (e.g., Marewski & Schooler, 2011). However, at its core choice behavior represents a primary means by which individuals exert control over their environments (Leotti, Iyengar, & Ochsner, 2010). Extrapolating this logic to the present focus, it is sensible that choice behavior would also allow individuals to control their internal emotional environment.

Four core regulatory stages have been suggested. Regulatory *identification* involves making the broad initial decision whether to regulate an emotion or not. If a decision to regulate (vs not regulate) is reached, a *selection* regulatory stage is activated, which involves deciding which of currently available regulatory strategies would be *implemented*. Following regulatory implementation, a *monitoring* regulatory stage kicks in, involving the decision whether and how to adjust an active implemented strategy.[1]

Despite considerable conceptual agreement on regulatory stages that transcend the "here & now" implementation stage, empirical evidence is slowly catching up. Of the three regulatory stages that precede and follow regulatory implementation, regulatory selection received the highest attention and support (Sheppes, 2014; Sheppes & Levin, 2013 for reviews). Accordingly, below I provide a systematic and thorough investigation of regulatory selection. However, because fully transcending the "here & now" focus must also transcend regulatory selection, following this section I describe the less explored monitoring and identification, stages, followed by emerging studies that begin linking between different regulatory stages.

4.2 Regulatory selection

4.2.1 Definition

The clear conclusion from the aforementioned "good & bad" sections is that regulatory strategies have different consequences in different contexts. This conclusion highlights the importance of selecting between regulatory strategies in ways that are sensitive to differing contextual demands.

[1] The broad term "emotion regulation choice" has been previously used to denote regulatory selection. However, given that choice is an important element in regulatory stages other than selection (i.e., identification, monitoring), in this paper I use specific terms (e.g., regulatory *selection* choice, regulatory *identification* choice) to provide definitional precision for the regulatory stage associated with each choice.

I find it useful to define regulatory selection as choices between regulatory options in different contexts, when regulation is warranted, and when more than one regulatory option is active (Sheppes, 2014). This definition highlights the following elements: (A) Regulatory selection occurs when regulation is warranted, that is following a regulatory identification stage where a decision to regulate one's emotions (vs not regulate) was reached. (B) The goal of regulatory selection is decision making or choosing between regulatory strategies that would deem suitable to differing contexts. (C) To constitute as a choice, more than one regulatory option of one's repertoire of strategies needs to be active.

Because this definition of regulatory selection highlights decision making (Sheppes et al., 2015; see also Gross, 2015, Gross et al., 2019), I focus in this review on studies where active choice can be identified. This definition precludes relevant important studies that, by assessing the frequency of regulatory strategy usage, cannot determine whether it is preceded by an active choice. Studies on frequency of strategy usage are of multiple kinds including: (A) self-report questionnaires (e.g., Garnefski, Kraaij, & Spinhoven, 2001; Gross & John, 2003; John & Gross, 2007; Nolen-Hoeksema, 1991); (B) experience sampling (e.g., Blanke et al., 2019; Eldesouky & English, 2019; English, Lee, John, & Gross, 2017; Kalokerinos, Erbas, Ceulemans, & Kuppens, 2019); (C) lab measures of spontaneous emotion regulation (e.g., Ehring, Tuschen-Caffier, Schnülle, Fischer, & Gross, 2010; Gruber, Harvey, & Gross, 2012; Livingstone & Isaacowitz, in press). I wish to also mention that the literature coverage in each of the below subsections is not intended to be exhaustive, rather illustrative of key ideas.

4.2.2 Basic experimental paradigm

To examine regulatory selection, my colleagues and I developed a novel behavioral paradigm (Sheppes, Scheibe, Suri, & Gross, 2011). In short, participants in the lab initially undergo a learning phase that teaches the differences between different regulatory options, and a training phase of how to accurately implement each regulatory option. Following this phase, participants are informed that they will be exposed to a series of emotional stimuli (e.g., images, electric shocks) for which they will freely choose between regulatory strategy options. Then participants practice making regulatory choices.

In the actual task (see Fig. 1B), participants perform a series of trials that involve a brief presentation preview of an emotional stimulus, followed by a choice screen where they select their preferred regulatory strategy.

Following a short preparation period, the emotional stimulus reappears and participants are instructed to implement their chosen strategy. When the emotional stimulus disappears, participants rate how they feel.[2]

Beyond providing a general scheme of the regulatory selection paradigm, I wish to elaborate on several core elements. The first element is the nature of *emotional stimuli* to which individuals make regulatory selections. In the original regulatory selection paradigm, emotional stimuli were negative images (e.g., Sheppes et al., 2011 Studies 1, 2; Sheppes, Scheibe, et al., 2014 Studies, 1, 2, 3, 5, 6). However, subsequent studies used many other types of emotional stimuli including negative words (Fine, Bloch, Hendler, & Sheppes, in preparation), negative emotional vignettes (Suri et al., 2018), aversive sounds (Feldman & Freitas, in press), electric shocks (Sheppes et al., 2011, Study 3), positive images (e.g., Hay, Sheppes, Gross, & Gruber, 2015; Martins, Sheppes, Gross, & Mather, 2018; Millgram, Sheppes, Kalokerinos, Kuppens, & Tamir, 2019), erotic images (Shafir, Zucker, & Sheppes, 2018), actual toys and candy (Dorman-Ilan, Tamuz, & Sheppes, 2019), and performance feedback on personality traits (Shafir, Guarino, Lee, & Sheppes, 2017).

The second element which I elaborate on in the next sections, involves factors that have been manipulated or examined as determinants or predictors of regulatory selection. These predictors are affective, cognitive, motivational, individual-social-cultural, developmental and clinical.

The third element entails the *regulatory options* individuals select between. Congruent with most studies in judgment and decision making, the decision

[2] Self-reported affective ratings that follow regulatory decisions are difficult to interpret (see Scheibe, Sheppes, & Staudinger, 2015; Sheppes, Scheibe, et al., 2014 for a detailed explanation). Inferences about differential efficacy of regulatory strategies following selection (e.g., whether in a high intensity condition distraction regulatory decisions lead to lower negative affect relative to reappraisal regulatory decisions) require equating stimuli's pre-choice emotional intensity for each of these two conditions (e.g., equating the initial negativity of stimuli that led to distraction relative to reappraisal decisions). While intensity is easily matched in regulatory implementation tasks (by fully randomizing emotional stimuli to regulatory strategy conditions), in the regulatory selection paradigm—matching the intensity is not possible because participants freely select strategies for each stimulus. Importantly, findings from prior related studies (e.g., Shafir et al., 2015; Shafir, Thiruchselvam, Suri, Gross, & Sheppes, 2016; Sheppes et al., 2011) have repeatedly shown that stimuli that lead to disengagement strategy decisions are more intense than stimuli that lead to engagement strategy decision. Furthermore, estimating the degree of this difference requires obtaining pre-choice ratings (i.e., negativity ratings to each emotional stimulus prior to regulation, see Shafir et al., 2016). In most regulatory selection studies, we refrain from asking participants to provide pre-choice self-report ratings immediately prior to making regulatory decisions, because of a concern that this explicit reporting will bias naturally occurring regulatory selections. Note that this concern does not apply to neural pre-choice indices that are collected continuously and unobtrusively.

architecture of all studies involve making decisions between two regulatory options (Sheppes & Levin, 2013 for review). Of existing regulatory options, most studies contrasted choices between attentional disengagement/distraction and engagement cognitive change/reappraisal (e.g., Sheppes et al., 2011; Sheppes, Brady, & Samson, 2014; Sheppes, Scheibe, et al., 2014; Murphy & Young, 2018; Young & Suri, in press). However, some recent studies examined other pairs of strategies including reappraisal and acceptance (Mehta, Young, Wicker, Barber, & Suri, 2017), distraction and rumination (Millgram et al., 2019), and avoidance and distancing (Sai et al., in preparation).

The fourth element is the *dependent measure* and the examination of its accuracy. In the regulatory selection paradigm, the main dependent measure is the proportion of choice of a particular regulatory option in a given experimental condition. Given that these studies include just two regulatory options, obtaining the choice proportion of only one regulatory option is satisfactory. Two different methods were used to evaluate accuracy or adherence of participants' behavioral reports of their chosen regulatory strategies (achieved via which button they pressed during the choice screen). One method involves asking participants to talk out loud (e.g., Dorman-Ilan et al., 2019; Sheppes et al., 2011) or type how they implement their chosen strategies (e.g., Levy-Gigi et al., 2016). A second method involves administering at the end of the paradigm a surprise memory test for emotional stimuli that were presented during the paradigm (e.g., Levy-Gigi et al., 2016; Sheppes et al., 2011). The logic of this second approach is that the selection of disengagement strategies should lead to impaired memory of emotional stimuli relative to engagement strategies. Results from both methods have proven satisfactory, manifested in very high agreement (~97%) between participants' regulatory selection button responses and their typed or talk out loud protocols, and in finding worse memory for disengagement relative to engagement regulatory selections.

Beyond these basic elements, two general psychometric properties of the regulatory selection paradigm have been recently examined. Specifically, the internal reliability of the paradigm is high (Kuder-Richardson-20 = 0.8, Levy-Gigi et al., 2016), and the test-retest reliability over 1 week duration is moderate ($r = 0.44$, $P < 0.001$, Fine et al., in preparation).

4.2.3 Applying the regulatory implementation framework to regulatory selection

Our aforementioned conceptual framework (Sheppes & Gross, 2011, 2012) explained that transcending the "good & bad" regulatory implementation

distinction, requires focusing on differential underlying mechanisms of regulatory strategies that lead to divergent cost-benefits. Applying this regulatory implementation conceptual framework to regulatory selection requires an additional assumption. Specifically, we assume that individuals can consider the central costs and benefits associated with the implementation of each regulatory option under different contexts, and to adapt their regulatory choices accordingly (Sheppes, 2014; Sheppes & Levin, 2013). It bears noting that this assumption is not unique to emotion regulatory selection, rather it is prevalent in several classic decision-making theories (e.g., Payne, Bettman, & Johnson, 1988, 1993). In the subsections below, I elaborate on how this conceptual framework sheds light on multiple dimensions of regulatory selection.

4.2.4 Affective determinants of regulatory selection

Being the target of every regulatory strategy, affect and its modulation are central for emotion regulation. Accordingly, affective factors should be important for regulatory selection. Our conceptual account (Sheppes & Gross, 2011, 2012) highlights that the *affective intensity* of emotional stimuli yields differential cost-benefit profile for the implementation of attentional disengagement and engagement meaning change regulatory strategies. Accordingly, for regulatory selection we predicted that in high intensity situations, where attentional disengagement provides strong immediate modulation, it should be strongly preferred (i.e., chosen) relative to engagement meaning change. However, in low intensity situations, where only meaning change strategies offer long term relief, it should be strongly preferred relative to attentional disengagement.

Two core dimensions of affective emotional intensity have been examined in regulatory selection studies. These dimensions include valence (i.e., intensity of *negative,* or *positive* emotional events) and locus (i.e., individuals' *internal* intensity responses, or contextual *external* intensity levels of the emotional event).

Most existing regulatory selection studies experimentally manipulated an *external negative* intensity independent variable by dichotomizing normative rating data of aversive images to high and low intensity, and examined its influence on the selection between attentional disengagement and meaning change (e.g., Sheppes et al., 2011, studies 1, 2; Sheppes, Brady, & Samson, 2014; Sheppes, Scheibe, et al., 2014). These studies found very strong support for our predictions, manifested in a very large effect size (Cohen's $d = \sim 2$) with ~90% of individuals showing some bias towards preferring attentional disengagement in high intensity, and meaning change for low intensity.

Since these initial studies, the effect of negative external emotional intensity on regulatory selection has been replicated and extended to many other emotional events. Specifically, watching high versus low negative intensity words (Fine et al., in preparation), listening to high versus low intensity aversive sounds (Feldman & Freitas, in press), or being exposed to a personally relevant emotional event involving the anticipation for high versus low intensity electric shocks (Sheppes et al., 2011, Study 3) prior to regulatory selection, all led to clear choice preference for attentional disengagement in high intensity, and to choice preference for engagement meaning change in low intensity.

While the influence of external negative intensity on regulatory selection proves robust, affective facets of negative external stimuli (e.g., intensity) need to be registered in the internal milieu. Accordingly, several studies used different approaches to examine how *internal negative* intensity influences regulatory selection.

Applying a dynamic theory approach, one study examined the lingering effect of negative internal intensity by examining how intensity self-report ratings to a negative image predict regulatory selection to a subsequent negative image (Murphy & Young, 2018). Findings indicated that current internal intensity levels constitute a reference point, such that higher levels of negative intensity reduce the intensity evaluation of subsequent stimuli, resulting in reduced selection of attentional disengagement.

Using a different clever approach, a recent study involved exposing participants to high or low intensity stimuli, prior to making regulatory selections to subsequent unknown stimuli (Feldman & Freitas, in press). Because regulatory selections were made to unknown stimuli, the study examined whether participants base their choices on internal intensity levels to preceding known stimuli (though intensity was not directly measured). Findings showed that exposure to high intensity stimuli, which is accompanied with high internal negative intensity, results in increased selection of attentional disengagement for subsequent unknown stimuli.

Two more direct findings indicated that higher subjective negative internal intensity ratings (Young & Suri, in press) and higher neural indices of negative internal intensity (Shafir et al., 2016) predict a regulatory preference for attentional disengagement over engagement meaning stage strategies. Taken together, findings on internal negative intensity on regulatory selection largely match findings obtained with external negative intensity and our conceptual framework.

Downregulating the influence of negative emotional intensity is both intuitive and widely studied. While being less studied, down-regulating

the intensity of *positive* emotional events is a fundamental facet of self-regulation (e.g., Mischel et al., 2011 for review). Healthy adaptation requires regularly keeping tempting appetitive stimuli in check. For example, the regulation of one's sexual desires is important for adaptive interpersonal functioning (e.g., Gailliot & Baumeister, 2007), and the regulation of food cravings is key for a healthy diet (e.g., Hill & Weaver, 1991).

Our conceptual account yields similar predictions for the influence of positive intensity on regulatory selection (Sheppes, 2014; Sheppes & Levin, 2013). Specifically, in high positive intensity situations, where attentional disengagement provides strong immediate modulation (e.g., Kanske et al., 2011; Shafir et al., 2018), it should be strongly preferred (i.e., chosen) relative to engagement meaning change. However, in low intensity situations, where only meaning change strategies offer long term modulation, it should be strongly preferred relative to attentional disengagement.

Supporting these predictions several studies examining the influence of *external positive* intensity show that watching high versus low intensity general positive images (e.g., Hay et al., 2015; Martins et al., 2018), or specific high versus low erotic images (Shafir et al., 2018), prior to regulatory selection, lead to clear choice preference for attentional disengagement in high intensity, and to choice preference for engagement meaning change in low intensity. A single study examining *internal positive* intensity showed that high vs low self-reported craving intensity ratings to toys and candy were associated with increased preference to select attentional disengagement over engagement meaning change (Dorman-Ilan et al., 2019).

Affective intensity is an important affective predictor of regulatory selection, but intensity is a general valence/arousal dimensional construct. A recent study adopted a specific discrete emotion approach and showed that increased self-reported levels of disgust (but not anger, fear, happiness, or sadness) experience was associated with selecting attentional disengagement over meaning change (Young & Suri, in press).

Taken together, findings showing that multiple forms of emotional intensity and discrete disgust powerfully shape regulatory selection largely support our conceptual account. Studies on other affective factors, such as on higher order discrete emotions (e.g., guilt, shame, pride), or on other personally relevant emotional events (e.g., autobiographical memories) are needed.

4.2.5 Cognitive determinants of regulatory selection

While emotions can be regulated in many different ways, cognition is central for many regulatory strategies (Ochsner & Gross, 2005 for review).

Accordingly, cognition should be important for regulatory selection. Cognitive determinants of regulatory selection have been examined using three interrelated constructs. These constructs include strategies: (A) Degree of *disengagement/engagement* with emotional information processing or meaning making (Sai et al., in preparation; Sheppes, Brady, & Samson, 2014; Sheppes, Scheibe, et al., 2014); (B) Degree of *cognitive effort* or resource expenditure (e.g., Milyavsky et al., 2019; Sheppes, Brady, & Samson, 2014; Sheppes, Scheibe, et al., 2014); (C) *Affordances* or opportunities for disengaging attention or for semantic reinterpretations that are inherent in emotional stimuli (Suri et al., 2018; Young & Suri, in press).

Theoretically, our conceptual account advocates that regulatory selections can be predicted by focusing on how underlying mechanisms of regulatory strategies lead to differential cost-benefit profiles (Sheppes & Gross, 2011; Sheppes & Levin, 2013). Here I focus on how the underlying mechanisms of different strategies vary on these three cognitive constructs.

Strategies like attentional *disengagement* involve not processing emotional information, they generally require minimal cognitive *resources*, and their operation does not depend on the *affordances* of the emotional stimulus. By contrast, strategies like *engagement* cognitive change involve processing emotional information, they require cognitive *resources*, and the operation of neutral reinterpretations semantically depends on *affordances* of the emotional stimulus.

Based on these differential underlying operations and differential cost-benefit profile of regulatory strategies, our conceptual framework predicts that reduced engagement, enhanced cognitive effort, and low affordances should all lead to reduced meaning change selection. Below I provide empirical evidence for the three cognitive constructs, followed by some challenges of isolating each.

Findings in support of the first *disengagement/engagement* factor come from studies that utilized the aforementioned affective intensity findings, according to which individuals prefer to engage with low intensity stimuli and disengage from high intensity stimuli (e.g., Sheppes et al., 2011). Extending these initial findings that contrasted one disengagement with one engagement strategy, in a recent study we investigated how emotional intensity determines regulatory selections of strategies that vary on a disengagement-engagement continuum (Sai et al., in preparation). The regulatory strategies examined in this study, varying from most disengaging to most engaging, were: (A) Avoidance—presentation of the emotional image is eliminated (e.g., Vujovic, Opitz, Birk, & Urry, 2014); (B) Distraction—

image is present but attention is disengaged (e.g., Sheppes et al., 2011); (C) Distancing—image is present, attentional engagement with emotional image, reinterpretation is based on adopting a general detached, objective mindset to contents of the emotional image (e.g., Ochsner et al., 2004); (D) Situation focused reappraisal—image is present, attentional engagement with emotional image, reinterpretation is based on specific contents of emotional image (e.g., Sheppes et al., 2011).

Findings (Sai et al., in preparation) supported predictions in showing that when presented with low intensity images, individuals preferred the more engaging option within each pair of strategies (e.g., preferring distraction over avoidance, distancing over distraction, and reappraisal over distancing), and when presented with high intensity images, individuals preferred the more disengaging option within each pair of strategies (i.e., preferring avoidance over distraction, distraction over distancing, and distancing over reappraisal).

Findings in support of the second *cognitive effort* factor on regulatory selection come from a handful of studies (e.g., Milyavsky et al., 2019; Sheppes, Brady, & Samson, 2014; Sheppes, Scheibe, et al., 2014). Specifically, in two studies cognitive effort reduction was achieved by having a group of participants only make hypothetical reappraisal choices (i.e., predict regulatory choices of others or of themselves without needing to actually implement choices), relative to a second group that made real regulatory choices that were followed by actual implementation. In another study, cognitive effort was manipulated by asking participants to select between a less effortful reality challenge reappraisal that questions the authenticity of emotional stimuli (i.e., this image is fake, see Sheppes, Brady, & Samson, 2014; Sheppes, Scheibe, et al., 2014), and between effortful situation focused reappraisal. Results showed that reductions in cognitive effort led to increased reappraisal choice, particularly in high intensity situations where the effort of reappraisal becomes more pronounced. Specifically, in high intensity participants selected more reappraisal when their choices were hypothetical or when they were allowed to select reality challenge reappraisal.

Findings in support of the third *affordances* factor on regulatory selection come from correlational (e.g., Young & Suri, in press) and experimental studies (e.g., Sheppes, Brady, & Samson, 2014; Sheppes, Scheibe, et al., 2014; Suri, Whittaker, & Gross, 2015; Suri et al., 2018, Studies 3, 4). In correlational studies affordances were operationalized as having participants self-report "how easy it is to form reappraisals or distractions to a given image." Supporting predictions regarding the importance of affordances

for meaning change strategies, findings showed that an increase in self-reported reappraisal affordances (but not distraction affordances) was correlated with increased reappraisal choice.

Experimental studies directly manipulated affordances by easing (vs not) the generation process of reappraisal and distraction (i.e., providing for participants concrete reappraisal and distraction options, vs having participants form their own distractions and reappraisals). Findings again showed that easing the generation of reappraisal enhanced its subsequent selection (Sheppes, Brady, & Samson, 2014; Sheppes, Scheibe, et al., 2014; Suri et al., 2015).

While being clearly important, findings supporting the three cognitive determinants of regulatory selection are hard to tease apart, because disengagement/engagement, cognitive effort and environmental affordances are interrelated. Specifically, the aforementioned disengagement/engagement study (Sai et al., in preparation), showing that increase in intensity leads to a preference for more disengagement regulatory options, can also be explained via cognitive effort, because more disengaging regulatory options are also easier to implement. The most direct aforementioned cognitive effort study (Milyavsky et al., 2019, Study 3), showing that the effortless reality challenge was preferred in high intensity relative to effortful situation focused reappraisals, can be explained via disengagement/engagement, because reality challenge is more disengaging than situation focused reappraisal. Finally, the aforementioned affordances studies (Suri et al., 2018; Young & Suri, in press), showing that lower opportunities for reinterpretations inherent in emotional stimuli were related to less reappraisal choice, can be explained by cognitive effort, because the operationalization of affordances involves the ease of forming reappraisals.

I am aware of a single study that tried to tease apart the engagement/disengagement from the cognitive effort factor (Sheppes, Brady, & Samson, 2014; Sheppes, Scheibe, et al., 2014, Study 5). This study examined how affective intensity influences the selection between two regulatory options that vary on engagement/disengagement and cognitive effort. Specifically, participants were exposed to high or low intensity images, and they were given a regulatory choice between performing two types of mathematical operations (see Erk, Kleczar, & Walter, 2007 who used mathematical subtractions as regulatory strategies). On each trial participants received a number (e.g., 23) and they could choose whether they wish to perform series of mathematical subtractions by 2s (e.g., 23, 21, 19, …), or whether they wish to perform mathematical subtractions by 7s (e.g., 23, 16, 9, …) while being

exposed to emotional images. At the end of the trial participants had to indicate the number they reached, which allowed measuring actual mathematical performance.

Previous studies have shown that subtracting 7s requires more cognitive effort and is also more disengaging from emotional contents than subtracting 2s (e.g., Erber & Tesser, 1992; Van Dillen & Koole, 2007). Importantly, these differential characteristics of subtracting 7s and 2s lead to opposite predictions with regard to the centrality of the engagement/disengagement versus cognitive effort factors.

A cognitive effort account suggests that, as intensity increases to high from low, regulation becomes more challenging, leading to reduced selection of effortful regulatory options. Accordingly, a cognitive effort prediction is that the preference for the effortful subtract 7s option should *decrease* for high (relative to low) intensity. By contrast, a disengagement/engagement account suggests that intensity increases to high from low, which leads to enhanced preference to disengage from emotional processing. Accordingly, a disengagement/engagement account predicts that the preference for the more disengaging subtract 7s option (despite being also more effortful) should *increase* for high (relative to low) intensity.

Findings exclusively supported the engagement/disengagement account in showing that the preference for the *effortful* subtract 7s option *increased* for high (relative to low) intensity emotional images (Sheppes, Brady, & Samson, 2014; Sheppes, Scheibe, et al., 2014). Furthermore findings of actual mathematical performance on this task confirmed that, relative to subtracting 2s, subtracting 7s is more effortful (i.e., participants generally performed less operations in the subtract 7s relative to subtract 2s in a given time) and more disengaging (i.e., mathematical performance was less affected by the intensity of the image in the subtract 7s relative to the subtract 2s option).

To summarize, several studies point out three central cognitive factors that determine regulatory selection. However, because the three factors appear to be interrelated, future studies that tease them apart and evaluate the relative contribution of each factor are crucially needed.

4.2.6 Motivational determinants of regulatory selection

Individuals regulate their emotions for different reasons, making motives or motivations central to self-regulation (see Tamir, 2016 for a review). Accordingly, motivation should be important for regulatory selection. Three motivational determinants of regulatory selection that have been

examined include *monetary rewards* (Sheppes, Brady, & Samson, 2014; Sheppes, Scheibe, et al., 2014, Study 1), *temporal goals* (short/long term goals, Sheppes, Brady, & Samson, 2014; Sheppes, Scheibe, et al., 2014, Study 3), and *directional goals* (up/down regulation, Millgram et al., 2019).

Monetary reward functions as a potent reinforcer that powerfully influences motivated behavior and decision making (e.g., Delgado, Labouliere, & Phelps, 2006; Knutson, Adams, Fong, & Hommer, 2001). The objectives of our prior study (Sheppes, Brady, & Samson, 2014; Sheppes, Scheibe, et al., 2014, Study 1) were twofold. First, given how potent monetary incentives were proven in shaping choice behavior between external options, we wanted to examine their influence on internal regulatory options. Second, the aforementioned affective intensity influence on regulatory selection has proven very strong, and we therefore wanted to examine its robustness by examining its effect when it conflicts with potent monetary rewards.

To that end, in this study we slightly modified our regulatory selection paradigm. Specifically, below the attentional disengagement and cognitive change regulatory choice options, we added actual money amounts that would be given to participants for selecting a particular option for given affective intensity. On different trials, monetary incentives varied between regulatory options (whether more money is given for attentional disengagement or meaning change) and on magnitude (whether the difference in money amounts between attentional disengagement and meaning change is small or large).

Supporting findings indicated that monetary incentives have a large influence, such that pairing a regulatory option with more money increased its selection, and this influence was stronger when the monetary magnitude between regulatory options was large. Furthermore, the aforementioned strong effect of affective intensity on regulatory selection was evident even when it conflicted with monetary rewards. That is, individuals preferred to select attentional disengagement in high intensity, even when selecting meaning change was given significantly more money, and individuals preferred selecting engagement meaning change in low intensity, even when selection of attentional disengagement was given significantly more money.

Two *temporal goals* appear central for emotion regulation. These include hedonic goals that refer to a motivation to regulate one's emotions to feel less negative or more positive in the short or immediate term, and instrumental goals involving a motivation to regulate one's emotions in order to achieve one's long-term goals. According to our aforementioned account (Sheppes & Gross, 2011, 2012), the clear benefit of meaning change

strategies (but not attentional disengagement) is that the negative influence of reencountered emotional information that has been processed and altered can gradually subside.

Examining the influence of this differential motivational benefit on regulatory selection involved designing a study that manipulated temporal goals (Sheppes, Brady, & Samson, 2014; Sheppes, Scheibe, et al., 2014, Study 3). In this study we rightfully informed a long-term goal group of participants that, after they complete the regulatory selection task, they would re-encounter and naturally watch all emotional stimuli. A second short-term goal group of participants expected to see each emotional stimulus only once. Confirming predictions, findings showed that relative to the short-term group, individuals in the long-term group selected more meaning change, which provides emotional relief for reencountered stimuli.

Whether hedonic or instrumental, all regulatory goals are *directional*. Two fundamental directional goals include: up-regulation efforts to enhance a facet of an emotional response, and down-regulation efforts to decrease a facet of an emotional response. Due to their centrality, directional goals are likely to influence regulatory selection.

Applying the logic of our aforementioned account, underlying operations of regulatory options yield a cost-benefit profile that should dictate regulatory selection. In this recent study (Millgram et al., 2019), we tested the assertion that some regulatory strategies are better tailored to achieve down-regulation goals, and other strategies are better tailored to achieve upregulation goals. Specifically, the underlying operation of engagement rumination involves *increasing* attention towards emotional stimuli, and the underlying operation of disengagement distraction involves *decreasing* attention from emotional stimuli. Accordingly, we tested the prediction that, when confronted with a down-regulation goal, individuals would prefer decreasing attention distraction over rumination, and when confronted with an upregulation goal, individuals would prefer increasing attention rumination over distraction. Supporting these predictions, we showed that across negative and positive emotional stimuli, across lab and daily life contexts, individuals strongly preferred engagement rumination to upregulate their emotions and strongly preferred attentional disengagement to down-regulate their emotions (Millgram et al., 2019).

To summarize, monetary rewards, temporal goals and directional goals all powerfully influence regulatory selection. However, the interactions between these goals, and other core goals (e.g., punishment, other hedonic vs instrumental goals) should be studied.

4.2.7 Underlying explicit and implicit mechanisms of regulatory selection

From the split of a second it takes to decide to divert attention away from a gruesome dirty toilet, to the careful consideration of whether it would be best to try to change the negative meaning of a mildly argument with your partner, it seems plausible that different underlying processes would guide our regulatory selections across affective contexts. While in some contexts the process that leads to selecting a certain emotion regulation strategy may be fast and effortless, thereby *implicit*, in other contexts it may be slow and effortful, thereby *explicit*.

The distinction between implicit and explicit processes is fundamental for dual process theories (see Bargh, 1994; Moors, 2016; Sherman, Gawronski, & Trope, 2014 for conceptual reviews). While dual process accounts received their share of criticism (e.g., Keren & Schul, 2009; Kruglanski & Gigerenzer, 2011), recent empirical support in cognitive science, together with important theoretical clarifications, make this account highly relevant across major fields of psychology (Evans & Stanovich, 2013 for a review), including self-regulation (Hofmann, Friese, & Strack, 2009; Sherman et al., 2008) and emotion regulation (see Braunstein, Gross, & Ochsner, 2017; Gyurak, Gross, & Etkin, 2011; Sheppes & Gross, 2014 for reviews).

Although, the importance of implicit and explicit processes in regulatory selection has been conceptually outlined (Koole, Webb, & Sheeran, 2015 for review), all existing empirical evidence has been limited to implicit and explicit processes in regulatory implementation (e.g., Gallo, Keil, McCulloch, Rockstroh, & Gollwitzer, 2009; Mauss, Cook, & Gross, 2007; Williams, Bargh, Nocera, & Gray, 2009). To fill this important gap, we recently investigated implicit and explicit underlying processes of regulatory selection (Shafir, Amit, Yuval-Greenberg, & Sheppes, under review). In doing so we focused on the underlying implicit-explicit processes of the robust affective negative intensity determinant of regulatory selection.

We predicted that high-intensity situations trigger *implicit processes* that rapidly and effortlessly lead toward preferring attentional disengagement. By contrast, low-intensity contexts trigger *explicit processes* that require substantial time and effort in order to lead to prefer engagement cognitive change. This hypothesis was derived from classic motivational systems of emotion theories, that describe a basic defensive motivational system that utilizes automatic processes to deal with high intensity survival threats,

but utilizes deliberate processes to deal with low intensity threats (Bradley, Codispoti, Cuthbert, & Lang, 2001; Cacioppo & Berntson, 1994; Cacioppo, Gardner, & Berntson, 1999; Lang & Bradley, 2010).

To test these predictions, we conducted two studies that examined implicit and explicit underlying processes in our regulatory selection paradigm (Shafir et al., under review). In a first study, one group of participants had to make their regulatory decisions very quickly, while a second group of participants had ample time. Forming decision time constraints is considered a classic manipulation that selectively interferes with the operation of effortful explicit processes that take time to complete (see Thomas, Dougherty, & Buttaccio, 2014 for a review).

We predicted and found that being under strict decision time constraints selectively interfered with explicit slow effortful processes, leading to reduced choice preference for engagement meaning change in low intensity. Decision time constraints had no influence on the implicit fast effortless processes that guide choice preference for attentional disengagement in high intensity.

In an effort to provide converging evidence, a second study utilized the high temporal resolution of eye-tracking methodology to explore early implicit and late explicit fixation patterns towards regulatory options when individuals made regulatory selections. Specifically, we focused on first and last fixations towards preferred regulatory options in different intensities. First fixations, which represent initial rapid orienting of attention, are associated with implicit processes (e.g., Aviezer et al., 2008; Garner, Mogg, & Bradley, 2006). Last fixations prior to choice, which represent late high level processing, are associated with explicit processes (Ghaffari & Fiedler, 2018; Krajbich, Armel, & Rangel, 2010).

Supporting predictions, we found (Shafir et al., under review) an exclusive enhanced implicit first fixation preference toward the attentional disengagement regulatory option in high intensity that was also associated with its subsequent selection. We also found an explicit last fixation preference toward the meaning change regulatory option in low intensity.

To summarize, these findings provide preliminary important evidence for the involvement of implicit and explicit underlying processes of regulatory selection. Given how central these processes are for emotion regulation in general, and for regulatory selections specifically, additional studies investigating other implicit/explicit factors (e.g., conscious awareness, intentionality; see Moors, 2016 for review) are crucially needed.

4.2.8 Neural correlates of regulatory selection

The last two decades brought an explosion of studies dedicated to the systematic study of neural correlates of emotion regulation (e.g., Buhle et al., 2014; Etkin, Büchel, & Gross, 2015; Hajcak, Dunning, Foti, & Weinberg, 2014 for reviews). While providing immense insights regarding temporal dynamics and neural bases of regulatory strategies, most existing studies focus exclusively on regulatory implementation, thus not transcending the "here & now" problem.

Only a handful of studies examined the neural correlates of regulatory selection. Indirect evidence comes from a neuroimaging study showing that enhanced emotion generation related amygdala activity, together with enhanced cognitive control related prefrontal activity, while passively viewing negative images predicted enhanced selection of meaning change strategy over no-regulation in a subsequent task (Doré, Weber, & Ochsner, 2017).

While being clearly important, this study provides only indirect evidence for regulatory selection, because the neural correlates were assessed during a task that does not involve choice, and because the regulatory choice to regulate one's emotions (via meaning change) versus no-regulation corresponds to the identification but not selection stage (see Gross, 2015; Sheppes et al., 2015).

Direct evidence comes from an electrophysiological study that examined the role of negative internal intensity on regulatory selection (Shafir et al., 2016). In this study, participants performed the regulatory selection paradigm while their electro-cortical responses were continuously monitored. This study examined whether individuals' online neural processing of negative affective intensity (LPPs) during the presentation preview of negative images predicts subsequent behavioral regulatory selection between attentional disengagement and engagement meaning change.

Supporting findings showed that enhanced neural processing of intensity (enhanced LPP amplitudes) predicted increased preference to select attentional disengagement over meaning change (Shafir et al., 2016). Furthermore, the predictive value of the neural internal intensity predictor was demonstrated in explaining unique variance, beyond external intensity normative ratings.

While electrophysiological and neuroimaging studies provide invaluable insights regarding temporal dynamics and neural bases, evidence remains correlational, because these studies only measure rather than experimentally manipulate neural responses. To fill this gap, we recently utilized major

technological advancements that allow to directly manipulate neural activity in order to examine the causal contribution of a key brain region in regulatory selection (Geva et al., under review). Specifically, this study utilized continuous theta-burst stimulation (cTBS), which involves applying short trains of high-frequency bursts to create cortical modulation or inhibition, that lasts up to an hour (e.g., Huang, Edwards, Rounis, Bhatia, & Rothwell, 2005). In particular, this study examined the causal role of the right dorsolateral prefrontal cortex (DLPFC) in regulatory selection between attentional disengagement and engagement meaning change (Geva et al., under review). Activity in the right DLPFC has been traditionally associated with general effortful control (e.g., Vanderhasselt et al., 2007; Vanderhasselt, De Raedt, Baeken, Leyman, & D'haenen, 2006) and cognitive inhibition (Aron, 2007).

Importantly, the right DLPFC has been associated with emotion regulation and specifically with enhanced cognitive effort associated with meaning change strategies. Specifically, neuroimaging studies show that the right DLPFC is active during the implementation of cognitive reappraisal (e.g., Ochsner et al., 2004, See Buhle et al., 2014 for a review), with some evidence for unique activation during the implementation of reappraisal under high intensity, due to increased cognitive demand (Silvers et al., 2014). Causal evidence comes from a study using anodal transcranial direct current stimulation (tDCS), showing that excitation of the right DLPFC during reappraisal implementation improves its efficacy (Feeser, Prehn, Kazzer, Mungee, & Bajbouj, 2014).

While prior studies provide important support for the role of the right DLPFC in effortful regulatory implementation, no study causally linked the right DLPFC to regulatory selection. Utilizing our conceptual framework (Sheppes, 2014; Sheppes & Levin, 2013) and in particular the cognitive determinants of regulatory selection, we predicted and found that, relative to no stimulation or sham stimulation, inhibiting the right DLPFC was associated with reduced regulatory selection of effortful meaning change in high intensity (Geva et al., under review).

To summarize, while preliminary studies begin to reveal neural underpinnings of regulatory selection, future studies, involving measurement and manipulation of neural correlates associated with affective, cognitive and motivational factors, are critically needed.

4.2.9 Individual-social-cultural influences on regulatory selection

Human action does not take place in a vacuum, rather it is embedded in and influenced by powerful contextual forces, ranging from a micro *individual*

level, through a *social* group level, to a macro *culture* level (Barrett, Mesquita, & Smith, 2010 for review). Contextual forces have been clearly described and studied across various fields of emotion science, including emotion regulation (e.g., Aldao, 2013; Aldao & Tull, 2015; Greenaway, Kalokerinos, & Williams, 2018 for reviews). With the risk of sounding like a broken record, I wish to repeat that these prior important studies have mainly looked at regulatory implementation rather than regulatory selection.

In this subsection, I wish to briefly describe emerging studies that test contextual forces on regulatory selection at the micro individual level (Shafir et al., 2017), social group level (Pliskin, Halperin, Bar-Tal, & Sheppes, 2018), and macro cultural level (Mehta et al., 2017). Starting with the micro *individual* level, in one study we examined how individual differences in self-esteem moderate regulatory selections when dealing with stressful performance feedback in an evaluative context (Shafir et al., 2017). Specifically, individuals varying in self-esteem were asked to give an impromptu speech in front of a video camera and in front of an individual who would evaluate their performance (see Kirschbaum, Pirke, & Hellhammer, 1993). Following the speech, individuals ranked their perceived performance on various personal dimensions (e.g., intelligence, creativity, competence). This ranking was used as a measure of individuals' perceived stress intensity from getting evaluator feedback. Then participants performed a modified regulatory selection paradigm. On each trial participants saw one personal dimension (e.g., intelligence), followed by making a regulatory decision between attentional disengagement and engagement meaning change, during a waiting period that preceded the receipt of (fictitious) performance feedback from the evaluator.

Our prediction integrated the logic of our regulatory selection account (Sheppes, 2014; Sheppes & Levin, 2013) with conceptual views on individual differences in defensive reactions to self-threats (e.g., Baumeister, Tice, & Hutton, 1989). Specifically, we predicted and found that individuals with low (but not high) self-esteem protected their vulnerable self-views by prioritizing the selection of attentional disengagement, which provides short-term disengagement benefits, over the selection of engagement meaning change, which allows learning from evaluative feedback and long-term benefits (Shafir et al., 2017).

Moving to the *social* group level, ideological belief systems that provide individuals with ways to interpret and experience their sociopolitical world have proven crucial for understanding intergroup conflicts (see Jost,

Federico, & Napier, 2009 for a review). Given how heated intergroup conflicts tend to be, it is not surprising that studies began focusing on how political ideology is associated with differences in emotional experience (e.g., Goldenberg, Halperin, van Zomeren, & Gross, 2016) and regulation (e.g., Gross, Halperin, & Porat, 2013) of conflict related contents and emotions.

In a recent study (Pliskin et al., 2018), we examined whether political ideology influences emotion generation and regulatory selection to different types of human suffering. Specifically, Jewish Israeli liberals and conservatives rated their negative intensity and performed a regulatory selection paradigm while viewing three types of human suffering images: (A) Ingroup human suffering (e.g., wounded Jewish Israelis following a Palestinian terror attack); (B) Outgroup human suffering (e.g., wounded Palestinians following Israeli army bombing); (C) nonconflict human suffering (e.g., wounded Americans following a road accident).

We predicted that emotion generation differences between liberals and conservatives would mainly manifest for outgroup suffering, with liberals feeling more negative intensity relative to conservatives, due to enhanced empathy towards outgroup harm (Pliskin & Halperin, 2016). With regard to regulatory selection, we expected that differences between liberals and conservatives would mainly evince for outgroup suffering, the sole condition where we expected differences between groups. However, we had competing predictions regarding the direction of this difference.

A "motivation hypothesis" predicts that, when confronted with outgroup harm, liberals (relative to conservatives) would show preference for engagement meaning change (over attentional disengagement), because only engagement with harm allows fulfilling motivations to experience intergroup empathy (Porat, Halperin, & Tamir, 2016). By contrast, our "intensity hypothesis" predicts that liberals would show preference for attentional disengagement (over engagement meaning change), because higher intensity is more efficiently regulated via disengagement attention (Shafir et al., 2015).

Emotion generation results supported predictions in showing higher negative intensity among liberals relative to conservatives, exclusively in the outgroup harm condition. Regulation selection results fully supported the intensity hypothesis, showing that liberals selected more attentional disengagement than conservatives only when exposed to outgroup suffering (Pliskin et al., 2018). A further recent study shed light on conservatives' engagement meaning change selection patterns (Cohen, Pliskin, & Halperin, 2019).

Findings showed that when needing to regulate fear from the outgroup, conservatives select reappraisals that enhance ingroup empowering (e.g., reappraising fear from Palestinians, by thinking that the Israeli army is strong and protecting).

Although these regulatory selection findings are tentative they may have important applied implications. Politicians and media outlets tend to show highly intense depictions of outgroup suffering, perhaps in an effort to motivate corrective action. However, a first step towards action requires engaging with emotional materials. Our findings show that liberals, who may be those mostly motivated to act against outgroup harm, are actually more likely to disengage when exposed to intense outgroup suffering.

Ending with the macro level, *culture* has been shown to play a huge role in explaining the ways different individuals experience (e.g., Tsai & Clobert, in press for review) and regulate (e.g., Kwon, Yoon, Joormann, & Kwon, 2013; see Mesquita, de Leersnyder, & Albert, 2014 for review) their emotions. However, I am aware of a single study that directly examined differences in behavioral regulatory selections between Indian and American cultures (Mehta et al., 2017).

In forming their regulatory selection hypotheses, the authors relied on core differences in the centrality of religion in Indian relative to American cultures. Religion, which constitutes a potent meaning making system, has been linked recently with better ability to implement engagement meaning change (Vishkin et al., 2016). Accordingly, it was predicted and found that Indian individuals who give religion a central role, selected more meaning change relative to American individuals (Mehta et al., 2017).

Collectively, these studies show that individual, group and cultural contextual levels provide strong moderators of regulatory selection effects. However, studies studying other contextual variables within each level (e.g., other personality, groups and cultures) and interacting influences across levels (i.e., interactions between social and culture factors) are needed.

4.2.10 Regulatory selection across development

From its beginning to its end, throughout human lifespan individuals encounter emotional challenges that require regulation. Hungry and fussy babies need to regulate general negative affect (Fox, 1998), toddlers and young children need to master an ability to delay gratification (Mischel et al., 2011; Peake, 2017), adolescents need to regulate peer rejection (Trentacosta & Shaw, 2009), young adults need to deal with work job

burnout (Grandey & Sayre, 2019), and older adults need to cope with the loss of a loved one (Bonanno & Kaltman, 2001).

As with other sections in this review, although it is widely agreed that regulatory selection is important across development (e.g., Opitz, Gross, & Urry, 2012 for review), empirical support remains modest. In several studies we investigated the importance of regulatory selection for older adults (Martins et al., 2018; Scheibe et al., 2015) and for first grade children (Dorman-Ilan et al., 2019). These studies adopted a central developmental account of emotion regulation: the Selection, Optimization, and Compensation with Emotion Regulation (SOC-ER, e.g., Opitz et al., 2012; Urry & Gross, 2010 for reviews). Central for SOC-ER is the idea that successful regulation is the result of a fit between the cognitive resources an individual or a group of individuals possess, and between the cognitive resources required for particular strategies.

The Selection element of the SOC-ER (also congruent with the cognitive effort factor described above) suggests that *choosing* regulatory strategies whose cognitive resource requirements fits with the cognitive resources an individual or groups possess, would lead to adaptive functioning. Importantly, considerations of effort in regulatory selection are particularly important for certain groups or individuals who face resource related challenges (Opitz et al., 2012). Specifically, for groups or individuals who possess low cognitive resources, selecting strategies that require minimal cognitive effort should lead to adaptive functioning.

Adopting this logic to older age, which is associated with cognitive decline and resource related challenges (e.g., Craik & Bialystok, 2006), in this study we (Scheibe et al., 2015) had younger adults (19–28 years old) and older individuals (65–75 years old) perform regulatory selections between low effort attentional disengagement and high effort engagement meaning change while viewing negative images. We also examined the affective consequences of differential regulatory selections.

We predicted and found that, relative to younger adults, older adults who face resource related challenges selected more attentional disengagement, which requires minimal cognitive resource expenditure, over effortful meaning change (Scheibe et al., 2015, but see Martins et al., 2018 not finding similar patterns among a different old age sample). Furthermore, confirming the link between fit and adaptive functioning, we found that exclusively among older individuals, higher selection of low-effort attentional disengagement was associated with higher levels of state affective well-being.

Apart from older individuals who show cognitive decline, at the other end of the developmental spectrum, younger kids whose executive abilities are maturing, face resource related challenges. In a recent study with a group of first grade children, we examined the SOC-ER prediction that, among young kids who possess low cognitive resources, selecting strategies that require minimal cognitive effort would lead to adaptive functioning (Dorman-Ilan et al., 2019).

In this study, a modified regulatory selection paradigm included asking first grade children to down-regulate their wanting of actual toys and candy by selecting between simplified versions of low effort attentional disengagement and high effort engagement meaning change. Specifically, to explain to children that many life situations require regulating appetitive desires, we described several daily events, such as wanting candy before dinner that a parent does not allow, or seeing an attractive toy at the mall that they cannot have. Throughout the task, children talked out loud their regulatory selections and subsequent implementation of their choices in order to verify adherence.

To assess individual differences in cognitive resource ability we examined working memory capacity, a central executive resource in SOC-ER (see Opitz et al., 2012) and in emotion and self-regulation research among children (e.g., Melby-Lervåg & Hulme, 2013). To assess healthy functioning, we had parents complete a questionnaire regarding the behavioral functioning of their children (e.g., *My child tends to lose control more than his peers*.). Confirming predictions, we found that, exclusively among children who have low cognitive resources (i.e., low working memory capacity), higher selection of low-effort attentional disengagement was associated with higher adaptive functioning reported by parents (Dorman-Ilan et al., 2019).

To summarize, studies of developmental influences on regulatory selection emerged only recently. Future studies comparing regulatory selections among different developmental groups cross-sectionally (e.g., children, adolescents, adults), or examining changes in regulatory selection longitudinally by following individuals across extended periods of time, are needed.

4.2.11 Regulatory selection and psychopathology

The relationship between emotion regulation and psychopathology may be the most documented or even obvious (e.g., Gross & Jazaieri, 2014; Kring & Sloan, 2010; Sheppes et al., 2015 for reviews). There is wall-to-wall agreement that emotion regulation problems figure prominently in most clinical

conditions, such as mood and anxiety disorders (Hofmann, Sawyer, Fang, & Asnaani, 2012), eating disorders (e.g., Leehr et al., 2015), substance use disorders (e.g., Kober, 2014), and personality disorders (e.g., Carpenter & Trull, 2013). Accordingly, several treatment protocols place a central emphasis on improving emotion dysregulation (e.g., emotion regulation therapy: Mennin & Fresco, 2015; Unified Protocol for Transdiagnostic Treatment of Emotional Disorders: e.g., Barlow & Farchione, 2017; Affect regulation training: Berking & Schwarz, 2014; Dialectical Behavioral Therapy: e.g., Linehan, 1993).

While recent conceptual advancements highlight that emotion dysregulation in psychopathology should transcend regulatory implementation (e.g., Gross et al., 2019; Sheppes et al., 2015), studies linking regulatory selection to psychopathology are slowly emerging. In this subsection, I describe studies that focus on *regulatory selection flexibility,* shedding new light on post-traumatic stress disorder (PTSD) and major depression. I end this section with a description of studies that did not find regulatory selection impairments in some other clinical conditions.

Because individuals' external environment and internal milieu are constantly fluctuating, several accounts propose that psychological flexibility is crucial for mental health (e.g., Kashdan & Rottenberg, 2010 for a review). One important aspect of psychological flexibility that has been linked to mental health is emotion regulatory flexibility (e.g., Aldao et al., 2015; Bonanno & Burton, 2013; Hollenstein, Lichtwarck-Aschoff, & Potworowski, 2013).

Emotion regulatory flexibility too is a broad construct that can be further broken down according to the aforementioned regulatory stages. Specifically, several seminal studies have shown that *regulatory implementation flexibility*, which refers to the ability to successfully execute different strategies upon demand, predicts healthy adaptation (Bonanno, Papa, Lalande, Westphal, & Coifman, 2004) over an extended time period (Westphal, Seivert, & Bonanno, 2010), and that high regulatory implementation flexibility can protect from complicated grief patterns in bereavement (Gupta & Bonanno, 2011).

In this subsection, I wish to highlight *regulatory selection flexibility,* which refers to the ability to flexibly choose between regulatory strategies by adequately considering the central costs and benefits associated with each regulatory option in different contexts (Sheppes, 2014; Sheppes & Levin, 2013). In particular, regulatory selection flexibility has proven important in understanding emotion dysregulation related to trauma.

Although our intuition strongly suggests that accumulative exposure to adversity should lead to more psychopathology, the relationship between repeated exposure to trauma and post-traumatic symptoms is inconsistent (Galatzer-Levy et al., 2013; Marmar et al., 2006; Seal et al., 2009). In a recent study, we investigated whether regulatory selection flexibility may moderate the relationship between repeated traumatic exposure and PTSD symptoms (Levy-Gigi et al., 2016).

In this study (Levy-Gigi et al., 2016), we examined a unique sample of firefighters, a population which is routinely exposed to adverse situations during duty, on three key variables: (A) *traumatic exposure*—was mainly assessed via number of years in service (see Meyer et al., 2012; Shepherd & Wild, 2014), where we additionally confirmed using actual event logs, that each year of service was associated with multiple traumatic episodes; (B) *regulatory selection flexibility*—individual differences were assessed using our regulatory selection paradigm. Specifically, flexible regulatory selection pattern in this paradigm involves adequately considering the central benefits of disengagement attention in high intensity events, and the benefits of engagement meaning change in low intensity events. Accordingly, the degree of regulatory selection flexibility is computed by subtracting attentional disengagement choice in low intensity (which should be minimal) from attentional disengagement in high intensity (which should be maximal); (C) *PTSD symptoms*—were assessed using standardized clinical interviews (Levy-Gigi et al., 2016). Results in this study shed new light by showing that the elusive relationship between enhanced traumatic exposure and higher PTSD symptoms holds true exclusively for individuals with low regulatory selection flexibility (Levy-Gigi et al., 2016).

While these findings may be important, firefighters are in general a healthy population (only two individuals in our sample met diagnostic criteria for PTSD). Accordingly, in a recent study in our lab we examined whether regulatory selection flexibility patterns diverge among individuals with and without PTSD (Fine et al., in preparation). Using a regulatory selection paradigm that includes high and low intensity words (instead of images), and using the same aforementioned regulatory selection flexibility measure, we found that PTSD individuals demonstrate lower regulatory selection flexibility relative to healthy controls.

Our two studies (Fine et al., in preparation; Levy-Gigi et al., 2016) focused on individuals' negative symptomatic responses to traumatic events. However, some individuals display posttraumatic growth (PTG), which refers to experiencing greater sense of personal strength and closer

relationships with others, following a traumatic event (Tedeschi & Calhoun, 2004). It is agreed that for PTG to occur, individuals need to form new positive hopeful *meanings* for highly intense traumatic events that question core beliefs about the self and the environment. Accordingly, meaning change strategies may be particularly important for PTG.

Based on this logic, in a recent study we predicted and found that a regulatory selection flexibility measure that included an increase in meaning change selection with increasing negative intensity was associated with higher self-reported PTG among individuals who experienced a traumatic event in the past 6 months (Orejuela-Dávila, Levens, Sagui-Henson, Tedeschi, & Sheppes, 2019).

Taken together, these two studies show that a regulatory selection flexibility pattern that involves enhanced attentional disengagement selection with increased intensity may be associated with reduced PTSD symptomatology. However, an opposite regulatory selection flexibility pattern, involving enhanced meaning change selection with increased intensity, may be required to foster posttraumatic growth.

Recently, the importance of regulatory selection flexibility has been extended to anxiety treatment (Alkoby, Pliskin, Halperin, & Levit-Binnun, 2019). Specifically, relative to a control group, an 8 week "Mindfulness Based Stress Reduction" intervention, that teaches flexible responding to negative events (e.g., Baer, 2003), led to enhanced regulatory selection flexibility (i.e., enhanced selection of attentional disengagement in high intensity and meaning change in low intensity).

Transcending stress-related symptomatology and intervention, a different type of regulatory selection flexibility has been linked with major depression (Millgram et al., 2019, Study 5). As described in the motivational determinants section above, healthy individuals can flexibly select regulatory strategies (decreasing attention distraction and increasing attention rumination) to match differential directional goals (down vs upregulation).

Given the centrality of rumination and distraction to depression (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008), we predicted that depressed individuals would differ from healthy individuals in their ability to match regulatory selections to differing directional goals. However, theories differ in their prediction of the direction of this difference. According to one set of theories (e.g., Watkins & Nolen-Hoeksema, 2014), because rumination is highly preferred and automatic in depression, we should observe higher rumination selection across both directional goals among depressed relative to nondepressed individuals. By contrast, according to another account

(e.g., Rottenberg, Gross, & Gotlib, 2005), because depression is associated with emotion context insensitivity, we should observe reduced regulatory selection flexibility, manifested in impaired matching of regulatory strategies to goals.

Results fully supported impaired regulatory selection flexibility, showing that, as opposed to healthy individuals who showed a clear flexible selection preference for rumination when needing to up regulate and a preference for distraction when down-regulating, depressed individuals selected rumination *less* for upregulation and distraction less for down-regulation (Millgram et al., 2019, Study 5). Further evidence showed that, within the depressed group, reduced regulatory selection flexibility was marginally correlated with higher depressive symptomatology.

As opposed to the clear patterns of regulatory selection impairments in anxiety and mood disorders, studies conducted with some other clinical conditions, such as remitted bipolar individuals (Hay et al., 2015) or borderline personality disorder individuals (e.g., Kuo, Fitzpatrick, Krantz, & Zeifman, 2018; Sauer et al., 2016), failed to find substantial regulatory selection differences. These null findings were obtained despite the use of symptom-related emotional contents (i.e., appetitive images for remitted bipolar individuals, and interpersonal conflict images for borderline personality disorder individuals). Accordingly, future studies should investigate the boundary conditions of regulatory selection impairments among different types of psychopathology.

4.3 Transcending regulatory selection

4.3.1 Roadmap

The study of regulatory selection has been flourishing, providing many novel insights to the maturing field of emotion regulation. Nevertheless, as I have indicated above, emotion regulation is a complex phenomenon composed of *four interacting* key stages. Congruent with this view of emotion regulation, in this final subsection, I wish to briefly outline three exciting avenues that transcend the important study of regulatory selection. These avenues include succinctly mapping the two remaining regulatory stages: *regulatory monitoring* and *regulatory identification*, and briefly describing the importance of *interactions between regulatory stages*.

4.3.2 Regulatory monitoring

Any proper operating system requires a quality control element. The quality control element in emotion regulation kicks in once a selected strategy is

implemented and is called *regulatory monitoring*. It is defined as the continuous tracking of an actively implemented regulatory strategy, in order to decide whether and how to adjust it in order to maximize adaptive outcomes (e.g., Gross, 2015, Sheppes et al., 2015 for reviews).

The decision space in regulatory monitoring includes three possible options (Gross, 2015; Sheppes et al., 2015). (A) *Maintenance*: a decision to continue the course of an actively implemented strategy. For example, one can decide to maintain an implemented strategy because it is operating as anticipated, or because an implemented strategy is expected to be successful in the future with continuous operation. (B) *Switching*: a decision to alter the implementation of a currently active implemented strategy, with a different strategy. Switching occurs when an implemented regulatory strategy is not operating as anticipated, and a different regulatory strategy is expected to operate more successfully. (C) *Stopping*: a decision to cease the operation of an actively implemented strategy, and halt regulation altogether. Stopping can occur in cases when an actively implemented strategy reaches its goal such that regulation is no longer needed. Stopping can also occur when an implemented strategy is not operating as anticipated, but none of the other available strategy options is deemed to be more successful. Whether deciding to maintain, switch, or stop regulating, the downstream effects of adequate monitoring decisions should ultimately lead to adaptive outcomes.

Congruent with the scope of this review, because this definition of regulatory monitoring highlights decision making (Sheppes et al., 2015; see also Gross, 2015, Gross et al., 2019), I focus here on studies where active choice can be identified. This definition precludes relevant important studies that assess neural underpinnings of maintaining strategies across time (e.g., Kalisch, 2009; Paret et al., 2011), studies assessing the effects of forced switching between strategies (e.g., Trask & Sigmon, 1999; Yoon & Joormann, 2012), and studies that examine self-reported regulatory switching (e.g., Kalokerinos, Résibois, Verduyn, & Kuppens, 2017), which cannot determine the operation of an active choice process.

The application of our conceptual framework (Sheppes, 2014; Sheppes & Levin, 2013) to regulatory monitoring follows the same aforementioned logic, where monitoring decisions should be dictated by maximization of the benefits over costs of different regulatory options across contexts. Empirical testing of regulatory monitoring involves instructing participants to implement a regulatory strategy, followed by making a decision to maintain, switch or stop regulating, followed by implementation of the chosen strategy (see Fig. 1D for more details).

At present, empirical evidence for regulatory monitoring remains limited. In a first pioneer study, Birk and Bonanno (2016) examined the influence of physiological internal intensity on regulatory monitoring decisions to maintain versus switch between attentional disengagement and engagement meaning change. Congruent with the aforementioned costs of meaning change with increasing intensity (Shafir et al., 2015), it was found that higher physiological negative intensity during meaning change implementation that demonstrates unsuccessful regulation predicted an increased selection to switch to attentional disengagement. In addition, this study found that the more individuals preferred to switch from unsuccessful meaning change as negative intensity increased, the higher their self-reported well-being was.

A recent study in our lab has investigated the role of external negative intensity on regulatory monitoring decisions to switch versus maintain attentional disengagement and meaning change, and the neuro-affective consequences of these monitoring decisions (Dorman-Ilan, Shafir, Birk, Bonanno, Sheppes, under review). Congruent with our conceptual framework and prior regulatory selection findings (e.g., Sheppes et al., 2011), we predicted and found that, in high intensity, when individuals are instructed to implement meaning change (i.e., the nonpreferred regulatory option for this intensity), they strongly prefer to switch to attentional disengagement. In low intensity, when individuals are instructed to implement attentional disengagement (i.e., the nonpreferred regulatory option in this intensity), they strongly prefer to switch to meaning change. Neuro-affective consequences of these monitoring decisions showed that in high intensity selecting attentional disengagement (either via switching to it from meaning change, or via deciding to maintain attentional disengagement following its implementation) resulted in strong modulation of neural negative intensity (stronger LPP modulation).

While preliminary studies in the regulatory monitoring space provide important empirical extension to our conceptual framework, more studies investigating all decision elements (e.g., when individuals select to stop regulating), and studies on various determinants (e.g., cognitive, motivational, individual differences, social, cultural) and underlying mechanisms (e.g., implicit, explicit) are critically needed.

4.3.3 Regulatory identification

Of the four central regulatory stages, regulatory identification involves making the most fundamental decision, described in Hamlet's language: to regulate or

not to regulate! Only after an identification decision to regulate has been made, subsequent regulatory selection, regulatory implementation and regulatory monitoring stages come into being.

Congruent with the scope of this review, because the definition of regulatory identification highlights decision making (Sheppes et al., 2015; see also Gross, 2015, Gross et al., 2019), I focus in this review on studies where an active choice can be identified. This definition precludes relevant important studies that map individual differences of abilities that are related to regulatory identification, such as emotional awareness (e.g., Coffey, Berenbaum, & Kerns, 2003), emotional differentiation (e.g., Barrett, Gross, Christensen, & Benvenuto, 2001), emotional clarity (e.g., Gratz & Roemer, 2004), beliefs about emotion regulation (e.g., Ford & Gross, 2019), and attitudes towards emotion (e.g., Markovitch, Netzer, & Tamir, 2017).

Applying our conceptual framework (Sheppes, 2014; Sheppes & Levin, 2013) to regulatory identification follows the same aforementioned logic according to which identification decisions would be determined by maximization of the benefits over costs of different regulatory options relative to not regulating. Testing regulatory identification empirically involves showing a short preview of emotional stimuli to participants, followed by making a decision whether to regulate or not regulate, followed by implementation of the chosen option (see Fig. 1A for more details).

To date, empirical evidence for regulatory identification remains modest. One set of influential studies, showed the strong effects of defaults on regulatory identification decisions (Suri et al., 2015). Specifically, one default group of participants were provided with a no-regulation default while watching negative images. This no regulation default could be changed to regulation by actively deciding to press a keyboard button. A second no-default group were shown the same negative images, but they were forced to make a choice between not regulating and regulating their emotions.

Results showed that, when individuals are put in a default state of not regulating their emotions, they show strong inertia effects, manifested in sticking with the no regulation option on most trials (Suri et al., 2015). However, it bears noting that while the default effect is highly potent, it is also very general. Specifically, when the default option was set to regulation, individuals showed equally strong inertia effects, manifested in sticking with the regulation option on most trials. Accordingly, the inertia effect may not reveal individuals' preferences regarding regulating their emotions versus not regulating.

In a recent set of studies performed in our lab, we investigated in two emotional contexts (negative pictorial stimuli or electric shocks), the role of external emotional intensity (high, low), and regulation strategy (whether a no regulation option was paired with attentional disengagement or with meaning change), on regulatory identification decisions (Amit, Schwartz, Bachar-Avnieli, Tamir, & Sheppes, under review).

Congruent with our conceptual framework arguing that attentional disengagement is highly effective in high intensity situations (Sheppes, 2014; Sheppes & Levin, 2013), we found that the preference to regulate (over not regulating) was evident only in a unique combination of conditions that included high intensity of personally relevant (electric shocks) emotional events, when participants had the option to regulate via attentional disengagement.

While supportive, two things struck us about these findings. First, even in the unique combination of conditions where individuals preferred to regulate, they still selected to not regulate their emotions on approximately one-third of the trails. In plain words, even when individuals faced a very intense personally relevant electric shock threat, and although they were given a highly effective attentional disengagement regulatory option, individuals still decided to allow their feelings on a significant portion of trials. Second, individuals did not show any signs of preferring to regulate via meaning change, even when facing horrific high intensity mutilation images or when facing high intensity shocks. A potential explanation for this latter puzzle was provided recently in a study showing that part of the reason individuals prefer to allow their feeling rather than select meaning change is related to the cognitive effort associated with meaning change (Milyavsky et al., 2019, Studies 1,2).

Studies in regulatory identification are sparse. One important future direction involves better understanding why in many potent affective situations individuals select not to regulate their emotions. Additional support is also needed for central determinants (e.g., motivational, individual social, cultural), underlying mechanisms, and neural underpinnings of regulatory identification.

4.3.4 Interactions between regulatory stages

Inherent to many conceptual accounts of emotion regulation is the notion that regulatory stages interact (Bonanno & Burton, 2013; Gross, 2015; Gross et al., 2019; Sheppes et al., 2015; Webb, Schweiger Gallo, et al., 2012).

Most of these models highlight feed forward interacting relationships that include a temporal sequence dependency. Specifically, the initial regulatory identification decision to regulate leads to a regulatory selection decision between available strategies, which leads to actual implementation of a chosen strategy, which leads to regulatory monitoring decisions to stop, switch from, or maintain an actively implemented strategy. Despite the importance of these feed forward relationships, descriptions of how these interactions actually pan out remain vague, and most existing evidence is of regulatory stages studied in isolation.

As opposed to feed forward relationships, feed backward interacting relationships that include reverse relationships between regulatory stages are also described. One prominent example of a reverse relationship is between the two mostly studied regulatory stages: regulatory implementation and preceding regulatory selection. This reversed relationship is described as how the ability to implement a particular strategy, predicts selecting it more often.[3]

Indirect conceptual theorizing comes from a recent framework that describes the relationship between regulatory implementation ability and between self-reported strategy usage frequency (Silvers & Moreira, 2019 for a review). This framework delineates potential relationships between brain regions active during regulatory implementation (prefrontal cognitive control regions and modulated limbic brain regions) and between self-reported strategy frequency usage.

Despite these clearly important conceptual links, existing empirical studies with adults fail to show consistent relationships between neural regulatory implementation ability and between self-reported strategy usage frequency (e.g., Giuliani, Mann, Tomiyama, & Berkman, 2014; Guassi Moreira, Parkinson, & Silvers, 2017; but see Ford et al., 2017, who found in a relationship between self-reported regulatory implementation ability and strategy frequency usage).

As I indicated above, self-reported frequency is not a direct proxy of regulatory selection, because it does not include any assessment of an active choice that is central for this regulatory stage. To fill this gap, in a recent

[3] A cautionary note should be made regarding strong directionality claims between regulatory stages. In general, it is impossible to reach definite conclusions about temporal ordering and causality from a finding reporting a positive relationship between two regulatory stages. However, some insights into likely temporal ordering can be obtained by ruling out reversed relationships. For example, longitudinal studies can examine whether regulatory implementation ability at time N predicts strategy usage frequency at time $N + 1$, and whether a reversed directionality does not (see Ford, Karnilowicz, & Mauss, 2017). Lab studies can also examine whether neural regulatory ability predicts regulatory selection, and whether a model of the reversed relationship does not (Schwartz et al., in preparation).

study in our lab, we directly tested whether neural regulatory implementation ability predicts behavioral regulatory selection (Schwartz, Fine, Hendler, Gonen, & Sheppes, in preparation).

In this study, we had participants perform a neuroimaging study that assessed their neural ability to implement attentional disengagement and engagement meaning change when exposed to high and low negative intensity images. Following the neuroimaging study, participants performed our behavioral regulatory selection paradigm, where they selected between attentional disengagement and meaning change to downregulate the influence of high and low intensity negative images. The main outcome measure in the neural regulatory implementation task was the degree of amygdala modulation, which is perhaps the mostly studied neural marker of successful implementation (Buhle et al., 2014 for review). The main outcome measure in the behavioral regulatory selection task was the percentage of regulatory choice.

Consistent with our conceptual model (Sheppes & Gross, 2011, 2012) and with some prior neuroimaging studies (e.g., Silvers et al., 2014) we found in the regulatory implementation task that attentional disengagement (but not meaning change) was associated with clear amygdala modulation. Furthermore, higher amygdala modulation during attentional disengagement implementation predicted choosing more attentional disengagement in the regulatory selection paradigm. Additional tentative evidence that is congruent with our framework (Sheppes & Levin, 2013) showed that the relationship between amygdala modulation during attentional disengagement and between selecting attentional disengagement was particularly evident in high intensity, where attentional disengagement's affective benefits are most profound.

While providing initial evidence for the interaction between regulatory stages, future studies are clearly needed. It appears crucially important to map potential interactions between all four basic regulatory stages. Clear evaluation of each regulatory stage and relationships between stages can provide a regulatory profile for individuals that can help understand strengths and weaknesses of emotion regulation abilities, which can help personalize and fine-tune interventions that target the improvement of emotion regulation. Current efforts in our lab include mapping this entire fascinating regulatory stage space.

5. CODA: Emotion regulation is here to stay

With increasing growth and impact across academic fields of psychology, as well as outside the academia, emotion regulation's stock has been on

a steep rise. Like any vibrant and maturing field, alongside enthusiasm, challenges appear. Among these challenges, a "good & bad" problem, dichotomizes regulatory strategies to adaptive and maladaptive camps, and a "here & now" problem, narrowly focuses on online implementation and immediate consequences of regulatory strategies. Facing the "good & bad" challenge includes better understanding underlying mechanisms of regulatory strategies that yield differential cost-benefit strategy profile. Facing the "here & now" problem, involves carefully mapping a complex space that includes core regulatory stages that precede and follow regulatory implementation.

Of existing regulatory stages, regulatory selection, which includes choosing between available strategies in accordance with differing situational demands, has received increased coverage and attention. Studies on regulatory monitoring and regulatory identification are beginning to emerge, together with an understanding that linking between stages is an important future goal. With these understandings in hand, and with constant elaborations, it may be safe to say that emotion regulation is not only here, there and everywhere, rather emotion regulation is here to stay!

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