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EMOTION REGULATION EFFECTIVENESS: SIXTEEN STRATEGIES IN THE DAILY
LIVES OF ESTONIANS DURING COVID-19

Master's thesis

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Emotion Regulation Effectiveness: Sixteen Strategies in the Daily Lives of Estonians During COVID-19

Abstract

Emotion regulation is a central aspect of mental and physical health. To improve health we must understand emotion regulation strategies are effective. However, previous studies of emotion regulation are not always consistent. This thesis addresses this issue by investigating 16 regulation strategies via the experience sampling method in a sample of randomly selected 314 Estonians. Results show six emotion regulation strategies (sport, other, relaxation, substances, reconstrual, and socialisation) are associated with hedonistically desirable change in emotion and perceived success. This study is important because it highlights further gaps in the literature of emotion regulation and how future research would greatly benefit from standardised and validated ESM items which also explore the specific contexts where emotion regulation strategies are used.

Keywords: emotion regulation, emotion, experience sampling method, effectiveness

Emotsiooni Regulatsiooni Tõhusus: Kuusteist Strateegiat Eestlaste Igapäevaelus COVID-19 Ajal

Lühikokkuvõte

Emotsiooni regulatsioon on vaimse ja füüsilise tervise keskne osa. Tervise edendamiseks peame me mõistma, millised emotsiooni regulatsiooni strateegiad on tõhusad. Samas varasemad emotsiooni regulatsiooni uuringud ei ole alati kooskõlalised. Käesolev uurimistöö uurib seda ebakõla 16 erineva emotsiooni regulatsiooni strateegiaga kogemuse väljavõtte meetodi abil 314 juhuslikult valitud eestlaste näitel. Tulemused näitavad kuus emotsiooni reguleerimise strateegiad (sport, muu, lõdvestus, ained, ümbermõtestamine ja sotsiaalne tugi), mis on seotud hedooniliselt soovitava emotsiooni muutusega ja mida tajutakse edukana. See uuring on oluline, sest see toob esile uued lüngad emotsiooni reguleerimise kirjanduses ning kuidas tulevane teadustöö võiks panustada standardiseeritud ja valideeritud kogemuste väljavõtte meetodi küsimustiku loomisesse, mis uurib ka spetsiifilisi kontekste, kus emotsiooni reguleerimise strateegiaid kasutatakse.

Märksõnad: emotsiooni regulatsioon, emotsioon, kogemuse väljavõtte meetod, tõhusus

Emotion Regulation Effectiveness: Sixteen Strategies in the Daily Lives of Estonians During COVID-19

Emotion regulation (ER) is a core aspect of mental and physical health (Brans et al., 2013; Cloitre et al., 2019; Low et al., 2021). To improve health, we must understand what emotion regulation strategies are effective for influencing the emotions we have, when we have them, how we experience, and express them (Gross, 1998). Previous studies have found that ER strategies such as rumination (Aldao et al., 2010; Lennarz, et al., 2019; Lincoln et al., 2022), avoidance (Aldao et al., 2010; Lincoln et al., 2022), and suppression (Aldao et al., 2010; Hu et al., 2014; Lincoln et al., 2022) are positively linked with mood disorders such as anxiety, depression or bipolar disorder. While ER strategies such as acceptance (Aldao et al., 2010; Azizi et al., 2018), reappraisal (Aldao et al., 2010; Hu et al., 2014), and problem solving (Aldao et al., 2010; Compas et al., 2017) are negatively linked with psychopathology.

ER also impacts physical health. In an observational study, Wilson et al (2017) found that sleep-deprived couples that used cognitive reappraisal and emotion expression had lower levels of inflammation than sleep-deprived couples who did not. Additionally, a recent nationally representative COVID-19 lockdown study showed that rumination and suppression predict poorer health while cognitive reappraisal may be protective (Low et al., 2021). A couple of studies have also found associations between cardiovascular health and ER: Butler et al (2003) reported mixed results but concluded that more often than not, emotion suppression was linked with higher blood pressure, and finally in a literature review of 135 papers (Balzarotti et al., 2017) cardiac vagal control has been found to be an objective marker for emotion regulation.

Furthermore, studies show that individual differences in the use of emotion regulation strategies predict self- and peer-rated ability of interpersonal sensitivity, prosocial tendencies, the proportion of positive vs. negative peer nominations, and reciprocal friendship nominations (Lopes et al., 2005). Preliminary results also show that emotion regulation also contributes to some, but not all aspects of professional job performance (Brackett & Salovey, 2006). Ergo, the importance of ER cannot be understated for social and professional functioning (Brans, 2013).

Emotion regulation from laboratory to real life

Traditionally, the vast majority of emotion regulation has been studied via global retrospective self-report questionnaires linking emotion regulation habit with general affect (Aldao, 2010), or laboratory studies which had an important part in uncovering potential causal relationships and even biological underpinnings (Webb et al, 2012; Boemo et al, 2023).

However, the vast majority of evidence for the effects of different ER strategies has been collected with methods which have the advantage of ease or precision but may cause artefacts of method such as biased recall or context specificity, and thus lack ecological validity (Brans et al., 2013; Aldao et al., 2010; Hiekkaranta et al., 2023). This concern for ecological validity is justified by studies that show how global reports are not always accurate - trait measures may only modestly correlate with ER in daily life (Brockman et al., 2017; Koval et al., 2023; Ludwig et al., 2020). As a specific contrary example, Rottweiler (2018) found that anxiety suppression actually improved mood in students anticipating an exam, while distraction only improved mood in non-exam contexts. Furthermore, Boemo et al (2023) found, contrary to prior laboratory studies, an association between reappraisal and positive affect, but not the expected association with negative affect. Finally, one can make this idea explicit if one were to look at uncommon situations of emotion suppression. Emotion suppression might be entirely appropriate when holding back laughter during a funeral, alternatively during a HORIZON project meeting with a tempestuous italian, or for a therapist who needs to seem non-judgemental with a volatile client. This incongruence in ER strategy use (Aldao et al., 2015, Burton & Bonnano, 2013) leads us to the need to measure ER effectiveness in the full complexity of daily life (Colombo et al., 2020).

Experience Sampling Method

One answer to these methodological difficulties is a method known as experience sampling (ESM), which increases ecological validity by addressing the fundamental problem of needing to measure emotion regulation in the natural environment in which it is experienced. ESM offers in the real world and in close-to real time assessments of emotion which reduce retrospective biases of memory and affect while staying clear of the artificiality that accompanies inducing emotion in a laboratory setting (Myin-Germeys & Kuppens, 2022). First developed by Csikszentmihalyi, Prescott and Larson (Csikszentmihalyi et al., 1977;

Larson & Csikszentmihalyi, 1983), ESM has come a long way, and has since been used among various populations such as non-clinical, clinical (Ludwig et al., 2020), adolescent (Silva et al., 2018), college aged (Brockman et al., 2017), adult (Liu et al., 2021), elderly (Livingstone & Isaacowitz, 2021), and across various phenomena such as psychosis (Ludwig et al., 2020), resilience (Lyu et al., 2017), interpersonal relations (Tran et al., 2024), video gaming and flow (Kaye et al., 2018), PTSD (Gaher et al., 2014) to even using the ESM method as part of treatment in depression (Kramer et al., 2014; von Klipstein et al., 2023);

ESM has also been successfully harnessed to study emotion regulation. In a recent systematic review and meta-analysis of 37 ESM studies, with no apparent publication bias, Boemo et al., (2022) found:

... significant large effect sizes in contemporaneous relations between negative affect (NA) and rumination, suppression, and worry, and in both contemporaneous and prospective relations between positive affect (PA) and reappraisal; medium effect sizes in prospective relations between NA and rumination, and PA and distraction; and a small effect size in the prospective relation between NA and suppression. (p.1)

Furthermore, in a unique 40 emotion regulation strategy study, Heiy & Cheavens (2014) concluded that strategies that serve to maintain or intensify negative emotions such as self-blame and generalising are rarely included in studies of emotion regulation, yet frequently used, and most importantly significant predictors of mood following use. They also noted how the average number of strategies (15) used is larger than the typical number of strategies studied. ESM studies have thus documented significant effects of many strategies often overlooked in laboratory or self-report studies. For example, Tschacher & Lienhard (2021) observed how mindfulness is associated with reduced negative affect. Furthermore, in exploring non-cognitive emotion regulation strategies such as exercise, ESM studies also show how engaging in physical activity increases positive affect (Guérin et al., 2013; Wichers et al., 2012). Additionally, in line with the self-medication hypothesis, research indicates that alcohol consumption is linked to decreased nervousness (Swendsen et al., 2000).

Goals of this thesis

The primary goal of this exploratory study is to evaluate the effectiveness of multiple ER strategies using frequency, emotion change and perceived success. Emotion change as

self-reported emotions pre-and post regulatory attempts, and perceived success as the self-reported success of used emotion regulation strategies. Statistically describe ER strategies (nothing, alcohol & drugs, eating, overeating, nicotine, other, relaxation, sport, express, professional, suppress, acceptance, situation, reconstrue, repurpose, distract, social) and analyse their effect on multiple affective states (anger, anxiety, happiness, calm, stress, fatigue, sadness) in the naturalistic setting of daily life. The objectives of my thesis were thus to investigate the following 2 questions:

How often are different strategies selected?

To understand emotion regulation effectiveness it's necessary to analyse frequency of strategy use. Frequency should in part reflect that the more effective a strategy has been in the past the more likely it is that it is used again. However, past studies report mixed results: citing ease of use and context as factors too (Brans et al., 2013; English et al., 2017; Heiy & Cheavens, 2014; Nezlek & Kuppens, 2008).

What strategies are effective for emotion regulation?

For understanding effectiveness I have operationalized it in two additional ways: emotion change and perceived success of emotion regulation. Operationalisations which raise the question how do these markers of effectiveness compare - is there a mismatch between reported success and emotion change?

Method

Sample

Out of the regionally representative stratified random sample of 20 000 participants (aged 15 or older) from the Estonian National Mental Health Study (EMHS) a subsample was invited to participate in a validation study (n=3698) (Laidra et al., 2023). Having met the criteria for the validation study (completing the EMHS wave 1, good command of Estonian, valid email address, and access to a smartphone with internet access), a further subsample of 2698 participants received an invite to participate in the ESM study (Laidra et al., 2023). Among the invited 322 fulfilled the initial selection criteria. Of the remaining 322, 8 (2.5%)

participants were excluded for not meeting analysis criteria: as they gave incomplete or incoherent answers, or due to technical errors such as two assessments within 10 minutes, or an anxiety score that exceeded intended scale size. The final sample size became 314 individuals with whom the data analysis was conducted.

Measurement

The experience sampling questionnaire (Table 1) measured emotions and emotion regulation strategies with 5 prompts per day for 7 days. In total, 35 prompts to 314 valid participants suggests a theoretical maximum of 10 990 assessments. However, due to actual adherence the number of ESM assessments was reduced down to 6639 (60%). Once a day the participants were also asked to report on their sleep quality (including bedtime), alcohol intake, physical activity, and to also make an assessment of their general health.

Table 1. EMS questionnaire, adapted from Laidre et al. (2023)

Item	Response options
At this moment how strongly do you feel...	
<i>Mark on each row how strongly do you currently experience one or more of these feelings</i>	
1	joyful, excited
2	satisfied, relaxed
3	worried, anxious
4	sad, disappointed
5	irritated, angry
6	tense, stressed
7	tired, listless
8	What are your current feelings related to? Choose all relevant options.
	a. An ongoing situation b. An earlier situation c. A situation in the future d. Same situation I mentioned in the previous prompt e. Work or studies f. Spending leisure time g. Close relationships h. Other relationships i. COVID-19 j. Celebrating something k. Eating l. Something else/ hard to say
9	What have you tried to do to make yourself feel better? Mark all strategies you have used since the previous prompt.
	a. I haven't tried anything b. I suppressed my feelings c. I acted out my feelings d. I solved problems causing these emotions e. I busied myself with something to take my mind off my troubles f. I thought how things are not as bad as they initially seemed g. I thought about how bad things can be good for something h. I accepted that things are as they are i. I meditated or did relaxation exercises j. I was physically active or worked out k. I smoked l. I consumed alcohol or other drugs m. I ate or snacked on something n. I ate more than I would have liked o. I sought emotional support from my loved ones p. I sought professional help or support r. I did something else: _____
10	Have these techniques made you feel any better?
11*	How well did you sleep last night?
12*	What time did you go to bed last night?
13*	What time did you wake up this morning?
14*	How many minutes did you engage in moderate to high physical activity yesterday? (f.e. Practised sports, worked out or went for a walk so that it made you sweat or gasp lightly)
14*	Insert minutes _____
15*	How many minutes did you engage in light physical activity yesterday? (f.e. slow-paced walk or cycling/bike ride)
15*	Insert minutes _____
16*	Did you consume alcoholic beverages yesterday?
16*	Yes / No
17*	How do you assess your health at the moment?
17*	Very bad ----- Very good (7-point scale)

Note. * Items included only in the first prompt of each day. ** Options covered 15-min periods from 8 pm to 3 am for item 12, and from 5 am to 12 pm for item 13; for times outside these periods, it was possible to enter the exact time as free text. Adapted from Laidra, K., Reile, R., Havik, M., Leinsalu, M., Murd, C., Tulviste, J., ... & Konstabel, K. (2023). Estonian National Mental Health Study: Design and methods for a registry-linked longitudinal survey. *Brain and Behavior*, 13(8), e3106.

Procedure

The participants were enrolled in the study on 04.05.2021-28.06.2021. They received an invitation with a personalised study link via email to the formr platform (<https://formr.org>; 2). Where they were informed about the study details, asked to give informed consent and leave contact information. Up to two reminders were sent via e-mail in the case of no response two and three weeks after the initial invitation. A week after consent and registration, the ESM subsample received an SMS reminder instructing them to fill out a emotion regulation strategies questionnaire (same items as in the ESM study) for the first time a day before the study, which although not pertinent for the study, may have influenced the following data collection by exposing participants to emotion regulation strategies. For the next 7 consecutive days 5 times per day participants were prompted randomly once per a 90-minute time slot between 9 am and 9 pm (09.00–10.30, 11.30–01.00, 02.00–03.30, 04.30–06.00, 07.00–08.30) for the experience sampling method. Each prompt was open for an hour.

Data Analysis

For data analysis RStudio version R 4.1.2 was used. Emotions were recoded for clarity: joyful, excited = Happy, satisfied, relaxed = Calm, worried, anxious = Anxiety sad, disappointed = Sadness, irritated, angry = Angry, tense, stressed = Stress, tired, listless = Fatigue. Also a strategy was recoded: use of alcohol & drugs = Substance. Statistical methods used included descriptive statistics, correlation analysis, linear mixed effects regression, structural equation modelling (latent change score; LCS). LCS modelling (Kievit et al., 2018) was used to estimate the change in pre- and post regulatory affective states. Latent change score modelling allows researchers to capture and quantify changes over time by estimating latent variables representing the initial level of emotion and the change in emotion over time. Emotions have both trait-like (stable individual differences) and state-like (temporary fluctuations) components. Latent change score modelling allows for the separation of these components, enabling researchers to focus specifically on the change in emotion that occurs over time while controlling for stable individual differences in baseline emotion levels.

Results

In the analyses I will first describe the overall distribution of affective states participants experienced, I will then describe the correlation and frequency of ER use, followed by different markers of effectiveness: perceived success and latent change score of emotion.

Descriptive Statistics of Emotions

The percentage distribution of positive and negative emotion intensity. Calm (89%) was the emotion with the highest proportion of non-zero values, then happiness (83%), fatigue (66%), stress (58%), anxiety (50%), sadness (32%), and anger (24%).

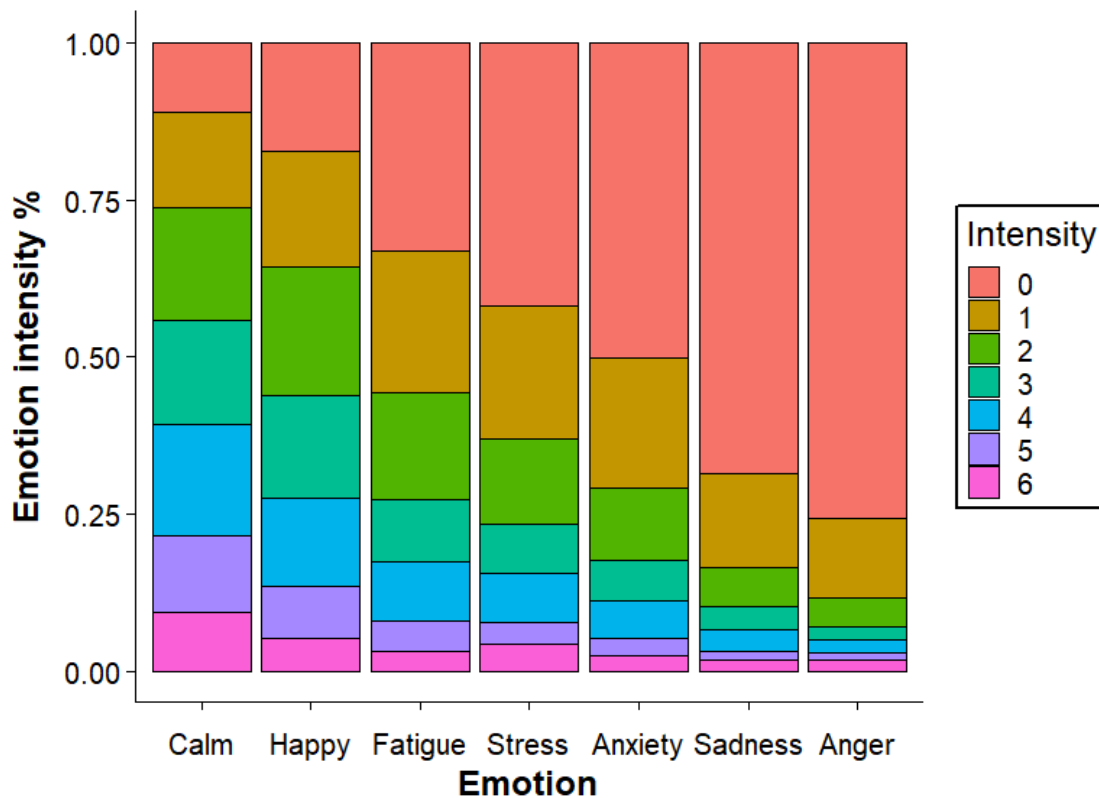


Figure 1. Percentual frequency of emotion intensity. *Note.* Intensity = “How strongly do you feel ...?”

Average intensity of emotions mapped for each day of the week shows that as the weekend approaches positive emotions tend to increase and negative emotions tend to decrease.

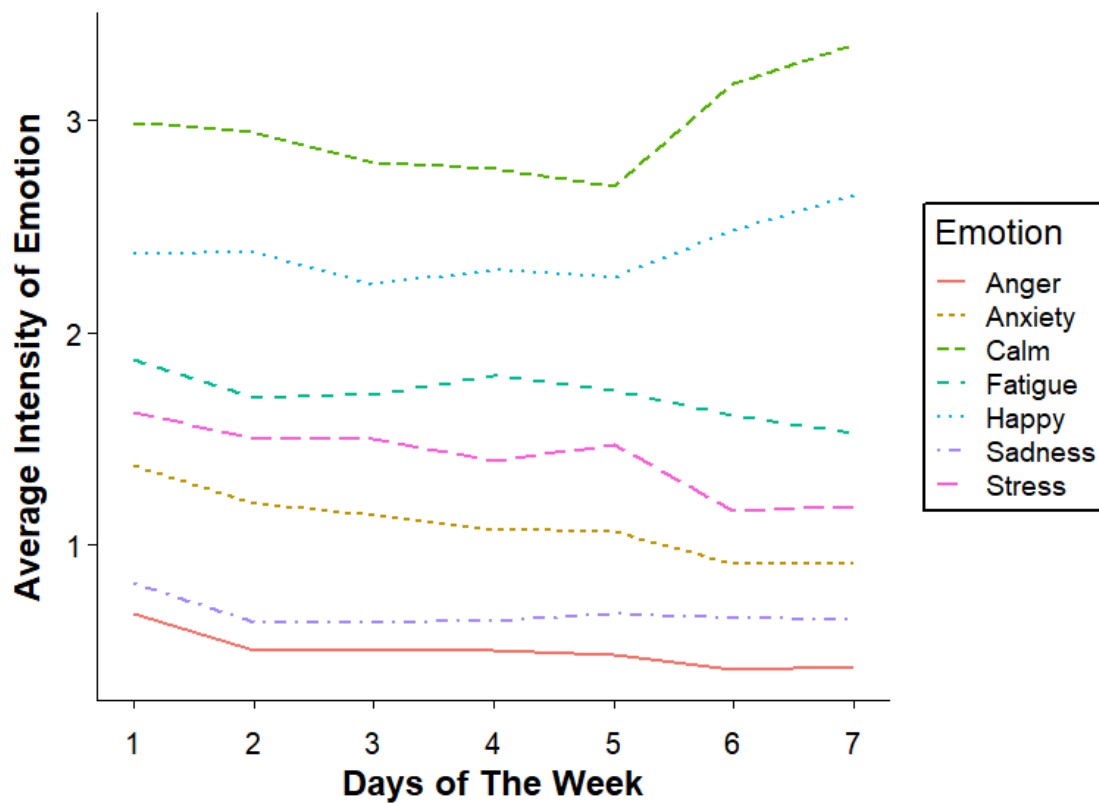


Figure 2. Average emotion intensity change within a week

Spearman correlation of emotions in Figure 3, not accounting for repeated assessments, presents the typical valence dimensions of positive and negative emotions. Happy and Calm are moderately correlated using (.53) and negatively correlated with Stress, Fatigue, Anxiety, Sadness, and Anger (in the range of $-.15$ to $-.31$).

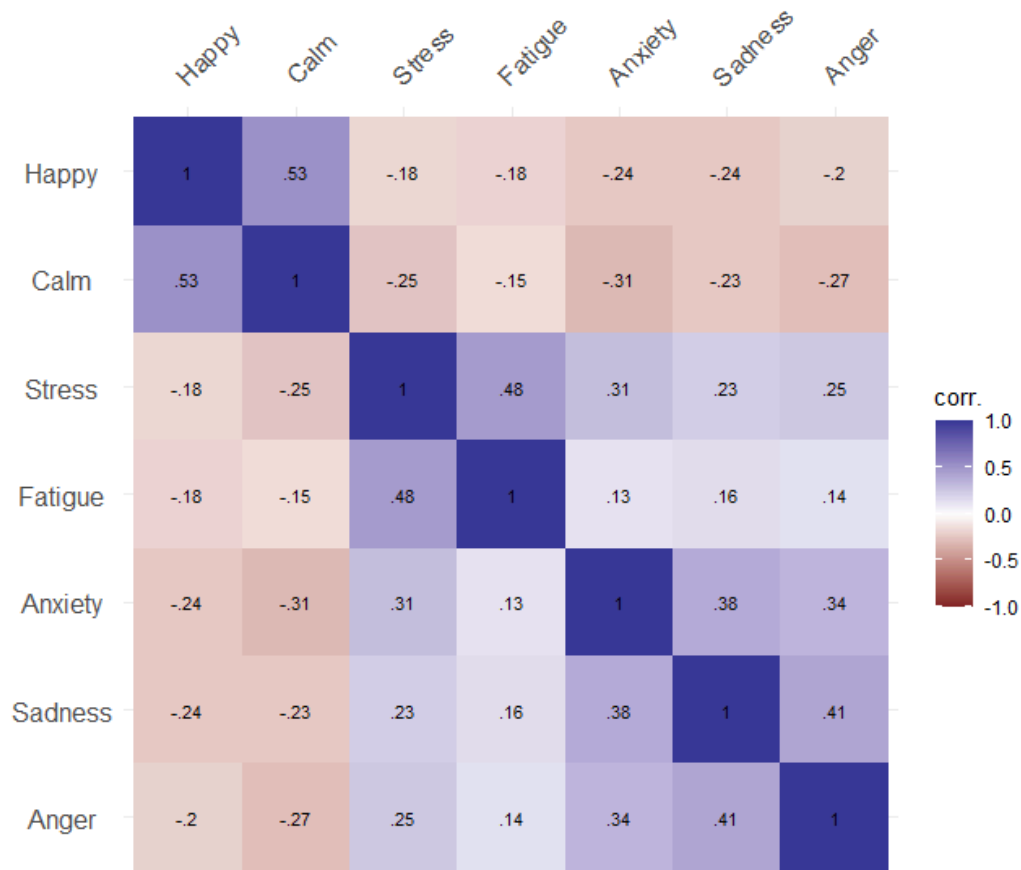


Figure 3. Spearman correlation matrix of positive and negative emotions

Frequency of Emotion Regulation Strategies

The number of times 314 participants used various emotion regulation strategies was summarised in Figure 4. Choosing not to regulate was the #1 most common course of action (N = 2930, 23%), followed by Distract (N = 1569, 12.3%), Accept (N = 1564, 12.3%), Sport (N = 1065, 8.4%), Problem solving (N = 997, 7.8%), Other (N = 941, 7.8%), Reconstruct (N = 602, 4.7%), Suppress (N = 594, 4.7%), food (N = 574, 4.5%), Repurpose (N = 359, 2.8%), Express (N = 356, 2.8%), Nicotine (N = 320, 2.5%), Social (N = 317, 2.5%), Relaxation (N = 262, 2.1%), Overeat (N = 115, 0.9%), Substance use (N = 110, 0.9%), and getting Professional help (N = 64, 0.5%).

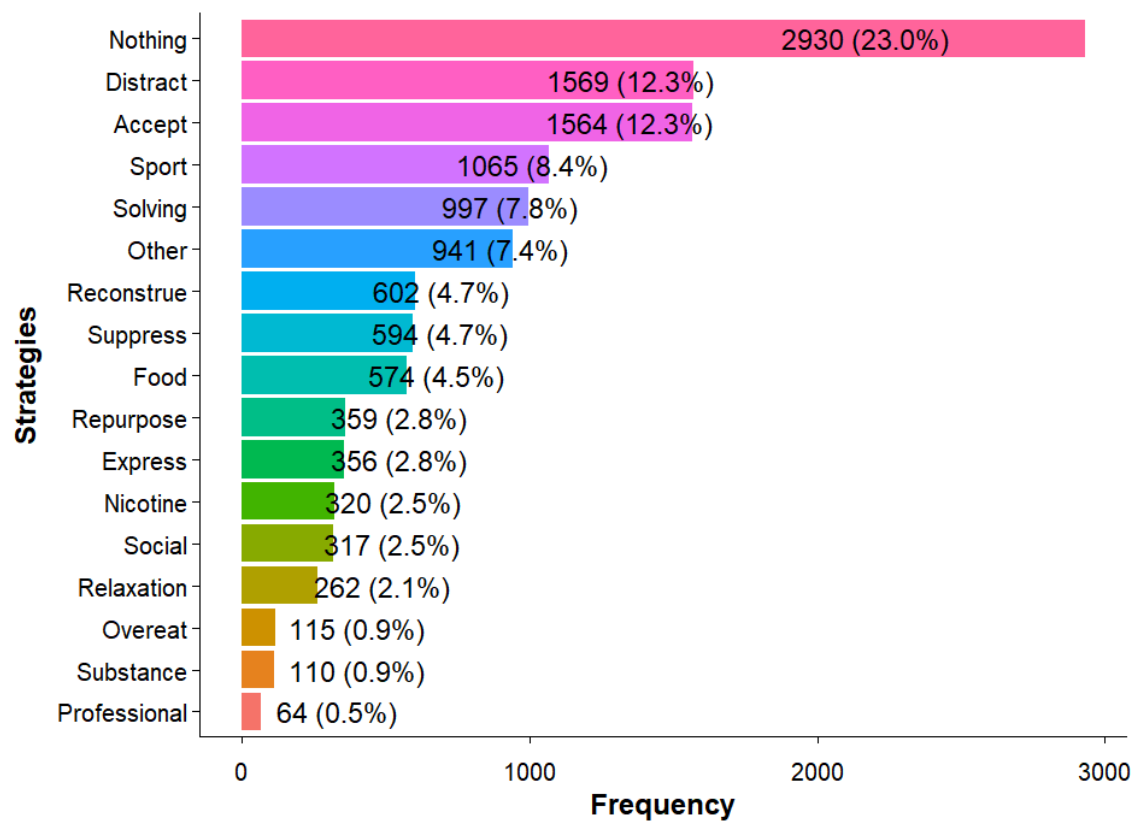


Figure 4. Frequency and percentage of emotion regulation strategies.

Correlation of Emotion Regulation Strategies

Tetrahoric correlation of emotion regulation strategies was calculated, not accounting for repeated assessments, in Figure 5. The three highest correlations were between conceptually related strategies such as repurpose and reconstrue ($r = .67$), eating and overeating ($r = .51$), expressing emotions and seeking professional help ($r = .52$). The three highest negative correlation are between: distraction and doing nothing ($r = -.62$), expressing emotion and doing nothing ($r = -.55$), Solving problems and doing nothing ($r = -.53$)

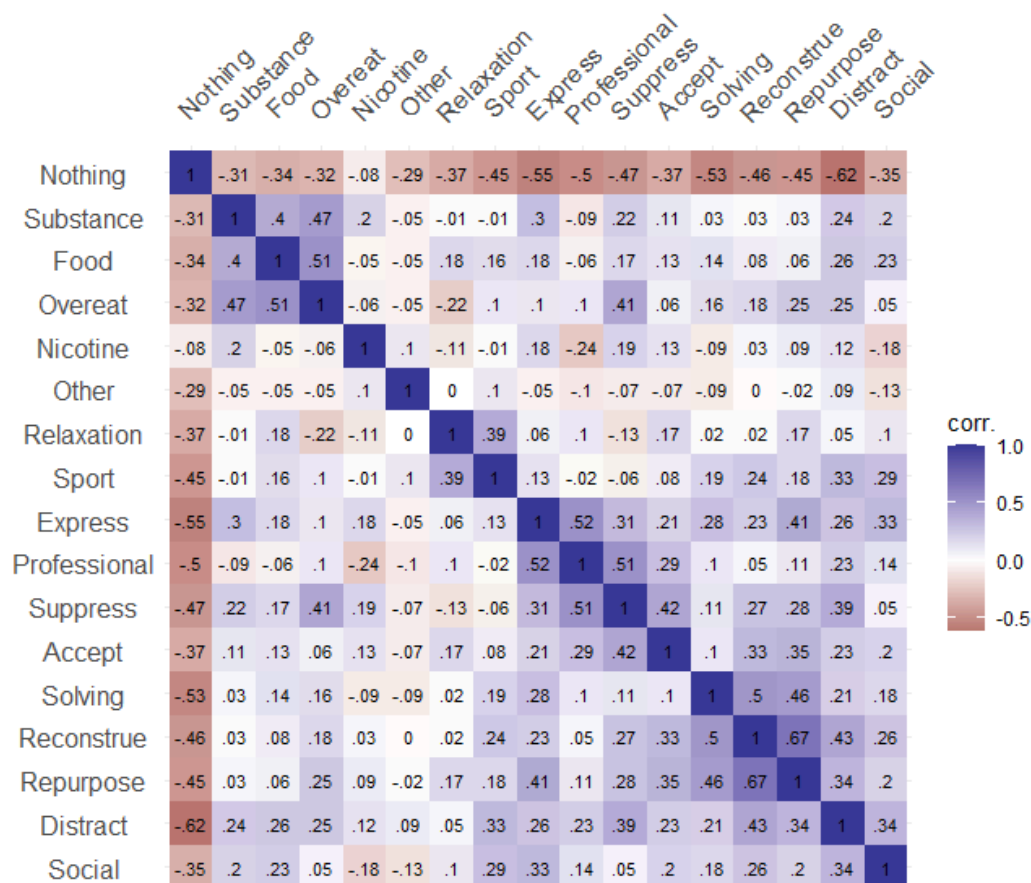


Figure 5. Correlation matrix of emotion regulation strategies.

Self-Reported Effectiveness of Emotion Regulation Strategies

In the linear mixed-effects regression analysis, subjectively reported regulation success was regressed on 16 emotion regulation strategies while accounting for the repeated assessments of individual participants. Results showed that subjectively experienced success in emotion regulation was positively related to using Sport ($\beta = 0.55$, 95% CI [0.45,0.65], $p < 0.001$), seeing a Professional ($\beta = 0.54$, 95% CI [0.16,0.92], $p = 0.005$), Other ($\beta = 0.43$, 95% CI [0.32,0.54], $p < 0.001$), Relaxation ($\beta = 0.42$, 95% CI [0.23,0.62], $p < 0.001$), Social ($\beta = 0.27$, 95% CI [0.11,0.42], $p = 0.001$), Substance (alcohol and drugs) ($\beta = 0.27$, 95% CI [0.01,0.53], $p = 0.043$), Reconstruct ($\beta = 0.21$, 95% CI [0.08,0.33], $p = 0.001$), Distraction ($\beta = 0.18$, 95% CI [0.09,0.27], $p < 0.001$), Repurpose ($\beta = 0.10$, 95% CI [-0.05,0.25], $p = 0.189$), Food ($\beta = 0.08$, 95% CI [-0.05,0.20], $p = 0.229$), Solving (of problems) ($\beta = 0.04$, 95% CI [-0.06,0.15], $p = 0.429$). However subjectively experienced success in emotion regulation was negatively related to expressing emotions ($\beta = -0.04$, 95% CI [-0.18,0.10], $p =$

0.585), Accepting emotions ($\beta = -0.19$, 95% CI $[-0.29,-0.10]$, $p < 0.001$), Smoking ($\beta = -0.24$, 95% CI $[-0.49,0.01]$, $p = 0.055$), Emotion suppression ($\beta = -0.64$, 95% CI $[-0.77,-0.50]$, $p < 0.001$), and Overeating ($\beta = -0.73$, 95% CI $[-0.97,-0.48]$, $p < 0.001$). The model yielded a marginal R-squared of 0.091, conditional R-squared of 0.53.

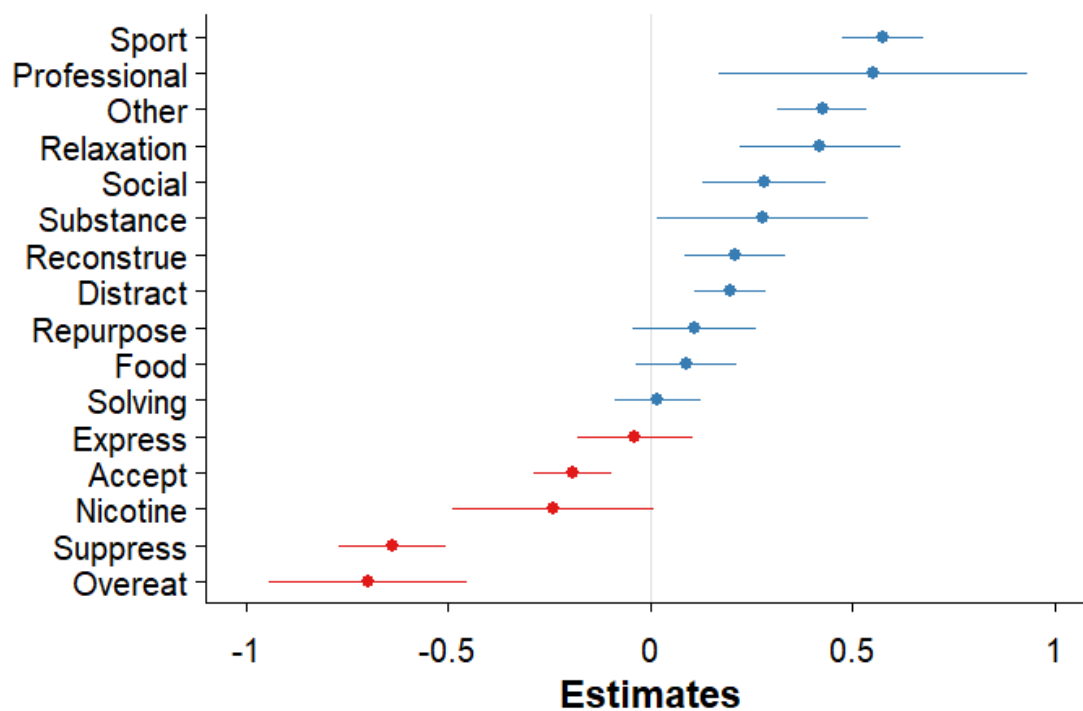


Figure 6. Coefficients from mixed linear regression of perceived ER success.

Emotion change via latent change score

Latent change score models were used to evaluate the effect of strategies on the change of affective states on subsequent assessments. Accounting for repeated assessments, average emotional intensity changes were calculated for each emotion regulation strategy. For brevity, only significant results are reported. In Table 1 latent change score results show strategies that significantly associated with increased emotions were: Happiness - Sport ($\beta = 0.27$, $p < 0.000$), Social support ($\beta = 0.37$, $p = 0.005$) and Substance (alcohol & drugs) ($\beta = 0.38$, $p = 0.041$); Calm - Sport ($\beta = 0.45$, $p < 0.000$); Fatigue - emotion Suppression ($\beta = 0.39$, $p = 0.001$), Overeat ($\beta = 0.36$, $p = 0.036$), seeking Professional help ($\beta = 0.59$, $p = 0.006$); Stress - emotion Suppression ($\beta = 0.64$, $p < 0.000$), Nicotine ($\beta = 0.41$, $p = 0.011$); Anxiety -

Suppress ($\beta = 0.62, p < 0.000$), Overeating ($\beta = 0.54, p = 0.005$); Sadness - Express emotion ($\beta = 0.41, p = 0.002$), Overeating ($\beta = 0.36, p = 0.015$), emotion Suppression ($\beta = 0.70, p < 0.000$); Anger - emotion Suppression ($\beta = 0.61, p < 0.000$), emotion Expression ($\beta = 0.46, p < 0.000$). Strategies that were significantly associated with decreased emotions: Happiness - Suppress ($\beta = -0.47, p < 0.000$) and Overeat ($\beta = -0.39, p = 0.003$); Calm - Solving ($\beta = -0.22, p = 0.008$), emotion Suppression ($\beta = -0.59, p < 0.000$); Fatigue - Sport ($\beta = -0.13, p = 0.035$), Relaxation ($\beta = -0.29, p = 0.031$), Substances ($\beta = -0.38, p = 0.049$); Stress - Nothing ($\beta = -0.16, p = 0.002$), Sport ($\beta = -0.29, p < 0.000$), Other ($\beta = -0.25, p < 0.000$), Substances ($\beta = -0.40, p = 0.017$); Anxiety - Nothing ($\beta = -0.25, p < 0.000$), Sport ($\beta = -0.25, p < 0.000$), Other ($\beta = -0.15, p = 0.028$), Relaxation ($\beta = -0.18, p = 0.046$), Substances ($\beta = -0.27, p = 0.039$); Sadness - Nothing ($\beta = -0.09, p = 0.025$), Sport ($\beta = -0.15, p < 0.000$), Reconstruct ($\beta = -0.16, p = 0.019$), Substances ($\beta = -0.36, p < 0.000$); Anger - Sport ($\beta = -0.15, p < 0.000$), Nothing ($\beta = -0.12, p = 0.016$);

Table 2. Frequency, self-reported success, and latent change scores of emotions for emotion regulation strategies.

ERS	Freq	Success	Fatigue	Stress	Anxiety	Sadness	Anger	Happy	Calm
Nothing - I haven't tried anything	0.23	NA	-0.08	-0.16**	-0.25***	-.09*	-0.12*	0.03	0.03
Distract - I busied myself with something to take my mind off my troubles	0.12	0.19***	0.01	0.13*	0.10	0.11	-0.01	0.05	0.04
Accept - I accepted that things are as they are	0.12	-0.19***	0.08	0.01	0.04	0.05	-0.05	0.13	0.06
Sport - I was physically active or worked out	0.08	0.57***	-0.13*	-0.29***	-0.25***	-0.15***	-0.15***	0.27***	0.45***
Solving - I solved problems causing these emotions	0.08	0.49	-0.01	0.11	0.10	-0.05	-0.05	-0.04	-0.22**
Other - I did something else	0.07	0.42***	0.02	-0.25***	-0.15*	-0.07	-0.11*	0.03	0.06
Suppress - I suppressed my feelings	0.05	-0.63***	0.39***	0.64***	0.62***	0.70***	.61***	-0.47***	-0.59***
Reconstrue - I thought how things are not as bad as they initially seemed	0.05	0.21***	-0.11	-0.03	-0.02	-0.16*	-0.03	0.03	0.04
Food - I ate or snacked on something	0.05	0.08	-0.06	0.02	-0.10	-0.04	-0.06	0.05	0.12

Table 2. Frequency, self-reported success, and latent change scores of emotions for emotion regulation strategies (Continued).

ERS	Freq	Success	Fatigue	Stress	Anxiety	Sadness	Anger	Happy	Calm
Repurpose - I thought about how bad things can be good for something	0.03	-0.69	0.14	0.19	0.10	0.01	0.04	0.12	0.26
Express - I acted out my feelings	0.03	-0.03	0.06	0.10	0.22	0.41**	0.46***	0.00	0.02
Social - I sought emotional support from my loved ones	0.03	0.28***	0.06	-0.00	0.17	0.07	-0.02	0.37**	0.24
Nicotine - I smoked	0.03	-0.24	0.08	0.41*	0.33	0.21	0.22	0.07	-0.18
Relaxation - I meditated or did relaxation exercises	0.02	0.42***	-0.29*	-0.11	-0.18*	-0.11	-0.07	0.19	0.27
Overeat - I ate more than I would have liked	0.01	-0.69***	0.36*	0.34	0.54**	0.36*	-0.00	-0.39**	-0.27
Alco Drugs - I consumed alcohol or other drugs	0.01	0.27*	-0.38*	-0.40*	-0.27*	-0.36***	-0.17	0.38*	0.22
Professional - I sought professional help or support	0.01	0.55**	0.59**	0.32	0.34	0.35	0.25	0.09	-0.08

Note. ERS = Emotion regulation strategy; Freq = Frequency of ERS; Success = self-reported ER success; Fatigue, Stress, Anxiety, Sadness, Anger, Happy and Calm = change scores for specific emotions per ER strategy. Signif. denoted: ‘***’ $p < 0.001$ ‘**’ $p < 0.01$ ‘*’ $p < 0.05$.

Discussion

The purpose of this thesis was to gain an understanding of the usage and effectiveness of 16 emotion regulation strategies. To that end I explored the frequency of ER strategies and compared markers of emotion regulation effectiveness. This thesis also addresses the limitations of previous studies of emotion regulation by evaluating the effectiveness of multiple ER strategies via multiple operationalisations, and using a method of analysis which addresses the shortcomings of difference scores.

The first frequency analysis revealed that the most used strategies are in a descending order: no regulation, distraction, acceptance, sport, problem solving, other, reconstrue, suppressing, food, repurpose, express, nicotine, social, relaxation, overeat, alcohol & drugs, and seeking professional help. In the second analysis I aimed to investigate how participants perceived the success of ER strategies. The most successful strategies were in a descending order: sport, seeing a professional, other, relaxation, social, alcohol & drugs, reconstrual, distraction, repurpose, food, and problem solving. And the most unsuccessful strategies were in an ascending order: expressing emotions, accepting emotions, smoking, emotion suppression, and overeating. In the third analysis, LCS modelling found positive emotions are predicted by sport, socialisation, alcohol & drugs, whereas strategies that predict decrease of positive affect are nicotine, overeating, seeing a professional, emotion suppression, and problem solving. Furthermore, strategies that predict negative affect are: suppression and expression of emotion, smoking, overeating, and seeing a professional. Lastly, strategies that predict decrease of negative affect are: nothing, sport, other, reconstrue, relaxation, and alcohol & drugs. Finally, cross-referencing these aforementioned results revealed six strategies to be congruent with perceived success and with hedonically aligned emotions: sport, other, relaxation, substances (alcohol & drugs), reconstrual, and socialisation. In the following I will discuss four of the most impactful results & their implications.

Sport

Whereas past research Heiy & Cheavens (2014) has found exercise to be the 17th strategy among 20 for a sample of students, the present study shows physical activity to be the 4th most common strategy among 16, which is counterintuitive because how resource intensive it is compared to cognitive strategies (Brans et al., 2013). A possible interpretation is that the

mood enhancing effects of exercise are sufficiently reliable and overcome the perceived cost of engaging in physical activity. However, the discrepancy between studies may be due to a number of other factors. Such as differences in sample demographics, incomparable selection of ER strategies, or because the wording of the item is less strict: “*I was physically active or I worked out*” versus “*I exercised*”. One could also assume it is the contextual influence of COVID-19 in the current study, however this is not supported by the evidence, as a literature review of physical activity during COVID-19 summarising 64 studies reported an overall decline in physical activity. However, in line with past research (Guérin et al., 2013; Hachenberger et al., 2023), these results also show that physical activity is significantly associated with substantially increased positive affect and decreased negative affect. Furthermore, in this study, subjects perceive it as the most successful emotion regulation strategy. Although the health and mood enhancing benefits of exercise are well known, future ER research could benefit from an increased emphasis on a broader definition, standardised and validated measure of physical activity to determine if these results replicate and if the known cognition enhancing effects of exercise (Basso & Suzuki, 2017) also improve the efficacy of cognitive ER strategies.

Suppression

Suppression was the 6th most used strategy in our sample and more frequent than forms of reappraisal (reconstruction and repurposing), a pattern which is consistent with previous literature (Brans et al., 2013; Brockman et al., 2017; Heiy & Cheavens, 2014). Current and past research have also indicated suppression to be a strategy that is highly unsuccessful (Heiy & Cheavens, 2014), anti-hedonic (Boemo et al., 2022), and associated with psychopathology (Aldao et al., 2010). I posit this may indicate that emotional suppression is rather a lack of affordances in the environment for dealing constructively with experienced emotions, and not a lack of ER ability, because the awareness of regulation failure seems conscious - a rational agent would not persist in using something unsuccessful. Future ER research could be well served to investigate why and in which contexts suppression is used despite its anti-hedonic effect and futility as an ER strategy.

Reconstruction

Reconstruction (“*I thought how things are not as bad as they initially seemed*”) was the 7th most frequent ER strategy. In line with previous studies of reappraisal, in our sample, a form of

reappraisal was also used less than acceptance (Wenzel et al., 2023). Which is coherent with the ease of use hypothesis by Brans et al. (2013), since acceptance requires less cognitive effort than reappraisal. Although reappraisal in traditional research is associated with reduced negative affect, newer ESM studies show an association with positive affect instead (Boemo et al., 2022). Even so, the present study did not replicate the expected association with positive affect, but instead showed a small significant negative association with sadness which is in line with traditional research. Boemo et al. (2022) posited that ER strategies may only be associated with only 1 type of affective experience due to the valenced nature of emotions, but the sport, suppression, and substance use effects in the present study are associated with the experienced both negative and positive emotions. Future research could elucidate how these differences come into being.

No Regulation

Contrary to a previous studies (Heiy & Cheavens, 2014; Lennarz et al., 2019; Wylie et al., 2023) which show that no regulation happens rarely (close to two percent of prompts), the present study shows that participants chose not to regulate their emotions for nearly a quarter of the prompts. In this study no regulation is significantly associated with reduction in negative affect across multiple emotions. Results from this study also show that positive affect increases and negative affect decreases during the weekends when most people do not work (See Figure 2). Generally, positive emotions do not need to be regulated, ergo it follows that future research could investigate if choosing not to regulate is a marker of person-environment fit.

Limitations

There are at least four potential limitations concerning the results of this study. The first limitation is the fact that ESM reduces but does not eliminate the shortcomings of self-reported data. Participants may still have blindspots concerning their behaviour, and may still be motivated to answer dishonestly due to the social desirability (Koval, 2024). A second potential limitation is that not all emotion regulation attempts are necessarily conscious (Brans, et al 2013) nor consciously accounted for - as seen in the 5th most popular strategy named "Other" in the present study. The third potential limitation is that standardised ESM items to assess emotion regulation are currently not available, which makes comparison between studies challenging. The fourth potential limitation is omitted variable bias - there is

little information about unassessed variables that might meaningfully alter results (Rottweiler, 2018).

Conclusion

Although the generality of the current results must be confirmed by future research, the present explorative study has provided converging evidence for sport, other, relaxation, substances (alcohol & drugs), reconstrual, and socialisation being effective emotion regulation strategies in achieving desirable affective consequences. Furthermore, analysis provided strong statistical evidence that emotion suppression, despite being the 6th most used strategy, offers none of the mood change or perceived regulation success that would be considered hedonically desirable. All of which leads us to a number of interesting avenues for future research.

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References

- Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review, 30*(2), 217–237. <https://doi.org/10.1016/j.cpr.2009.11.004>
- Arslan, R. C., Walther, M. P., & Tata, C. S. (2020). formr: A study framework allowing for automated feedback generation and complex longitudinal experience-sampling studies using R. *Behavior Research Methods, 52*, 376–387. <https://doi.org/10.3758/s13428-019-01236-y>
- Azizi, A., Mohammadkhani, P., Pourshahbaz, A., Doulatshahi, B., & Moghaddam, S. (2018). Role of Emotion Regulation in Psychopathology. *Iranian Rehabilitation Journal,*

- 16(2), 113–120. <https://doi.org/10.32598/irj.16.2.113>
- Balzarotti, S., Biassoni, F., Colombo, B., & Ciceri, M. R. (2017). Cardiac vagal control as a marker of emotion regulation in healthy adults: A review. *Biological Psychology, 130*, 54–66. <https://doi.org/10.1016/j.biopsycho.2017.10.008>
- Basso, J. C., & Suzuki, W. A. (2017). The Effects of Acute Exercise on Mood, Cognition, Neurophysiology, and Neurochemical Pathways: A Review. *Brain Plasticity, 2*(2), 127–152. <https://doi.org/10.3233/BPL-160040>
- Boemo, T., Nieto, I., Vazquez, C., & Sanchez-Lopez, A. (2022). Relations between emotion regulation strategies and affect in daily life: A systematic review and meta-analysis of studies using ecological momentary assessments. *Neuroscience & Biobehavioral Reviews, 139*, 104747. <https://doi.org/10.1016/j.neubiorev.2022.104747>
- Brackett, M. A., & Salovey, P. (2006). Measuring emotional intelligence with the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT). *Psicothema, 18 Suppl*, 34–41.
- Brans, K., Koval, P., Verduyn, P., Lim, Y. L., & Kuppens, P. (2013). The regulation of negative and positive affect in daily life. *Emotion (Washington, D.C.), 13*(5), 926–939. <https://doi.org/10.1037/a0032400>
- Brockman, R., Ciarrochi, J., Parker, P., & Kashdan, T. (2017). Emotion regulation strategies in daily life: Mindfulness, cognitive reappraisal and emotion suppression. *Cognitive Behaviour Therapy, 46*(2), 91–113. <https://doi.org/10.1080/16506073.2016.1218926>
- Cloitre, M., Khan, C., Mackintosh, M.-A., Garvert, D. W., Henn-Haase, C. M., Falvey, E. C., & Saito, J. (2019). Emotion regulation mediates the relationship between ACEs and physical and mental health. *Psychological Trauma: Theory, Research, Practice, and Policy, 11*(1), 82–89. <https://doi.org/10.1037/tra0000374>
- Colombo, D., Fernández-Álvarez, J., Suso-Ribera, C., Cipresso, P., Valev, H., Leufkens, T.,

- Sas, C., Garcia-Palacios, A., Riva, G., & Botella, C. (2020). The need for change: Understanding emotion regulation antecedents and consequences using ecological momentary assessment. *Emotion, 20*(1), 30–36. <https://doi.org/10.1037/emo0000671>
- Compas, B. E., Jaser, S. S., Bettis, A. H., Watson, K. H., Gruhn, M., Dunbar, J. P., Williams, E., & Thigpen, J. C. (2017). Coping, Emotion Regulation and Psychopathology in Childhood and Adolescence: A Meta-Analysis and Narrative Review. *Psychological Bulletin, 143*(9), 939–991. <https://doi.org/10.1037/bul0000110>
- Csikszentmihalyi, M., Larson, R., & Prescott, S. (1977). The ecology of adolescent activity and experience. *Journal of Youth and Adolescence, 6*(3), 281–294. <https://doi.org/10.1007/BF02138940>
- English, T., Lee, I. A., John, O. P., & Gross, J. J. (2017). Emotion regulation strategy selection in daily life: The role of social context and goals. *Motivation and Emotion, 41*(2), 230–242. <https://doi.org/10.1007/s11031-016-9597-z>
- Gaher, R. M., Simons, J. S., Hahn, A. M., Hofman, N. L., Hansen, J., & Buchkoski, J. (2014). An experience sampling study of PTSD and alcohol-related problems. *Psychology of Addictive Behaviors, 28*(4), 1013–1025. <https://doi.org/10.1037/a0037257>
- Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2*(3), 271–299. <https://doi.org/10.1037/1089-2680.2.3.271>
- Guérin, E., Fortier, M. S., & Sweet, S. N. (2013). An Experience Sampling Study of Physical Activity and Positive Affect: Investigating the Role of Situational Motivation and Perceived Intensity Across Time. *Health Psychology Research, 1*(2), e21. <https://doi.org/10.4081/hpr.2013.e21>
- Hachenberger, J., Teuber, Z., Li, Y.-M., Abkai, L., Wild, E., & Lemola, S. (2023). Investigating associations between physical activity, stress experience, and affective wellbeing during an examination period using experience sampling and

accelerometry. *Scientific Reports*, *13*(1), 8808.

<https://doi.org/10.1038/s41598-023-35987-8>

Heiy, J. E., & Cheavens, J. S. (2014). Back to basics: A naturalistic assessment of the experience and regulation of emotion. *Emotion*, *14*(5), 878–891.

<https://doi.org/10.1037/a0037231>

Hiekkaranta, A. P., Kirtley, O. J., Eisele, G., Houben, M., Lafit, G., & Myin-Germeys, I. (2023). Time to reappraise or distract? Temporal and situational context in emotion regulation in daily life. *Current Psychology*.

<https://doi.org/10.1007/s12144-023-05233-5>

Hu, T., Zhang, D., Wang, J., Mistry, R., Ran, G., & Wang, X. (2014). Relation between Emotion Regulation and Mental Health: A Meta-Analysis Review. *Psychological Reports*, *114*(2), 341–362. <https://doi.org/10.2466/03.20.PR0.114k22w4>

Kaye, L. K., Monk, R. L., Wall, H. J., Hamlin, I., & Qureshi, A. W. (2018). The effect of flow and context on in-vivo positive mood in digital gaming. *International Journal of Human-Computer Studies*, *110*, 45–52. <https://doi.org/10.1016/j.ijhcs.2017.10.005>

Kievit, R. A., Brandmaier, A. M., Ziegler, G., van Harmelen, A.-L., de Mooij, S. M. M., Moutoussis, M., Goodyer, I. M., Bullmore, E., Jones, P. B., Fonagy, P., Lindenberger, U., & Dolan, R. J. (2018). Developmental cognitive neuroscience using latent change score models: A tutorial and applications. *Developmental Cognitive Neuroscience*, *33*, 99–117. <https://doi.org/10.1016/j.dcn.2017.11.007>

Koval, P., Kalokerinos, E. K., Greenaway, K. H., Medland, H., Kuppens, P., Nezlek, J. B., Hinton, J. D. X., & Gross, J. J. (2023). Emotion regulation in everyday life: Mapping global self-reports to daily processes. *Emotion*, *23*(2), 357–374.

<https://doi.org/10.1037/emo0001097>

Kramer, I., Simons, C. J., Hartmann, J. A., Menne-Lothmann, C., Viechtbauer, W., Peeters,

- F., Schruers, K., Bemmels, A. L., Myin-Germeys, I., Delespaul, P., Os, J., & Wichers, M. (2014). A therapeutic application of the experience sampling method in the treatment of depression: A randomized controlled trial. *World Psychiatry, 13*(1), 68–77. <https://doi.org/10.1002/wps.20090>
- Laidra, K., Reile, R., Havik, M., Leinsalu, M., Murd, C., Tulviste, J., Tamson, M., Akkermann, K., Kreegipuu, K., Sultson, H., Ainsaar, M., Uusberg, A., Rahno, J., Panov, L., Leetmaa, K., Aasa, A., Veidebaum, T., Lehto, K., & Konstabel, K. (2023). Estonian National Mental Health Study: Design and methods for a registry-linked longitudinal survey. *Brain and Behavior, 13*(8), e3106. <https://doi.org/10.1002/brb3.3106>
- Larson, R., & Csikszentmihalyi, M. (1983). The experience sampling method. *New Directions for Methodology of Social & Behavioral Science*. <https://psycnet.apa.org/record/1984-00092-001>
- Lennarz, H. K., Hollenstein, T., Lichtwarck-Aschoff, A., Kuntsche, E., & Granic, I. (2019). Emotion regulation in action: Use, selection, and success of emotion regulation in adolescents' daily lives. *International Journal of Behavioral Development, 43*(1), 1–11. <https://doi.org/10.1177/0165025418755540>
- Lincoln, T. M., Schulze, L., & Renneberg, B. (2022). The role of emotion regulation in the characterization, development and treatment of psychopathology. *Nature Reviews Psychology, 1*(5), Article 5. <https://doi.org/10.1038/s44159-022-00040-4>
- Liu, D. Y., Strube, M. J., & Thompson, R. J. (2021). Interpersonal Emotion Regulation: An Experience Sampling Study. *Affective Science, 2*(3), 273–288. <https://doi.org/10.1007/s42761-021-00044-y>
- Livingstone, K. M., & Isaacowitz, D. M. (2021). Age and emotion regulation in daily life: Frequency, strategies, tactics, and effectiveness. *Emotion (Washington, D.C.), 21*(1),

39–51. <https://doi.org/10.1037/emo0000672>

Lopes, P. N., Salovey, P., Côté, S., & Beers, M. (2005). Emotion Regulation Abilities and the Quality of Social Interaction. *Emotion*, *5*(1), 113–118.

<https://doi.org/10.1037/1528-3542.5.1.113>

Low, R. S. T., Overall, N. C., Chang, V. T., Henderson, A. M. E., & Sibley, C. G. (2021).

Emotion regulation and psychological and physical health during a nationwide COVID-19 lockdown. *Emotion (Washington, D.C.)*, *21*(8), 1671–1690.

<https://doi.org/10.1037/emo0001046>

Ludwig, L., Mehl, S., Krkovic, K., & Lincoln, T. M. (2020). Effectiveness of emotion regulation in daily life in individuals with psychosis and nonclinical controls—An experience-sampling study. *Journal of Abnormal Psychology*, *129*(4), 408–421.

<https://doi.org/10.1037/abn0000505>

Lyu, M., Xi, J., & Luo, Y. (2017). Daily emotional characteristics in individuals with different resilience levels: Supplementary evidence from experience-sampling method (ESM).

Acta Psychologica Sinica, *49*(7), 928–940.

<https://doi.org/10.3724/SP.J.1041.2017.00928>

Nezlek, J. B., & Kuppens, P. (2008). Regulating Positive and Negative Emotions in Daily Life. *Journal of Personality*, *76*(3), 561–580.

<https://doi.org/10.1111/j.1467-6494.2008.00496.x>

Rottweiler, A.-L., Taxer, J. L., & Nett, U. E. (2018). Context Matters in the Effectiveness of Emotion Regulation Strategies. *AERA Open*, *4*(2), 2332858418778849.

<https://doi.org/10.1177/2332858418778849>

Silva, E., Freire, T., & Faria, S. (2018). Concurrent and Lagged Relations between Emotion Regulation and Affect in Adolescents' Daily Life. *The Spanish Journal of*

Psychology, *21*, E67. <https://doi.org/10.1017/sjp.2018.61>

Swendsen, J. D., Tennen, H., Carney, M. A., Affleck, G., Willard, A., & Hromi, A. (2000).

Mood and alcohol consumption: An experience sampling test of the self-medication hypothesis. *Journal of Abnormal Psychology, 109*(2), 198–204.

<https://doi.org/10.1037/0021-843X.109.2.198>

Tran, A., Greenaway, K. H., Kostopoulos, J., Tamir, M., Gutentag, T., & Kalokerinos, E. K.

(2024). Does interpersonal emotion regulation effort pay off? *Emotion, 24*(2),

345–356. <https://doi.org/10.1037/emo0001289>

Tschacher, W., & Lienhard, N. (2021). Mindfulness Is Linked with Affectivity in Daily Life:

An Experience-Sampling Study with Meditators. *Mindfulness, 12*(6), 1459–1472.

<https://doi.org/10.1007/s12671-021-01615-7>

von Klipstein, L., Servaas, M. N., Schoevers, R. A., van der Veen, D. C., & Riese, H. (2023).

Integrating personalized experience sampling in psychotherapy: A case illustration of the Therap-i module. *Heliyon, 9*(3), e14507.

<https://doi.org/10.1016/j.heliyon.2023.e14507>

Wenzel, M., Blanke, E. S., Rowland, Z., & Brose, A. (2023). The Costs and Benefits of

Mindfulness and Reappraisal in Daily Life. *Affective Science, 4*(2), 260–274.

<https://doi.org/10.1007/s42761-022-00178-7>

Wichers, M., Peeters, F., Rutten, B. P. F., Jacobs, N., Derom, C., Thiery, E., Delespaul, P., &

van Os, J. (2012). A time-lagged momentary assessment study on daily life physical activity and affect. *Health Psychology, 31*(2), 135–144.

<https://doi.org/10.1037/a0025688>

Wylie, M. S., Colasante, T., De France, K., Lin, L., & Hollenstein, T. (2023). Momentary

emotion regulation strategy use and success: Testing the influences of emotion intensity and habitual strategy use. *Emotion, 23*(2), 375–386.

<https://doi.org/10.1037/emo0001074>

- Pessoa, L (2019) Embracing integration and complexity: placing emotion within a science of brain and behaviour, *Cognition and Emotion*, 33:1, 55-60, DOI: 10.1080/02699931.2018.152007919
- Myin-Germeys, I., & Kuppens, P. (Eds.). (2022) *The open handbook of experience sampling methodology: A step-by-step guide to designing, conducting, and analyzing ESM studies* (2nd ed.). Leuven: Center for Research on Experience Sampling and Ambulatory Methods Leuven.
- Azizi, A., Mohammadkhani, P., Pourshahbaz, A., Doulatshhi, B., & Moghaddam, S. (2018). Role of Emotion Regulation in Psychopathology. *Iranian Rehabilitation Journal*, 16(2), 113-120.

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