

Effectiveness of Extrinsic Emotion Regulation Strategies in Text-Based Online Communication

Yuki Nozaki^{1,2} and Moira Mikolajczak³

¹ Department of Human Science, Faculty of Letters, Konan University

² Graduate School of Education, Kyoto University

³ Department of Psychology, UCLouvain

In daily life, others play a key role in helping regulate an individual's emotions. Such emotion regulation occurs not only in face-to-face communication but also in text-based online communication. To date, much research has examined strategies for alleviating one's own negative emotions (intrinsic emotion regulation) based on the process model of emotion regulation (Gross, 1998, 2015a). However, little is known about the effectiveness of the full range of strategies for alleviating others' negative emotions (extrinsic emotion regulation) derived from this model. This research aims to fill this gap. In study 1, participants wrote response letters to bogus pen pals who had recently experienced negative emotional events. Independent coders rated the effectiveness of these response letters in alleviating pen pal's negative emotions. In study 2, participants communicated with each other on an online forum by posting about distressing events and messages that attempted to alleviate another person's negative emotions. When participants received a reply to their posts, they rated its effectiveness in alleviating their negative emotions. The results of both studies consistently showed that strategies classified as reappraisal and empathic responding effectively alleviated others' negative emotions. Moreover, emotional intensity moderated the effectiveness of some extrinsic emotion regulation strategies. Specifically, problem-solving and reappraisal showed positive effects on the alleviation of relatively less intense negative emotions. However, these effects were neither positive nor negative in regulating relatively intense negative emotions. The present study offers novel insights into other-focused emotion regulation research by clarifying similarities and differences between intrinsic and extrinsic emotion regulation.

Keywords: emotion regulation, extrinsic emotion regulation, interpersonal emotion regulation, online communication, social support

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When they experience negative emotions, people often turn to others to help regulate these emotions (Barthel et al., 2018; Hofmann et al., 2016; Williams et al., 2018). This happens not only in face-to-face but also in online communication. For example, on

online forums, people offer text-based emotional support to one another (Doré et al., 2017). With the development of information technology, such digital emotion regulation plays a vital role in daily lives (Wadley et al., 2020).

Given this background, it is important to clarify how one can effectively regulate the negative emotions of others in text-based online communication. In emotion regulation theory, regulation of another person's emotions is called *extrinsic emotion regulation*¹, whereas regulation of one's own emotions is called *intrinsic emotion regulation* (Gross, 2015a; Hofmann, 2014; Zaki & Williams, 2013). The field of emotion regulation has primarily focused on intrinsic emotion regulation strategies (see Sheppes & Gross, 2013; Webb et al., 2012 for a review) based on the process model of emotion regulation (Gross, 1998, 2015a). In contrast, there is much room for further research on the effectiveness of extrinsic

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Yuki Nozaki  <https://orcid.org/0000-0001-6510-7827>

Moira Mikolajczak  <https://orcid.org/0000-0002-7333-1578>

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Correspondence concerning this article should be addressed to Yuki Nozaki, Department of Human Science, Faculty of Letters, Konan University, 8-9-1, Okamoto, Higashinada-ku, Kobe-shi, Hyogo 658-0072, Japan. Email: y_nozaki@konan-u.ac.jp

¹ Some researchers have used the term *interpersonal emotion regulation* when referring to regulation of another person's emotions (e.g., Niven et al., 2015). However, the term *interpersonal emotion regulation* has also been used when referring to regulation of one's own emotions (i.e., intrinsic emotion regulation) with the help of another person (e.g., Hofmann et al., 2016). To clarify that this research focuses on strategies for regulating others' emotions, we use the term *extrinsic emotional regulation* in this research.

emotion regulation strategies based on this model. Thus, this research aims to fill this gap to advance an emerging field of extrinsic emotion regulation research (Nozaki & Mikolajczak, 2020).

Emotion Regulation Strategies Based on the Process Model

The advantage of introducing a theoretical framework of emotion regulation into online communication research is that it provides a rationale for classifying various strategies for regulating emotions. The process model of emotion regulation can distinguish between families of emotion regulation strategies based on the point at which they primarily impact the emotion-generative process (Gross, 1998, 2015a; Yih et al., 2019). As shown in Figure 1, according to this model, the emotion generation process begins with the situation, which can be external or internal. Individuals attend to key aspects of the situation (e.g., having an important assignment to write). Subsequently, they appraise whether the perceived situation is good, bad, or irrelevant, given their desired state of the situation (e.g., the important assignment should be finished, so the current situation is bad). This valuation elicits an emotional response (e.g., anxiety and irritation) to prompt action to reduce the gap between their perception and the desired state of the world.

While the process model of emotion regulation has been widely used to investigate intrinsic emotion regulation, it can also be used to examine extrinsic emotion regulation (Nozaki & Mikolajczak, 2020; Reeck et al., 2016). Specifically, the regulator can suggest to the regulatee that they should select or change the situation, for example by *problem-solving* (situation selection/modification); try to direct the regulatee's attention away from an emotional situation, for example by *distraction* (attentional deployment); alter how the regulatee cognitively appraises a situation, for example by *reappraisal* (cognitive change); or directly influence the regulatee's emotion-related responses, for example by *suppression*, *relaxation*, or *empathic responding* (response modulation). Thus, the process model offers a useful vehicle for classifying extrinsic emotion regulation strategies.

Effectiveness of Extrinsic Emotion Regulation Strategies to Alleviate Negative Emotions

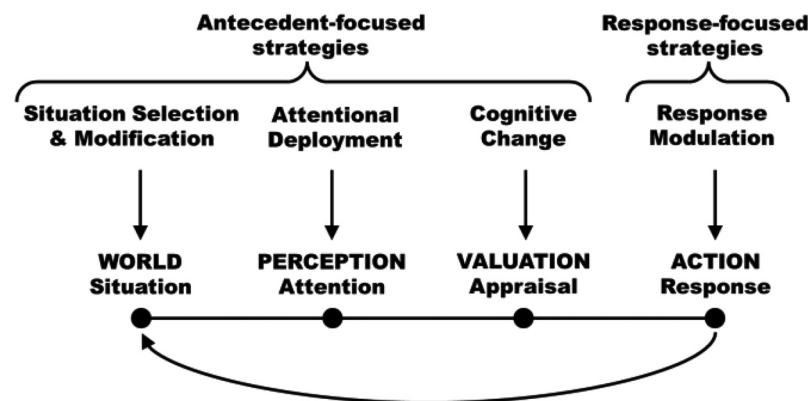
According to the accumulated findings regarding intrinsic emotion regulation, strategies coming earlier in the emotion-generative process, such as situation selection/modification, attentional deployment, or cognitive change, should be more effective for alleviating negative emotions than strategies coming later on, such as response modulation (Sheppes & Gross, 2013; Webb et al., 2012). This is because antecedent-focused strategies can alter the emotion generation process earlier than response-focused strategies (Gross, 1998).

Are antecedent-focused strategies more effective than response-focused strategies for extrinsic emotion regulation too? Compared to intrinsic emotion regulation, the effectiveness of extrinsic emotion regulation strategies has not yet been thoroughly examined. As an exception, Little et al. (2013) found that customer service representatives' situation modification (problem-solving) and cognitive change (reappraisal) are more effective in reducing customer-expressed negative emotions than response modulation (suppression and relaxation) in call centers. These results are consistent with the findings for intrinsic emotion regulation.

However, response modulation includes a variety of strategies that directly influence the regulatee's emotion-related responses (Sheppes & Gross, 2013). In the domain of extrinsic emotion regulation, there may be an additional form of response modulation that is not available in the domain of intrinsic emotion regulation. In particular, studies in relationship science have revealed the utility of *empathic responding* (O'Brien et al., 2009). Empathic responding refers to an action conveying understanding, validation, and caring, which has been alternatively called emotion-focused support (Cheung & Gardner, 2015), socio-affective support (Pauw et al., 2018; Rimé, 2009), or responsive behavior (Maisel et al., 2008; Reis & Gable, 2015). This strategy is regarded as an important facet of extrinsic emotion regulation strategies (Cheung & Gardner, 2015; Nozaki & Mikolajczak, 2020; Swerdlow & Johnson, 2022).

Previous research has suggested the positive effect of receiving empathic responding to alleviate negative emotions at least at that

Figure 1
The Process Model of Emotion Regulation



Note. This figure is adapted from "Better together: A unified perspective on appraisal and emotion regulation," by J. Yih, A. Uusberg, J. L., Taxer, & J. J., Gross, 2019, *Cognition and Emotion*, 33(1), p. 43 (<https://doi.org/10.1080/02699931.2018.1504749>). Copyright 2018 by Informa UK Limited, trading as Taylor & Francis Group. Adapted with permission.

point (Swordlow & Johnson, 2022) from a person in a close relationship (Maisel & Gable, 2009; Pauw et al., 2018) as well as from a stranger (Seehausen et al., 2012, 2016). As an exception, Nils and Rimé (2012) found that empathic responding is not effective for alleviating regulatee's negative emotions induced by watching a short video about the negative side of human nature. However, based on the aforementioned research, empathic responding is expected to work well, at least when more personal experiences cause negative emotions. We address this empirical research question in the context of text-based online communication.

Beyond their absolute effectiveness, the effectiveness of emotion regulation strategies can vary across situations. One notable example in intrinsic emotion regulation research is that emotional intensity moderates the effectiveness of cognitively taxing strategies such as reappraisal. Specifically, reappraisal is less successful in regulating one's own relatively intense negative emotions than relatively less intense negative emotions (Shafir et al., 2015). This is because reappraisal requires elaborate semantic processing, which is more difficult to implement when experiencing intense negative emotions (Sheppes et al., 2014). In the case of extrinsic emotion regulation, the regulatee also requires elaborate semantic processing to interpret the regulator's suggestions for reappraisal. Therefore, emotional intensity may also moderate the effectiveness of extrinsic emotion regulation strategies, especially reappraisal.

The Current Study

We investigated the effectiveness of extrinsic emotion regulation strategies in text-based online communication. Based on the accumulated findings in the field of intrinsic emotion regulation, we hypothesized that antecedent-focused strategies (e.g., problem-solving, distraction, and reappraisal) would be effective in alleviating others' negative emotions (Hypothesis 1). Moreover, based on the findings in relationship science research, we hypothesized that a form of response modulation strategy (i.e., empathic responding) would also be effective in alleviating others' negative emotions (Hypothesis 2). We also examined whether the regulatee's emotional intensity moderates the effectiveness of extrinsic emotion regulation strategies in study 2. Based on the findings in the field of intrinsic emotion regulation, we hypothesized that reappraisal would be less effective in alleviating other people's relatively intense negative emotions (Hypothesis 3).

To test these research hypotheses, study 1 used an extrinsic emotion regulation task, asking participants to write response letters to pen pals that felt negative emotions due to recent experiences. Independent coders coded response letters regarding the number of times participants used each of the extrinsic emotion regulation strategies and the effectiveness for alleviating pen pals' negative emotions, following previous research (e.g., Cheung & Gardner, 2015; Pekaar et al., 2019). Although this procedure offered novel findings, it could capture only a limited number of negative emotional event types. Moreover, it could not assess the regulatee's own effectiveness evaluation of extrinsic emotion regulation strategies. To address these limitations, study 2 asked participants to communicate on an online forum. This procedure enabled us to test whether the intensity of negative emotions moderates the effectiveness of extrinsic emotion regulation strategies by collecting various negative emotional events. It was also possible to collect data from both the regulators and regulatees.

As in previous research on extrinsic emotion regulation (e.g., Austin et al., 2014; Niven et al., 2015), we included age and gender as control variables for analyses. This is because several studies have suggested that female and older people have better extrinsic emotion regulation abilities (e.g., Niven, 2022; Niven et al., 2011; Nozaki, 2015). Moreover, we repeated the analyses without these control variables to check the robustness of the main findings.

Transparency and Openness

In the main text and [online supplemental material](#), we report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in studies 1 and 2. We follow journal article reporting standards for quantitative research in psychology (Appelbaum et al., 2018). All data, analysis codes, and research materials are available at <https://osf.io/xszde/> (Nozaki & Mikolajczak, 2021). Data were analyzed using R 4.1.3 (R Core Team, 2021). These studies' design and their analyses were not preregistered.

Study 1

Method

Participants

The participants were 360 people (180 men, 180 women, M age = 44.00, SD = 8.76) recruited via Cross Marketing Inc., a Japanese online survey company. Given that careless responding can reduce data quality, we embedded two direct accuracy-check items in the survey to identify careless respondents (Kam & Meyer, 2015). These items directed respondents to select the extreme response option on a scale (i.e., "Please select the leftmost response option for this item," and "Please select the rightmost response option for this item"). We also relied on an index of identical consecutive responses, which is another effective method for identifying careless respondents (Kam & Meyer, 2015). The online data collection company excluded data from people who did not correctly answer the two accuracy-check items or chose the same response options within a section.

We conducted a power analysis using the Monte Carlo simulation using the SIMR 1.0.2 package (Arend and Schäfer, 2019; Green and MacLeod, 2016) to determine the sample size. Based on this, we collected participants to detect small-to-medium effects (Level 1 direct effect: $\tau_{std} = .20$) at the level of .05, with a power of over .95 (see [online supplemental material 1](#) for detailed information on the power analysis).

Material and Procedure

Participants completed the extrinsic emotion regulation task used by Cheung and Gardner (2015). The materials were slightly changed to fit Japanese participants (e.g., city names). They were told that the experimenters were interested in developing a new "pen pal" type of social networking site and that they would take part in a pilot pen pal exchange. They were ostensibly paired with three pen pal buddies who had already written introductory letters to the participant and were asked to write a response letter to each pen pal. Each of the three bogus pen pals described a recent emotional event in their lives: feeling sad because her dog had passed

away, feeling anxious because she had recently been laid off and needed a job to support her child, and feeling happy because of the birth of his first grandchild (see [online supplemental material 2](#) for a full description of messages). The order was randomized across participants.

Following [Cheung and Gardner \(2015\)](#), participants wrote response letters to all three pen pals. However, because we were interested in extrinsic emotion regulation to alleviate negative emotions in this study, we focused on the responses to the first two pen pals (i.e., the pen pal feeling sad because her dog had passed away, and the pen pal feeling anxious because she had recently been laid off and needed a job to support her child) in the analyses². After that, participants answered several individual difference measures unrelated to the current research question (see [online supplemental material 3](#) for a full description of these individual difference measures). The procedure was approved by the Ethics Committee at the Graduate School of Education, Kyoto University.

Coding

Participants' letters were coded according to the type of extrinsic emotion regulation strategies and their effectiveness, following [Cheung and Gardner's \(2015\)](#) procedure. Two research assistants, who were blind to the study hypotheses, coded the number of times participants used each of the following strategies to regulate the pen pals' negative emotions.

Problem-Solving. Offering solutions and advice to improve the situation that elicits a regulatee's emotion (situation selection/modification in the process model).

Distraction. Trying to get the regulatee to engage in activities or think about other things to take their mind off the situation (attentional deployment in the process model).

Reappraisal. Trying to help the regulatee see their situation and ability in a different light, for instance, good aspects, different interpretations, and new perspectives (cognitive change in the process model).

Suppression. Saying the regulatee should suppress their current emotion (response modulation in the process model).

Relaxation. Telling the regulatee to relax, for example by taking a deep breath or getting some physical rest (response modulation in the process model).

Empathic Responding. Conveying understanding, validation, and caring for the regulatee's emotional experience (response modulation in the process model).

Coders were first explained the extrinsic emotion regulation task. Subsequently, they read each participant's response letter and counted the number of sentences in which the participants used each of the above strategies. One response letter could be coded as containing multiple different emotion regulation strategies because it consists of multiple sentences.

Interrater reliability was assessed using Gwet's AC₂ ([Gwet, 2008](#)). This coefficient is superior to traditional interrater reliability coefficients such as Cohen's κ because it overcomes the limitations of these coefficients and has better statistical properties ([Gwet, 2008, 2014](#)). Gwet's AC₂ was calculated using the irrCAC 1.0 package ([Gwet, 2019](#)). Interrater reliability was very good (Gwet's AC₂ = .98–1.00). Discrepancies in coding were resolved by a third independent coder, who was blind to the study hypotheses.

Moreover, 12 additional research assistants, who were blind to the study hypotheses, rated the effectiveness of each participant's response letters in regulating their pen pals' emotions. They were first explained the extrinsic emotion regulation task. They then rated how effective each participant's response letter was at alleviating pen pal's negative emotions on a five-point scale from 1 (*not at all effective*) to 5 (*extremely effective*). When rating each response letter, they were asked to consider how they would feel if they were in that pen pal's emotional situation and received that letter. The interrater reliability was good (Gwet's AC₂ = .67). The average scores across the coders were used in the analyses (see [online supplemental material 4](#) for example response letters with high and low effectiveness ratings).

Statistical Analysis

We used the tidyverse 1.3.1 package ([Wickham et al., 2019](#)) for data exploration and descriptive statistics. Because each effectiveness rating was nested within participants, we conducted multilevel random effects models ([Raudenbush et al., 2019](#)) to examine the relationships between extrinsic emotion regulation strategies and effectiveness ratings by third coders (see the analysis code for full model equations of the random effects models used in this study). Because multilevel models often require complex parameter estimation, convergence issues sometimes occur. In this case, the Bayesian method is a well-known alternative to the maximum likelihood method for fitting multilevel models because convergence issues are less likely to occur ([Mai & Zhang, 2018](#); [van de Schoot et al., 2017](#)). With this background, there is a steady increase in articles using Bayesian multilevel modeling ([van de Schoot et al., 2017](#); see [Zee et al. \[2020\]](#) for an application to empirical research on social support). Therefore, we used Bayesian estimation with the brms 2.17.0 package ([Bürkner, 2017](#)).

Bayesian multilevel modeling was performed using four independent Markov chain Monte Carlo chains, with 50,000 iterations (of which the first 25,000 were discarded as the burn-in phase). Thinning was not performed. Model convergence was monitored by R-hat (a value ≤ 1.10 suggests convergence) and visually checking trace plots. We used the default noninformative priors of the brms package. Because we were mainly interested in Level 1 association between each extrinsic emotion regulation strategy and the effectiveness rating by third coders, all Level 1 predictors (i.e., emotion regulation strategies) were group-mean centered at the level of each message's content, whereas a Level 2 continuous predictor (i.e., age) was grand-mean centered ([Enders & Tofighi, 2007](#); [Peugh, 2013](#)). Given that there were only two types of messages, they were treated as fixed effects rather than random effects (fixed-effects approach; [McNeish & Stapleton, 2016](#)). To determine the random effect structure, we followed the "keep it maximal approach," in which all associated random effects were

² During the review process, reviewers suggested including a response letter to the happy pen pal in the analyses. However, the problem lies in the fact that it is necessary to use different strategy categories for analyzing it from those of extrinsic down-regulation of negative emotions. Indeed, four strategies (problem-solving, distraction, suppression, relaxation), except for reappraisal and empathic responding, are unlikely to be used for up-regulation of others' positive emotions. Given that further theoretical development is needed to categorize the up-regulation of other's positive emotions, it was not included in the analysis of this research.

included (Barr et al., 2013; Brauer & Curtin, 2018). ICC at the level of participants was calculated using the performance 0.9.0 package (Lüdtke et al., 2021).

As an output of the parameter estimation, we presented median unstandardized estimates from the posterior distribution, standard errors, and 95% credibility intervals based on the highest density intervals, indicating the range of values in which 95% of the posterior values fell. Moreover, we presented Bayesian *p*-values based on the probability of direction as an index of effect existence. These were calculated using the bayestestR 0.11.5 package (Makowski, Ben-Shachar, & Lüdtke, 2019). The probability of direction refers to the number of posterior draws from the distribution (i.e., possible parameter values) falling above (or below) 0 divided by the total number of posterior values. Moreover, it is strongly correlated with the frequentist *p*-value, suggesting that it can be used as an index of effect existence (Makowski, Ben-Shachar, Chen et al., 2019).

Results

Relationships Between Extrinsic Emotion Regulation Strategies and Effectiveness Ratings by Third Coders

Table 1 shows descriptive statistics of the variables. ICC was .44 at the level of participants. To investigate the relationship between extrinsic emotion regulation strategies and effectiveness ratings by third coders, we conducted Bayesian multilevel modeling with effectiveness rating as a dependent variable, each emotion regulation strategy as a Level 1 predictor variable, and age, gender (male = −0.5, female = 0.5), and message content (“dog passed away” = −0.5, “laid off” = 0.5) as Level 2 predictor variables. Table 2 presents the fixed effects of this analysis (see online supplemental material 5 for full results, including both fixed and random effects). All R-hats were less than 1.10, suggesting good convergence.

With regard to fixed effects, we identified several meaningful predictors. We found positive effects of gender, $b = 0.21$, 95% CI [0.11, 0.31], $p < .001$; problem-solving, $b = 0.20$; 95% CI [0.13, 0.27], $p < .001$; reappraisal, $b = 0.10$, 95% CI [0.05, 0.15], $p < .001$; relaxation, $b = 0.20$, 95% CI [0.06, 0.34], $p = .007$; and empathic responding, $b = 0.28$, 95% CI [0.22, 0.34], $p < .001$, on the effectiveness rating. We also found negative effects of age, $b = -0.01$, 95% CI [−0.01, −0.00], $p = .024$. We found no strong evidence regarding the positive or negative effects of distraction, $b = -0.01$, 95% CI [−0.13, 0.11], $p = .895$; and suppression, $b = -0.13$, 95% CI [−0.34, 0.08], $p = .206$.

Table 1
Descriptive Statistics of Variables (Study 1)

Variable	Mean	SD	Min	Max
Dependent variable				
Effectiveness rating by third coders	3.25	0.69	1.00	4.67
Level 1 predictor variable				
Problem-solving	0.39	0.72	0	4
Distraction	0.13	0.38	0	3
Reappraisal	0.77	0.99	0	6
Suppression	0.04	0.21	0	2
Relaxation	0.08	0.31	0	3
Empathic responding	0.83	0.81	0	4

Table 2

Fixed Effects Predicting Effectiveness Rating by Third Coders From Each Extrinsic Emotion Regulation Strategy (Study 1)

Variable	Estimate	95% CI	Bayesian <i>p</i> -value
Intercept	3.27	[3.22, 3.32]	<.001
Age	−0.01	[−0.01, −0.00]	.024
Gender ^a	0.21	[0.11, 0.31]	<.001
Message contents ^b	0.02	[−0.05, 0.09]	.576
Problem-solving	0.20	[0.13, 0.27]	<.001
Distraction	−0.01	[−0.13, 0.11]	.895
Reappraisal	0.10	[0.05, 0.15]	<.001
Suppression	−0.13	[−0.34, 0.08]	.206
Relaxation	0.20	[0.06, 0.34]	.007
Empathic responding	0.28	[0.22, 0.34]	<.001

Note. Estimate = median unstandardized estimate from the posterior distribution; CI = credible interval.

^aMale = −0.5, female = 0.5. ^bDog passed away message = −0.5, laid off message = 0.5.

Moreover, to investigate whether the effectiveness of extrinsic emotion regulation strategies differed between message contents, we added interaction terms between a dummy variable of the message content (“dog passed away” = −0.5, “laid off” = 0.5) and each emotion regulation strategy predicting effectiveness ratings by third coders. We found that the effects of the interaction between message contents and empathic responding existed, $b = -0.14$, 95% CI [−0.24, −0.04], $p = .006$, whereas there was no strong evidence regarding the existence of other interactions ($ps > .054$; see online supplemental material 6 for full results including both fixed and random effects). Simple slope analysis revealed that the effect of empathic responding was stronger on the “dog passed away” message, $b = 0.34$, 95% CI [0.26, 0.42], $p < .001$, than on the “laid off” message, $b = 0.20$, 95% CI [0.12, 0.28], $p < .001$, although these effects were positive and significant in both messages.

Robustness Checks: Analyses Without Control Variables

We repeated the above analyses without control variables (i.e., age and gender). The main findings remained unchanged, suggesting the robustness of the results (see online supplemental material 7 and 8 for full results, including both fixed and random effects).

Discussion

Study 1 investigated the effectiveness of each extrinsic emotion regulation strategy by asking participants to write response letters to pen pals. Consistent with Hypothesis 1, we found positive effects of some antecedent-focused strategies on effectiveness ratings by third coders: problem-solving and reappraisal. However, contrary to Hypothesis 1, distraction was neither effective nor ineffective in regulating others' negative emotions. Therefore, the results partially support Hypothesis 1.

We also found positive effects of empathic responding on effectiveness ratings by third coders. Thus, the results support Hypothesis 2. Consistent with findings in relationship science, this study showed the utility of empathic responding, a form of response modulation strategy, in regulating others' negative emotions.

Although not the primary aim of this study, we also found that females wrote more effective response letters for alleviating others'

negative emotions than males. This is consistent with the notion of previous research that females have better extrinsic emotion regulation ability (e.g., Niven et al., 2011). Moreover, age was negatively associated with effectiveness ratings by third coders, contrary to the implication of previous research (Niven, 2022). This discrepancy may be because the younger participants were more familiar with the online communication paradigm used in this study.

Study 1 provides novel findings regarding the effectiveness of extrinsic emotion regulation strategies in text-based online communication. However, it has several limitations. First, we could not systematically investigate whether the effectiveness of an emotion regulation strategy could vary across situations based on emotional intensity because there were only two types of negative events. Second, because third independent coders rated effectiveness, it is unclear whether regulatees themselves regard these strategies as effective in regulating their negative emotions. To address these issues, study 2 asked participants to communicate with each other on an actual online forum to collect a variety of events that cause negative emotions and data from both regulators and regulatees.

Study 2

Method

Participants

A total of 118 undergraduate and graduate students participated in the study. Two participants were excluded from the analysis because they answered only the baseline measure and did not post on the online forum. This resulted in a final sample of 116 participants (72 men, 44 women; M age = 21.03, SD = 1.83). They received JPY 5000 (approximately US\$50) to complete their research participation. We conducted a power analysis with Monte Carlo simulation using the SIMR 1.0.2 package (Arend & Schäfer, 2019; Green and MacLeod, 2016) to determine the sample size. Based on this, we collected participants to detect small-to-medium Level 1 direct effects ($\tau_{std} = .20$) and medium cross-level interaction effects ($\tau_{std} = .30$) at the level of .05, with a power of over .95 (see online supplemental material 1 for detailed information on the power analysis).

Procedure

At baseline, participants got together and received a lecture on how to use the online forum developed for this research. This was a social network website where users could interact with peers to alleviate negative emotions. They interacted on the online forum anonymously using handles. They could access this website using smartphones or computers. Initially, the participants logged into the online forum. During the research period (three weeks), participants were asked to post about a distressing experience. Then, they rated the intensity of their negative emotion on a five-point scale (1 = *very weak*, 2 = *weak*, 3 = *moderate*, 4 = *strong*, 5 = *very strong*). This rating was blinded to other participants.

In addition, participants could read other participants' posts about distressing experiences. During the research period, they were asked to respond to other participants to alleviate their negative emotions. Moreover, when participants received a reply to

their posts from other participants, they were notified via e-mail. After reading the reply, they rated it in terms of the extent to which their negative emotions were alleviated by receiving it on a five-point scale (1 = *not at all*, 2 = *just a little*, 3 = *somewhat*, 4 = *quite a lot*, 5 = *very much*). This rating was blinded to other participants. To ensure participants' commitment, they were asked to write a minimum of five posts about distressing experiences and 15 replies for three weeks.

In the baseline lecture, participants received these instructions and practiced using the online forum. They communicated with each other about what they had eaten yesterday to become familiar with the user interface. After that, participants answered several individual difference measures unrelated to the current research question (see online supplemental material 2 for a full description of these individual difference measures). The participants then communicated with each other for three weeks. The full transcripts of all posts and replies were recorded and stored. The procedure was approved by the Ethics Committee at the Graduate School of Education, Kyoto University.

Coding

Participants' responses were coded according to the type of extrinsic emotion regulation strategies. As in study 1, two research assistants, who were blind to the study hypotheses, coded the number of times participants used each of the following strategies to regulate the posters' negative emotions: problem-solving, distraction, reappraisal, suppression, relaxation, and empathic responding. Interrater reliability was assessed with Gwet's AC₂ (Gwet, 2008), which was calculated using the irrCAC 1.0 package (Gwet, 2019). Interrater reliability was very good (Gwet's AC₂ = .96–1.00). Discrepancies in coding were resolved by a third independent coder who was blind to the study hypotheses.

Statistical Analysis

We used the tidyverse 1.3.1 package (Wickham et al., 2019) for data exploration and descriptive statistics. As in study 1, we used Bayesian multilevel modeling for the main data analysis. In this study, each rating of the alleviation of negative emotions was nested within the posts and responders. Moreover, each post was nested within the posters. For this reason, we conducted a three-level hierarchical and cross-classified random effects model (Raudenbush et al., 2019; see the analysis code for full model equations of the random effects models used in this study). As in study 1, we calculated ICCs with the performance 0.9.0 package (Lüdtke et al., 2021). Moreover, we used Bayesian estimation with the brms 2.17.0 package (Bürkner, 2017) and the bayestestR 0.11.5 package (Makowski, Ben-Shachar, & Lüdtke, 2019). The condition settings of the analyses were the same as those in study 1. All Level 1 predictors (i.e., emotion regulation strategies) were group-mean centered at the level of each post, a Level 2 predictor (i.e., intensity of negative emotions) was group-mean centered at the level of each poster, and a Level 3 continuous predictor (i.e., age) was grand-mean centered for interpretation (Enders & Tofighi, 2007; Peugh, 2013).

Moreover, there were several missing values in the alleviation of negative emotions (3.33%) and intensity of negative emotions (1.89%). Little's Missing Completely at Random Test (Little, 1988) with the naniar 0.6.1 package (Tierney et al., 2021) was

nonsignificant, $\chi^2(26) = 23.30$, $p = .618$, suggesting that missing values in the dataset were completely missing at random and could be reliably estimated. Therefore, these were imputed during model fitting with the `mi()` function of the `brms` 2.17.0 package.

Results

Relationships Between Extrinsic Emotion Regulation Strategies and Alleviation of Negative Emotions

In total, participants posted 582 messages about distressing events and 1,823 responses on the online forum. Table 3 shows descriptive statistics of the variables. ICCs were .07, .14, and .15 at the level of responders, posts, and posters, respectively. To investigate the relationships between extrinsic emotion regulation strategies and the alleviation of negative emotions, we conducted Bayesian multilevel modeling with the alleviation of negative emotions as a dependent variable and each emotion regulation strategy as a Level 1 predictor variable. Table 4 presents the fixed effects of this analysis (see online supplemental material 9 for full results, including both fixed and random effects). All R-hats were less than 1.10, suggesting good convergence.

With regard to fixed effects, we found positive effects of gender, $b = 0.23$, 95% CI [0.10, 0.36], $p = .001$; reappraisal, $b = 0.10$, 95% CI [0.02, 0.18], $p = .012$; and empathic responding, $b = 0.14$, 95% CI [0.04, 0.23], $p = .005$. However, we found no strong evidence regarding the positive or negative effects of age, $b = 0.01$, 95% CI [−0.03, 0.04], $p = .735$; problem-solving, $b = 0.08$, 95% CI [−0.01, 0.16], $p = .089$; distraction, $b = 0.33$, 95% CI [−0.03, 0.69], $p = .070$; suppression, $b = -0.30$, 95% CI [−0.62, 0.01], $p = .059$; and relaxation, $b = 0.07$, 95% CI [−0.46, 0.60], $p = .781$.

Moderated Effects of the Intensity of Negative Emotions on the Relationships Between Extrinsic Emotion Regulation Strategies and Alleviation of Negative Emotions

To investigate whether the effectiveness of extrinsic strategies differed according to the intensity of negative emotions, we added interaction terms between the intensity of negative emotion and emotion regulation strategies predicting the alleviation of negative emotions. Table 5 presents the fixed effects of this model (see online supplemental material 10 for full results, including both fixed and random effects). We found significant interactions between the intensity of negative emotions $\times$ problem-solving, $b = -0.11$, 95% CI [−0.22, −0.01], $p = .040$, and between the intensity

Table 4

Fixed Effects Predicting Alleviation of Negative Emotions From Each Extrinsic Emotion Regulation Strategy (Study 2)

Variable	Estimate	95% CI	Bayesian <i>p</i> -value
Intercept	3.49	[3.41, 3.57]	<.001
Age	0.01	[−0.03, 0.04]	.735
Gender ^a	0.23	[0.10, 0.36]	.001
Problem-solving	0.08	[−0.01, 0.16]	.089
Distraction	0.33	[−0.03, 0.69]	.070
Reappraisal	0.10	[0.02, 0.18]	.012
Suppression	−0.30	[−0.62, 0.01]	.059
Relaxation	0.07	[−0.46, 0.60]	.781
Empathic responding	0.14	[0.04, 0.23]	.005

Note. Estimate = median unstandardized estimate from the posterior distribution; CI = credible interval.

^a Male = −0.5, female = 0.5.

of negative emotions $\times$ reappraisal, $b = -0.09$, 95% CI [−0.18, −0.00], $p = .045$.

Figure 2 presents the results of the simple slope analysis. When the intensity of negative emotions was relatively low (−1SD), the effects of problem-solving and reappraisal were positive, $b = 0.18$, 95% CI [0.06, 0.30], $p = .004$, and $b = 0.18$, 95% CI [0.08, 0.29], $p < .001$, respectively. In contrast, when the intensity of negative emotions was relatively high (+1SD), the results showed no strong evidence regarding the positive or negative effects of problem-solving and reappraisal, $b = -0.01$, 95% CI [−0.13, 0.11], $p = .843$, and $b = 0.02$, 95% CI [−0.08, 0.13], $p = .649$, respectively. Therefore, problem-solving and reappraisal worked as effective extrinsic emotion strategies only when regulating relatively less intense negative emotions.

Robustness Checks: Analyses Without Control Variables

We repeated the above analyses without control variables (i.e., age and gender). The main findings remained unchanged, suggesting the robustness of the results (see online supplemental material 11 and 12 for full results, including both fixed and random effects).

Discussion

Study 2 investigated the effectiveness of each extrinsic emotion regulation strategy by asking participants to communicate with each other on an online forum. This procedure enabled us to collect data from both regulators and regulatees about a variety of events that cause negative emotions.

Consistent with study 1, we found a positive main effect of reappraisal on alleviating negative emotions. We also found no strong evidence regarding the positive or negative effects of distraction. However, contrary to study 1, we did not find a positive main effect of problem-solving. Therefore, the results partially support Hypothesis 1.

Furthermore, as in study 1, we found positive effects of empathic responding on alleviating negative emotions. Thus, the results support Hypothesis 2. They showed the utility of empathic responding, a form of response modulation strategy, in regulating others' negative emotions.

We also found that emotional intensity moderated the effectiveness of some extrinsic emotion regulation strategies. Specifically,

Table 3

Descriptive Statistics of Variables (Study 2)

Variable	Mean	SD	Min	Max
Dependent variable				
Alleviation of negative emotions	3.45	1.08	1	5
Level 1 predictor variables				
Problem-solving	0.61	0.81	0	7
Distraction	0.03	0.18	0	2
Reappraisal	0.71	0.95	0	8
Suppression	0.04	0.21	0	2
Relaxation	0.03	0.19	0	2
Empathic responding	0.67	0.70	0	5
Level 2 predictor variable				
Intensity of negative emotions	3.42	1.02	1	5

Table 5

Fixed Effects Predicting Alleviation of Negative Emotions From Main Effects and Interactions Between Intensity of Negative Emotions and Each Extrinsic Emotion Regulation Strategy

Variable	Estimate	95% CI	Bayesian <i>p</i> values
Intercept	3.48	[3.40, 3.57]	<.001
Age	0.00	[−0.03, 0.04]	.799
Gender ^a	0.24	[0.11, 0.37]	<.001
Intensity of negative emotions	0.07	[−0.01, 0.15]	.073
Problem-solving	0.08	[−0.01, 0.17]	.066
Distraction	0.32	[−0.05, 0.71]	.087
Reappraisal	0.11	[0.03, 0.18]	.008
Suppression	−0.23	[−0.55, 0.09]	.159
Relaxation	0.11	[−0.43, 0.65]	.689
Empathic responding	0.14	[0.05, 0.23]	.005
Intensity of negative emotions × Problem-solving	−0.11	[−0.22, −0.01]	.040
Intensity of negative emotions × Distraction	−0.03	[−0.61, 0.54]	.924
Intensity of negative emotions × Reappraisal	−0.09	[−0.18, −0.00]	.045
Intensity of negative emotions × Suppression	−0.34	[−0.73, 0.04]	.081
Intensity of negative emotions × Relaxation	0.62	[−0.16, 1.41]	.113
Intensity of negative emotions × Empathic responding	0.02	[−0.09, 0.14]	.665

Note. Estimate = median unstandardized estimate from the posterior distribution; CI = credible interval.

^aMale = −0.5, female = 0.5.

problem-solving and reappraisal showed positive effects on the alleviation of negative emotions when the regulatee felt relatively less intense negative emotions. In contrast, these effects disappeared when the regulatee felt relatively intense negative emotions. Therefore, the results support Hypothesis 3.

Although not the main target of this study, we also found that females wrote more effective responses for alleviating others' negative emotions than males, consistent with study 1. Moreover, age was not significantly associated with alleviation of negative emotions, unlike in study 1, probably due to a limited age range in this study.

General Discussion

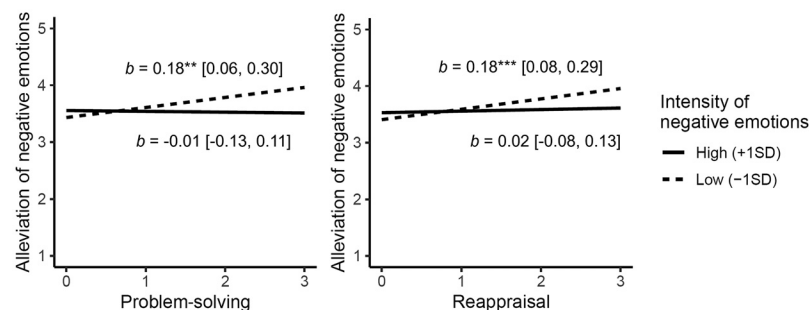
This research investigated the effectiveness of extrinsic emotion regulation strategies in text-based online communication. For this purpose, we classified strategies for alleviating others' negative emotions based on the process model of emotion regulation

(Gross, 1998, 2015a). This classification enabled us to note the similarity or dissimilarity between our findings and the results of previous studies regarding the effectiveness of intrinsic emotion regulation strategies.

Study 1 asked participants to write letters to two bogus pen pals who were said to have recently experienced negative emotional events. Independent coders coded response letters regarding the number of times participants used each of the extrinsic emotion regulation strategies and the effectiveness for alleviating pen pals' negative emotions. To address potential limitations of study 1, which was that the number of negative emotional event types was limited and third coder rated effectiveness, study 2 asked participants to communicate with each other on an online forum for three weeks. Participants posted about distressing events and messages that attempted to alleviate another person's negative emotions. They also rated to what extent replies they received to their posts alleviated their negative emotions. These studies offer novel findings regarding the effectiveness of extrinsic emotion regulation strategies based on the process model.

Figure 2

Moderated Effects of Intensity of Negative Emotions on the Relationships Between Extrinsic Emotion Regulation Strategies (Problem-Solving and Reappraisal) and Alleviation of Negative Emotions



** $p < .01$. *** $p < .001$.

Are Antecedent-Focused Strategies (i.e., Problem-Solving, Distraction, and Reappraisal) Effective for Regulating Others' Negative Emotions?

Given the accumulated findings in intrinsic emotion regulation research (e.g., Gross & Thompson, 2007; Webb et al., 2012), we predicted that antecedent-focused strategies (e.g., problem-solving, distraction, and reappraisal) would be effective in alleviating others' negative emotions (Hypothesis 1). The results of studies 1 and 2 partially support this hypothesis. In both studies 1 and 2, we found positive effects of reappraisal. Therefore, consistent with the findings of intrinsic emotion regulation (Webb et al., 2012), they suggest that reappraisal is an effective strategy in general for alleviating others' negative emotions. In contrast, the effects of problem-solving were inconsistent across studies. Although study 1 found a positive effect of problem-solving, study 2 found no strong evidence of it having either a positive or a negative effect. This inconsistency may be due to differences in the variety of events across studies (only two emotional events in study 1, more diverse emotional events in study 2) or the fact that effectiveness was coded by a third party in study 1 and by the regulatee in study 2. Another possibility is that the posters in study 2 (i.e., actual participants contrary to study 1) might just search for empathic responding rather than problem-solving in many cases, given that individuals often have such motives when sharing their negative emotions with others (e.g., Liu et al., 2021; Pauw et al., 2018).

In both studies 1 and 2, we found no strong evidence about the positive or negative effects of distraction. This may be because the frequency of distraction was low in our study. Distraction was included in the category because it is theoretically important as a strategy of attentional deployment (Gross & Thompson, 2007; Sheppes et al., 2014), and it has been included in previous studies of extrinsic emotion regulation (Cheung & Gardner, 2015). Interestingly, Pauw et al. (2019) found that distraction (and suppression) was more likely to be used to downregulate others' negative emotions when immediate down-regulation was required (e.g., needing to leave for an important job interview in half an hour) compared to low situational demand conditions (e.g., home alone with plenty of time). Because our study targeted text-based online communication, the regulatee could read the message at any time. Therefore, the regulator chose strategies in situations where immediate down-regulation was not necessarily required. This situational characteristic may have led to a low-frequency choice of distraction (and suppression). More research is needed to clarify the factors that influence strategy choice for regulating the emotions of others.

Is a Form of Response Modulation Strategy (i.e., Empathic Responding) Effective for Regulating Others' Negative Emotions?

Based on the findings of relationship science research (e.g., Maisel & Gable, 2009; Seehausen et al., 2016), we predicted that a form of response modulation strategy, empathic responding, would show positive effectiveness (Hypothesis 2). These results fully support this hypothesis. In both studies, we found consistent positive effects of empathic responding in alleviating others' negative emotions. To date, research has suggested that receiving empathic responding promotes the recipient's well-being at least at that point (Maisel & Gable, 2009; Pauw et al., 2018; Seehausen

et al., 2012, 2016; Swerdlow & Johnson, 2022). Consistent with these findings, we offer novel findings demonstrating that empathic responding is also an effective strategy in alleviating others' negative emotions in text-based online communication between strangers.

This research did not assess the mid- and long-term effects of extrinsic emotion regulation strategies. Of note, some studies have suggested that the positive effects of empathic responses may be limited to temporary relief of emotional distress, unlike cognitive supports such as reappraisal (Pauw et al., 2018; Rimé, 2009). However, given that distress diminishes elaborate semantic processing (Bodie et al., 2011; Sheppes et al., 2014), alleviation of negative emotions, even if only temporarily, with the help of others would play an important role in recovering the regulator's capacity to implement cognitive processing for medium- to long-term emotional recovery. It would be important for future research to capture emotional changes in the regulatee over time and the interactive effects of the regulator's extrinsic emotion regulation and regulatee's intrinsic emotion regulation.

Does the Regulatee's Emotional Intensity Moderate Effectiveness of Extrinsic Emotion Regulation Strategies?

Study 2 investigated whether emotional intensity moderated the effectiveness of extrinsic emotion regulation strategies. Specifically, based on intrinsic emotion regulation research (Shafir et al., 2015), we predicted that reappraisal would be less effective in alleviating other people's intense negative emotions (Hypothesis 3). These results support this hypothesis. Reappraisal was only positively related to effectiveness ratings when the regulatee felt relatively less intense negative emotions. This was also the case for problem-solving. Reappraisal requires elaborate semantic processing, which could be difficult when experiencing intense negative emotions (Sheppes et al., 2014). In text-based online communication, problem-solving has the same feature because the regulatee must interpret the regulator's suggestions to improve the situation and decide what to do. For these reasons, reappraisal and problem-solving did not work well in alleviating others' intense negative emotions.

Theoretical Implications

Recent emotion regulation theory calls for further research to clarify the commonalities and differences between intrinsic and extrinsic emotion regulation (Gross, 2015b; Nozaki & Mikolajczak, 2020). Although numerous studies have already shown how we can effectively regulate our own negative emotions (see Sheppes & Gross, 2013 for a review), little is known about how we can effectively regulate the negative emotions of other people. Our research contributes to filling this gap by offering novel findings regarding the effectiveness of extrinsic emotion regulation strategies.

Our results, using a text-based online communication paradigm, suggest that extrinsic emotion regulation has much—but not everything—in common with intrinsic emotion regulation with regard to effectiveness. For example, reappraisal is a generally effective strategy in regulating others' negative emotions in text-based communication, consistent with the accumulated findings of

intrinsic emotion regulation. Moreover, emotional intensity moderates the effectiveness of reappraisal (and problem-solving) in a manner similar to intrinsic emotion regulation: i.e., it is only effective for regulating relatively less intense emotions. These results are consistent with other studies showing commonalities between intrinsic and extrinsic emotion regulation (e.g., Netzer et al., 2015; Niven et al., 2019).

However, we also found a divergence between extrinsic and intrinsic emotion regulation. Specifically, extrinsic emotion regulation strategies contain empathic responding, which is an additional form of response modulation that has no direct correspondent in the domain of intrinsic emotion regulation. Response modulation includes a variety of strategies that directly influence the regulatee's emotion-related responses (Sheppes & Gross, 2013). Our research reveals that a form of response modulation, empathic responding, can work well in regulating the negative emotions of others.

Introducing a theoretical framework of emotion regulation into online communication research provides a rationale for classifying various strategies for regulating emotions. The current research contributes to integrating emotion regulation theory with online communication research based on the process model, which is the most influential emotion regulation model. It expands a series of studies addressing the relationships between the characteristics and consequences of computer-mediated communication (e.g., Meier & Reinecke, 2021).

Limitations and Future Directions

Despite the strengths of this research, several limitations should be acknowledged. First, this research only targeted text-based online communication among strangers. We focused on this type of communication because it has the advantage of keeping the relationship constant, which has often been done in previous studies (Doré & Morris, 2018; Nozaki & Koyasu, 2013). Moreover, supporting communication is increasingly occurring via texts with others outside of close relationships (Shu et al., 2021). Nevertheless, future research should investigate whether the current results can be replicated in different types of relationships such as among couples (Bar-Kalifa et al., 2021), between leader and follower (Vasquez et al., 2020), or between parent and child (Somers et al., 2021). Furthermore, Rains et al. (2016) found that reduced social cues in online text-based communication increased the recipient's motivation to process support message content itself and that this led support messages to have a greater impact than face-to-face communication. Based on this finding, the effects of extrinsic emotion regulation strategies observed in our research may be stronger in online text-based communication than in face-to-face communication. Therefore, future research should examine whether the effectiveness of diverse strategies will vary across different communication channels.

Second, this study targeted a relatively homogenous sample of individuals, namely, the Japanese. However, this could be considered a strength of the study. Like other psychological topics (Cheon et al., 2020; Henrich et al., 2010), most extrinsic emotion regulation research has been conducted among Western populations. In response to this situation, some researchers have pointed out the importance of valuing research in the non-Western world (e.g., Bauer, 2020; Rad et al., 2018). Our research offers novel insights into the generalizability of the existing findings in

emotion regulation research. For example, the findings of our research were consistent with the findings of Western research, which includes the positive effect of reappraisal in general (Webb et al., 2012), moderated effects of emotional intensity on the effectiveness of reappraisal (Shafir et al., 2015), and positive effects of empathic responding (O'Brien et al., 2009). Nevertheless, future research should investigate the extent to which the current findings can be generalized across populations with different cultural backgrounds.

Third, this study did not compare healthy and clinical populations in terms of the effectiveness of extrinsic emotion regulation strategies. In the intrinsic emotion regulation literature, existing research has already tested the effectiveness of emotion regulation strategies in clinical populations (McRae & Gross, 2020). Given that extrinsic emotion regulation could also be linked to psychopathology (Hofmann, 2014; Marroquín, 2011), future research should examine to what extent the current findings can be generalized to clinical populations.

Conclusion

The findings presented in this article clarify the strategies that effectively alleviate others' negative emotions in text-based online communication. With the development of information technology, digital emotion regulation, such as offering emotional support to one another on online forums, plays an important role in daily lives. The current study offers novel insights into the advancement of extrinsic emotion regulation research with respect to strategy effectiveness.

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