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The Dynamic Interplay Between Emotions in Daily Life: Augmentation, Blunting, and the Role of Appraisal Overlap

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Our emotions don't have lives of their own, but mutually influence each other across time. Augmentation and blunting occur when experience of a current emotion increases or decreases the experience of another, subsequent emotion, and play a role in many everyday phenomena. In this study, we investigated patterns of augmentation and blunting between the experience of anger, sadness, relaxation, and happiness in daily life. In general, emotions with similar (opposite) valence showed augmentation (blunting) from one moment to the next. In search for a possible underlying mechanism, we showed that strength of augmentation and blunting was a function of degree of idiosyncratic appraisal overlap between two emotional states. This occurred even to the point that emotions with similar valence blunted one another in cases of small overlap, and emotions with opposite valence augmented one another in cases of large overlap. The findings reveal the dynamic interplay between different emotions across time, and highlight the role of appraisal overlap therein.

Keywords: emotion dynamics, emotion augmentation, emotion blunting, appraisal

People experience various emotions across time. Although situations causing such experiences can be largely independent from one another, we nevertheless experience fluid transitions among these different emotional experiences in our lives. Part of this may stem from the fact that one's current emotional state influences and blends into the experience of another, subsequent emotion. Indeed, we would argue that emotional experiences do not end abruptly, but rather merge into new emotional experiences as new events unfold. For instance, being stressed when approaching a deadline at work can make a person experience stronger anger when someone jumps queue in the supermarket after work, and this in turn may decrease the person's happiness upon arrival home.

Emotion Augmentation and Emotion Blunting

If emotions influence each other across time, they can do so in two possible ways: One emotion can either *augment* (increase) or *blunt* (decrease) the experience of another, subsequent emotion. Research on these aspects of emotion or emotional dynamics is largely uncharted territory (for recent exceptions, see Wenze, Gunthert, Forand, & Laurenceau, 2009; Winterich, Han, & Lerner, 2010). Because of the temporal dimension—how emotional states affect each other across time—augmentation and blunting also reflect fundamentally different phenomena than those examined in studies on concurrent interrelations between emotions (e.g., research into the momentary structure of affect or into the degree of covariance between emotions; Feldman, 1995; Feldman-Barrett, 2004). Yet, they could account for a host of everyday psychological phenomena in which our emotional experiences are aggravated or attenuated by how we responded to previous events. For instance, augmentation and blunting can be considered to reflect the essential processes behind mood spillover between life domains (Song, Foo, & Uy, 2008), buffering effects of positive emotions on stress (Folkman & Moskowitz, 2000), positive emotions undoing the effect of negative emotions (Fredrickson & Levenson, 1998), emotion context insensitivity related to depressed mood (Rottenberg, Gross, & Gotlib, 2005), experiential avoidance (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996), and emotional transformations necessary for emotion management (i.e., emotion segues; Lively & Heise, 2004). Unlike previous research, which has focused on specific instantiations (e.g., Wenze et al., 2009; Winterich et al., 2010), in the present study we aim to discover general principles underlying emotion augmentation and blunting.

Mechanisms Underlying Emotion Augmentation and Blunting

In searching for possible mechanisms underlying emotion augmentation and blunting, several proposals have been formulated. The first is valence overlap. If the valence of the subsequent emotion is similar to that of the current emotion, then these emotions will sum up and result in a more intense emotional experience (augmentation); but, if they are of opposite valence,

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then these will counterbalance and produce a less intense emotional experience (blunting; Branscombe, 1985; Neumann, Seibt, & Strack, 2001).

The second is appraisal overlap. Appraisals of situations are often viewed as centrally determining components of emotions (Ellsworth & Scherer, 2003; Frijda, 2007; Smith & Ellsworth, 1985). The appraisal tendency framework (ATF; Lerner & Keltner, 2000) assumes that each emotion triggers a cognitive predisposition to appraise future events in ways similar to the central appraisals characterizing that emotion. This implies that an emotion's appraisals linger on across time. Therefore, a subsequent emotional experience can be influenced by the appraisals of a current emotion. For example, in a study done by Winterich et al. (2010), they discussed that experiencing anger will activate the appraisal tendencies that characterize it (e.g., other-agency). These appraisal tendencies will carry over and influence the appraisals made for a subsequent emotional event (e.g., event that causes sadness). Since anger and sadness have contrasting appraisals, they hypothesized that the appraisal tendencies activated by the anger experience (other-agency) will counteract the appraisals of sadness (situational-agency); this would then blunt the experience of sadness. As a result, it can be expected that augmentation will occur if current and subsequent emotions have similar underlying appraisals (high appraisal overlap), while blunting will occur if these appraisals strongly diverge (low appraisal overlap; Winterich et al., 2010).

However, an important qualification regarding the appraisal overlap perspective is that appraisal patterns underlying emotional experiences are not the same for everyone. Indeed, previous studies have shown that there are individual differences in relationships between appraisals and emotional experiences (Kuppens, Van Mechelen, & Rijmen, 2008; Kuppens, Van Mechelen, Smits, De Boeck, & Ceulemans, 2007; Nezlek, Vansteelandt, Van Mechelen, & Kuppens, 2008; Tong, 2010; for a review, see Kuppens & Tong, 2010). As a consequence, there are likely to be individual differences in appraisal overlap between pairs of emotions (i.e., the degree of similarity between the appraisal patterns associated with any two emotions). For example, anger may be strongly associated with the appraisal of other-blame for one individual, whereas this may not be the case for another individual (Kuppens et al., 2008). The same may hold for the emotion of sadness. As a result, anger and sadness may more closely resemble one another in terms of underlying appraisals for one individual compared to the other.

If appraisals determine emotional quality and linger on across time (see above), then appraisals from a current emotion will carry over to impact the occurrence of another, subsequent emotion. Given this, individual differences in appraisal overlap should determine the extent to which one emotion will augment or blunt the experience of a subsequent emotion. When appraisals associated with two emotions are highly similar for a particular individual, these two emotions will show augmentation (even if they are of opposite-valence). If, however, two emotions strongly diverge in terms of appraisals, they will blunt each other (even if they are of similar-valence).

As a final possibility, it is important to note that in everyday life, complex blends of more than one emotion can occur (Smith & Ellsworth, 1987) and people differ to the extent that they experience such mixed emotions (e.g., Larsen, McGraw, & Cacioppo, 2001). Research that draws on Cacioppo and Berntson's (1994) evaluative space model (ESM) even explores the possibility that people can experience opposite emotions (e.g., happiness and sadness) at the same time (Larsen & McGraw, 2011; Larsen et al., 2001). Given that emotions can co-occur, a third possibility to explain augmentation and blunting may lie in this tendency for people to experience mixed emotions. For example, if someone tends to experience sadness and anger concurrently, the sadness accompanying anger may augment subsequent sadness directly, regardless of appraisal overlap. If this were the case, then mixed emotions in general, and not appraisal overlap per se, would primarily explain the augmentation and blunting phenomena. To ascertain that it is appraisal overlap and not the experience of mixed emotions that moderates augmentation and blunting, it seems advisable to control for the experience of mixed emotions when examining the relationship between appraisal overlap, and the augmentation and blunting of emotions.

In sum, we hypothesize that, as a general rule, augmentation and blunting occur between emotions of similar- and opposite-valence, respectively. However, we predict that the degree of augmentation or blunting between two emotional states is moderated by individual differences in appraisal overlap, even to the extent that similar-valence blunting and opposite-valence augmentation may occur if the underlying appraisal patterns sufficiently diverge or overlap. We will also examine whether these results will remain after controlling for the tendency to experience mixed emotions.

This Study

Augmentation and blunting have mostly been examined using laboratory studies (with the exception of Wenze et al., 2009). While this approach gives important insights in how one emotion influences the experience of the next emotion in the laboratory (often in response to standardized stimuli), it fails to shed light on these phenomena in the context of the complexities encountered in daily life (Conner, Tennen, Fleeson, & Barrett, 2009). For this reason, we performed an experience sampling study to examine patterns of augmentation and blunting. A random sampling schedule was employed to help ascertain that a representative sample of daily experiences was obtained (Alliger & Williams, 1993). This methodology allowed us to capture how the experience of one emotion influences the experience of another, subsequent emotion. It also enabled us to determine for every individual the patterns of associations that exist between the emotions under study and a number of fundamental appraisal dimensions (i.e., appraisals of events that caused the emotions). Consequently, this made it possible to obtain a measure of appraisal overlap between emotions for each individual. Four commonly experienced emotions were selected (angry, sad, happy, and relaxed), each representing one of the quadrants of the core affect space (Russell, 2003). We adopted the widely used appraisal dimensions from Smith and Lazarus (1993) which are considered to reflect the most important appraisal dimensions, and with its brevity allowed easy application in the context of an experience sampling study.

Method

Participants

Eighty university students from the University of Leuven participated in this study. They were recruited through an advertisement on the university job service seeking for participants for a study on "emotions in daily life." One participant withdrew early from the study, resulting in a final sample of 79 participants (50 females, 29 males; mean age = 23.52 years, *SD* = 7.82). Participants were paid 40€ for their participation.

Materials

Repeated assessment of emotional experience. At each sampling moment, participants were asked to report how they were currently feeling. Using a continuous slider scale that ranged from 0 (*not at all*) to 100 (*very much*), participants reported their current levels of anger, sadness, happiness, and relaxation, among others. The order of the questions was randomized across beeps.

Repeated assessment of appraisals. At each sampling moment, participants also answered a total of seven appraisal questions about current events that were based on the appraisal theory framework proposed by Smith and Lazarus (1993). Using a continuous slider that in all but one case ranged from 0 (*not at all*) to 100 (*very much*), participants responded to each of the appraisal items. Each item started with the prompt "Think about what causes your feelings right now, to what extent" followed by an appraisal item: "is this important for you?" (motivational relevance), "is this advantageous or disadvantageous to you?" (motivational congruence, with the response ranging from −50 = *very disadvantageous* to + 50 = *very advantageous*), "is someone else responsible for this? " (other-agency), "are you yourself responsible for this?" (self-agency), "do you think you can change something about this situation?" (problem focused coping potential), "do you think you can emotionally cope with the situation?" (emotion focused coping potential), and "do you think events will turn out the way you want?" (future expectancy).

Data Preparation

Calculation of appraisal overlap. To measure appraisal overlap between pairs of emotions for each participant, we first computed the zero-order correlation between each emotion and each appraisal per participant across beeps. This yielded, for every participant, a pattern of associations between each emotion and appraisal. Next, we used these correlation indices to compute the Euclidian distance between the appraisal patterns of each emotion pair for every participant (see also, Kuppens, Van Mechelen, Smits, & De Boeck, 2004).

For example, the Euclidian distance between anger and relaxation was calculated as:

$$d_{(ang,rel)_i} = \sqrt{\begin{aligned}&[MotRel_{ang_i} - MotRel_{rel_i}]^2 + [MotCon_{ang_i} - MotCon_{rel_i}]^2 \\ &+ [OthAge_{ang_i} - OthAge_{rel_i}]^2 + [SelAge_{ang_i} - SelAge_{rel_i}]^2 \\ &+ [ProCop_{ang_i} - ProCop_{rel_i}]^2 + [EmoCop_{ang_i} - EmoCop_{rel_i}]^2 \\ &+ [FutExp_{ang_i} - FutExp_{rel_i}]^2\end{aligned}} \quad (1)$$

where $d_{(ang,rel)_i}$ is participant *i*'s Euclidian distance measure for anger and relaxation; $MotRel_{ang_i}$ is participant *i*'s correlation between motivation relevance and anger; $MotRel_{rel_i}$ is participant *i*'s correlation for the motivation relevance—relaxation relationship; and so on for the remaining appraisals *MotCon* (motivation congruence), *OthAge* (other agency), *SelfAge* (self agency), *ProCop* (problem-focused coping), *EmoCop* (emotion-focused coping), and *FutExp* (future expectancy). This distance inversely reflects the overlap between the appraisals underlying the emotional states of anger and relaxation for that individual. This implies that the higher the distance between two emotions, the smaller the appraisal overlap, and vice versa. To obtain a direct measure of appraisal overlap, distance scores were reversed. The closer the value is to 0, the higher the appraisal overlap. Appraisal overlap measures were computed for each emotion pair, resulting in a total of 6 overlap measures for each participant.

Calculation of tendency to experience mixed emotions. To measure the tendency to experience mixed emotions for every emotion pair, we calculated the number of beeps where participants rated both emotions (e.g., anger and relaxed) to be greater than 0 (*not at all*), regardless of intensity (following Larsen et al., 2001; Miyamoto, Uchida, & Ellsworth, 2010). Since the number of responded beeps varied across participants, the proportion score was computed by dividing the frequency of mixed emotions over the total number of responded beeps for a specific participant. The higher the proportion score, the more the emotions of that specific pair had been jointly experienced. This score was computed for every pair of emotions per participant.

Statistical Model

Our main research questions concern how the experience of one emotion impacts the experience of another emotion at a following time point (with a positive impact reflecting augmentation and a negative impact reflecting blunting), and how individual differences in the observed augmentation or blunting of emotional states are moderated by idiographic levels of appraisal overlap between the emotion pairs.

Following Wenze et al.'s (2009) analyses, we estimated cross-lagged multilevel models to examine augmentation or blunting between emotional states, and how appraisal overlap moderated this effect. For example, to model the lag effect of relaxation (REL) on subsequent anger (ANG) experience, REL at time *j* was used to predict ANG at time *j + 1,* controlling for ANG at time *j* at level 1 of the model (thereby modeling the change in ANG from time *j* to time *j + 1*). Time *j* and *j + 1* refer to two consecutive beeps within the same day.[1] Such a cross-correlation approach is the closest one can come to make causal inferences based on time series data (e.g., Gottman, 1990; Granger, 1969). Both predictors were centered on each individual's mean score (Enders & Tofighi, 2007). The regression equation at level 1 of the model is as follows:

$$ANG_{ij+1} = \eth_{0i} + \eth_{1i}(ANG_{ij}) + \eth_{2i}(Rel_{ij}) + e_{ij} \quad (2)$$

Of primary interest to our first research question is the parameter $\eth_{2i}$, which indicates the extent of augmentation (when positive)

[1] We also performed analyses including overnight lags. Findings remained the same with those presented in the Results section.

or blunting (when negative). At Level 2, we examined how appraisal overlap of the emotion pair ($d_{ang,rel}$) moderated the augmentation or blunting effect. In these analyses, the appraisal overlap index was grand mean centered. The equations are as follows:

$$\eth_{0i} = b_{00} + b_{01}(d_{ang,rel}) + r_{0i} \quad (3)$$

$$\eth_{1i} = b_{10} + b_{11} + r_{1i} \quad (4)$$

$$\eth_{2i} = b_{20} + b_{21}(d_{ang,rel}) + r_{2i} \quad (5)$$

Of primary interest for our second research question is Equation 5. b_{20} indicates how being relaxed at the current time point predicts the change in the experience of anger at the subsequent time point for a participant with an average level of appraisal overlap for the angry-relaxed affect pair. b_{21} reflects how individual differences in the relaxed$_j$-anger$_{j+1}$ slope are a function of individual differences in appraisal overlap for these two emotional states. Such a model was estimated twice for every emotion pair, using each emotion as either the outcome or predictor variable. This resulted in a total of 12 cross-lagged analyses.

Procedure

In the first session, each participant received a Tungsten E2 palmtop computer along with instructions for its use in general as well as for responding to the questions at each beep. For two weeks, participants carried the palmtop computer as they went about their daily activities and responded to the questions when signaled (i.e., beep from the palmtop). The palmtop was individually programmed (using ESP 4; Barrett & Feldman-Barrett, 2005) to beep 10 times a day for 14 consecutive days.[2] Participant's waking hours[3] were divided into 10 equal intervals and one beep was programmed randomly in each interval. Items were presented in random order at each beep. Overall, participants responded to 82% of the programmed beeps (range: 55% to 99%). Participants could respond to every item at each beep for a maximum of 80 seconds; they responded in an average time of 3.60 seconds (SD = 4.27) for each item. In total, participants took an average time of 78.84 seconds (SD = 40.66) to respond to all the items at one beep. After two weeks, participants attended a second session, where they filled out other questionnaires. Subsequently, they were debriefed and paid for their participation.

Results

Descriptive Statistics

Table 1 presents the mean emotion intensity ratings and appraisal overlap measures for the different emotion combinations. It also shows the breakdown of these intensity ratings into proportion of occurrence for each emotion, the various mixed emotions, and one emotion following another emotion.

On average, positive emotions were rated higher and more frequent than negative emotions. In addition, the occurrence of a positive emotion following another positive emotion (i.e., happy → relaxed and relaxed → happy) happened most frequently, while the occurrence of a negative emotion following another negative emotion (i.e., angry → sad, sad → angry) happened least frequently. Appraisal overlap scores for similar-valence emotions were higher than for opposite-valence emotions. In terms of mixed emotions, participants experienced the co-occurrence of happy and relaxed states more, and the co-occurrence of angry and sad states less than any other emotion combination.

We also examined the correlations between the measures of appraisal overlap and mixed emotions to find out whether appraisal overlap is related the experience of mixed emotions. Results showed that for opposite-valence emotions, appraisal overlap and mixed emotions were slightly negatively correlated (angry-happy, $r = -.28$, $p = .01$; relaxed-sad, $r = -.28$, $p = .01$; happy-sad, $r = -.28$, $p = .02$; except for angry-relaxed, $r = -.21$, $p = .07$), while they were positively but nonsignificantly correlated for similar-valence emotions (angry-sad, $r = .14$, $p = .22$; relaxed-happy, $r = .21$, $p = .07$).

Augmentation and Blunting as a Function of Appraisal Overlap

Results are presented in Table 2. Figure 1 provides a summary of the main blunting and augmentation effects and how these are moderated by appraisal overlap.

Main effect of emotion augmentation and emotion blunting. Supporting our predictions, there was consistent augmentation between similar-valence emotions, and blunting between opposite-valence emotions (with exception of anger predicting positive emotions; see Table 2 and Figure 1). Thus, experiencing a specific positive (negative) emotion predicts an increase in the experience of another positive (negative) emotion at the next time point; and experiencing a specific positive (negative) emotion predicts a decrease in the experience of another negative (positive) emotion at the next time point.

Moderation by appraisal overlap. Key to our current proposal is the hypothesis that the degree of augmentation or blunting is a function of individual differences in appraisal overlap, even to the extent that if the appraisal overlap is small or large enough, it can result in within-valence blunting or cross-valence augmentation, respectively.

As shown in Table 2, we found significant appraisal overlap moderation for almost all emotion combinations. This means that the degree of augmentation (for similar-valence emotions) and the degree of blunting (for opposite-valence emotions) are moderated by appraisal overlap. In addition, Table 2 presents the numbers of participants who experienced augmentation or blunting effects for each of the emotion combinations. These results show that within-valence blunting and cross-valence augmentation are indeed observed for at least some individuals in each case (except for happy → relaxed).

Figure 2 gives a pictorial representation of the moderating effect. It represents the slope of individuals with average ap-

[2] We performed additional analyses to examine whether effects differed on a weekend compared to a weekday. Findings revealed that the patterns of augmentation/blunting did not differ on weekends compared to weekdays (except for relaxed → angry); the effect of appraisal overlap on the emotion combinations also did not differ on weekends versus weekdays (except for sad → relaxed).

[3] Since participants had varying waking hours, we also performed all analyses while controlling for participants' median waking hours. Results remained the same.

Table 1
Descriptive Statistics of the Variables and Relationships in the Study

Variables	*M*	*SD*	Range	
			Possible	Actual
Intensity of Emotions				
Angry	6.77	14.90	0 to 100	0 to 100
Sad	8.71	16.60	0 to 100	0 to 100
Happy	58.20	22.97	0 to 100	0 to 100
Relaxed	61.27	24.47	0 to 100	0 to 100
Appraisal Overlap				
Angry – Sad	−.45	.21	−5.29 to 0	−1.01 to −.10
Angry – Happy	−1.46	.48	−5.29 to 0	−2.69 to −.68
Angry – Relaxed	−1.40	.46	−5.29 to 0	−2.63 to −.58
Sad – Happy	−1.41	.50	−5.29 to 0	−2.63 to −.48
Sad – Relaxed	−1.32	.49	−5.29 to 0	−2.59 to −.46
Happy – Relaxed	−.35	.16	−5.29 to 0	−.95 to −.10
Proportion of Occurrence				
One emotion				
Angry	.29	.26	0 to 1.00	0 to .99
Sad	.35	.29	0 to 1.00	0 to .98
Happy	.97	.05	0 to 1.00	.70 to 1.00
Relaxed	.97	.04	0 to 1.00	.75 to 1.00
Mixed emotions				
Angry – Sad	.19	.24	0 to 1.00	0 to .97
Angry – Happy	.28	.26	0 to 1.00	0 to .98
Angry – Relaxed	.28	.26	0 to 1.00	0 to .99
Sad – Happy	.34	.29	0 to 1.00	0 to .97
Sad – Relaxed	.34	.29	0 to 1.00	0 to .98
Happy – Relaxed	.95	.06	0 to 1.00	0 to 1.00
One emotion following another emotion				
Angry → Sad	.15	.21	0 to 1.00	0 to .91
Angry → Happy	.25	.23	0 to 1.00	0 to .93
Angry → Relaxed	.25	.23	0 to 1.00	0 to .94
Sad → Angry	.16	.21	0 to 1.00	0 to .92
Sad → Happy	.30	.26	0 to 1.00	0 to .92
Sad → Relaxed	.30	.26	0 to 1.00	0 to .93
Happy → Angry	.25	.23	0 to 1.00	0 to .93
Happy → Sad	.30	.26	0 to 1.00	0 to .92
Happy → Relaxed	.82	.10	0 to 1.00	.50 to .99
Relaxed → Angry	.25	.23	0 to 1.00	0 to .93
Relaxed → Happy	.82	.10	0 to 1.00	.50 to .99
Relaxed → Sad	.31	.26	0 to 1.00	0 to .92

Note. Proportion of occurrence for each emotion was computed from the proportion of beeps in which the specific emotion was present (i.e., intensity rating was greater than zero) (Schimmack, 2003). Proportion of mixed emotions was computed from the proportion of beeps where the two emotions of interest were present (Larsen et al., 2001; Miyamoto et al., 2010). Proportion of one emotion following another emotion was computed from the proportion of beeps where one emotion was present at *t-1* and the other emotion was present at time *t*.

praisal overlap and individuals whose appraisal overlap scores are 2*SD* above and below the mean score for each emotion combination. As can be seen, this moderation was consistently in the predicted direction. For similar-valence emotions, the larger the appraisal overlap, the stronger the augmenting effect of the current emotion on another, subsequent emotion; and the smaller the appraisal overlap, the weaker the augmenting effect, even to the point of blunting in many cases. Likewise, for opposite-valence emotions, the smaller the appraisal overlap, the stronger the blunting effect of the current emotion on another, subsequent emotion; and the larger the appraisal overlap, the weaker the blunting effect, even to the point of augmentation in many cases.[4]

Controlling for mixed emotions. To preclude the possibility that the occurrence of mixed emotions (and not appraisal overlap itself) would predict the present findings, we ran the same models as above while controlling for occurrence of mixed emotions (i.e., in addition to the appraisal overlap measure, the mixed emotions

[4] It is possible that relationships between emotions are nonlinear. For example, low intensity anger might augment sadness, but high intensity anger might not. To examine this possibility, we estimated models including quadratic terms at Level 1. For example, the model for investigating the relationship of lagged relaxed on current anger experience would be: $ANG_{ij+1} = \delta_{0i} + \delta_{1i}(ANG_{ij}) + \delta_{2i}(Rel_{ij}) + \delta_{3i}(Rel_{ij})^2 + e_{ij}$. At Level 2, we included the appraisal overlap index (grand mean centered) as a predictor for the Level 1 intercept, relaxed$_j$-anger$_{j+1}$ slope and the relaxed$_j^2$-anger$_{j+1}$ slope. The results showed nonsignificant quadratic terms for most emotion pairs (except for happy → relaxed, relaxed → happy, sad → anger). Also, appraisal overlap did not significantly moderate the quadratic relationships in all but one case (relaxed → sad).

Table 2
Results From Cross-Lagged Multi-Level Analyses Showing Main Augmentation and Blunting Effects Between a Current and Subsequent Emotion and How This is Moderated by Appraisal Overlap

Emotion			Main effect			Moderating effect			Number of partipants	
Current		Subsequent	b_{20}	*SE*	*p*	b_{21}	*SE*	*p*	Augment	Blunt
Happy	→	Relaxed[a]	.13	.02	<.01	.28	.13	.04	79	0
	→	Angry[b]	−.04	.01	<.01	.05	.02	<.01	5	73
	→	Sad[c]	−.04	.01	<.01	.09	.02	<.01	20	57
Relaxed	→	Happy[a]	.07	.01	<.01	.24	.06	<.01	74	5
	→	Angry[b]	−.03	.01	<.01	.04	.02	.07	9	69
	→	Sad[c]	−.02	.01	.05	.03	.02	.13	23	54
Angry	→	Happy[b]	−.01	.02	.72	.09	.04	.03	38	40
	→	Relaxed[b]	−.02	.02	.46	.16	.03	<.01	38	40
	→	Sad[d]	.05	.02	.01	.17	.08	.03	58	18
Sad	→	Happy[c]	−.07	.02	<.01	.11	.03	<.01	8	69
	→	Relaxed[c]	−.05	.02	<.01	.07	.03	<.01	5	72
	→	Angry[d]	.03	.02	.03	.10	.07	.16	55	21

Note. Coefficient values are unstandardized.
[a] $n = 79$. [b] $n = 78$. [c] $n = 77$. [d] $n = 76$.

measure was also included as a predictor for the person-specific intercept and slope values at Level 2). Results showed that appraisal overlap remained a significant predictor of augmentation or blunting after controlling for mixed emotions (with the exception of angry → sad, which became marginally significant, $p = .09$).[5] This suggests that it is unlikely that participants' experience of mixed emotions could explain the moderating effect of appraisal overlap on the augmentation and blunting phenomena.

Discussion

The present study was designed to gain a better understanding into the dynamic interplay between emotional states across time. By repeatedly measuring the emotions participants experienced in daily life, we were able to demonstrate that the experience of a current emotion consistently influences the experience of another emotion at a next time point (while controlling for the current level of that emotion).

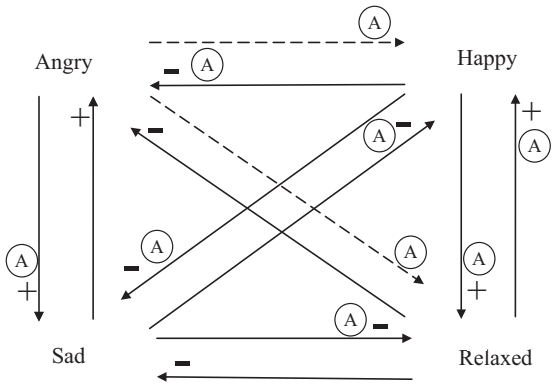

Figure 1. The effect of a current emotion on a subsequent emotion, and the moderating effect of appraisal overlap on this relationship. Arrows represent augmentation (+) or blunting (−) from a predicting emotion at the current time point to the outcome emotion at the next time point. Dashed arrows correspond to nonsignificant values ($p > .05$). The circled A indicates significant moderation by appraisal overlap ($p < .05$) for the specified sequential emotion relationship.

Our study identified a possible mechanism behind augmentation and blunting. Individual differences in these phenomena were consistently found to be related to idiosyncratic levels of appraisal overlap between the emotions in question. In cases of strong overlap or divergence, the moderation even went to the extent that evidence was found for augmentation between opposite-valence emotions and blunting between similar-valence emotions. In other words, our findings point to why current emotional experiences may be differentially affected by previous emotional states for different individuals. As such, they can partly explain, for instance, why an anger episode may be followed by an increased level of positive emotion for some people but not for others (see panels "angry → happy" and "angry → relaxed" in Figure 2; Bushman, Baumeister, & Phillips, 2001), or why anger may attenuate feelings of sadness for some individuals, but not for others (see panel "angry → sad" in Figure 2; Winterich et al., 2010). Importantly, we were able to show that the moderating effect of appraisal overlap was not due to the tendency to experience mixed emotions for the pairs of emotions, ruling out an alternative explanation for the moderating effect of appraisal overlap on emotion augmentation and blunting.

Our results further demonstrate that arousal did not seem to play a significant role in these phenomena, as supported by the

[5] The experience of mixed emotions moderated the relationship above appraisal overlap for four out of twelve emotion combinations: sad → angry, $\beta = .16$, $p = .02$; relaxed → angry, $\beta = -.12$, $p < .01$; relaxed → happy, $\beta = -.25$, $p = .04$; happy → sad, $\beta = -.09$, $p = .02$. In those cases, this means that, for instance, experiencing mixed emotions of anger and sadness would increase the experience of anger after a sad experience. For relaxed → angry and happy → sad, a more frequent occurrence of mixed emotions would further blunt the experience of the subsequent emotion (i.e., there is a stronger blunting effect of relaxation and happiness on anger and sadness, respectively). For relaxed → happy, a more frequent occurrence of mixed emotions for these two emotions would lessen the augmenting effect of relaxation on happiness, after controlling for appraisal overlap.

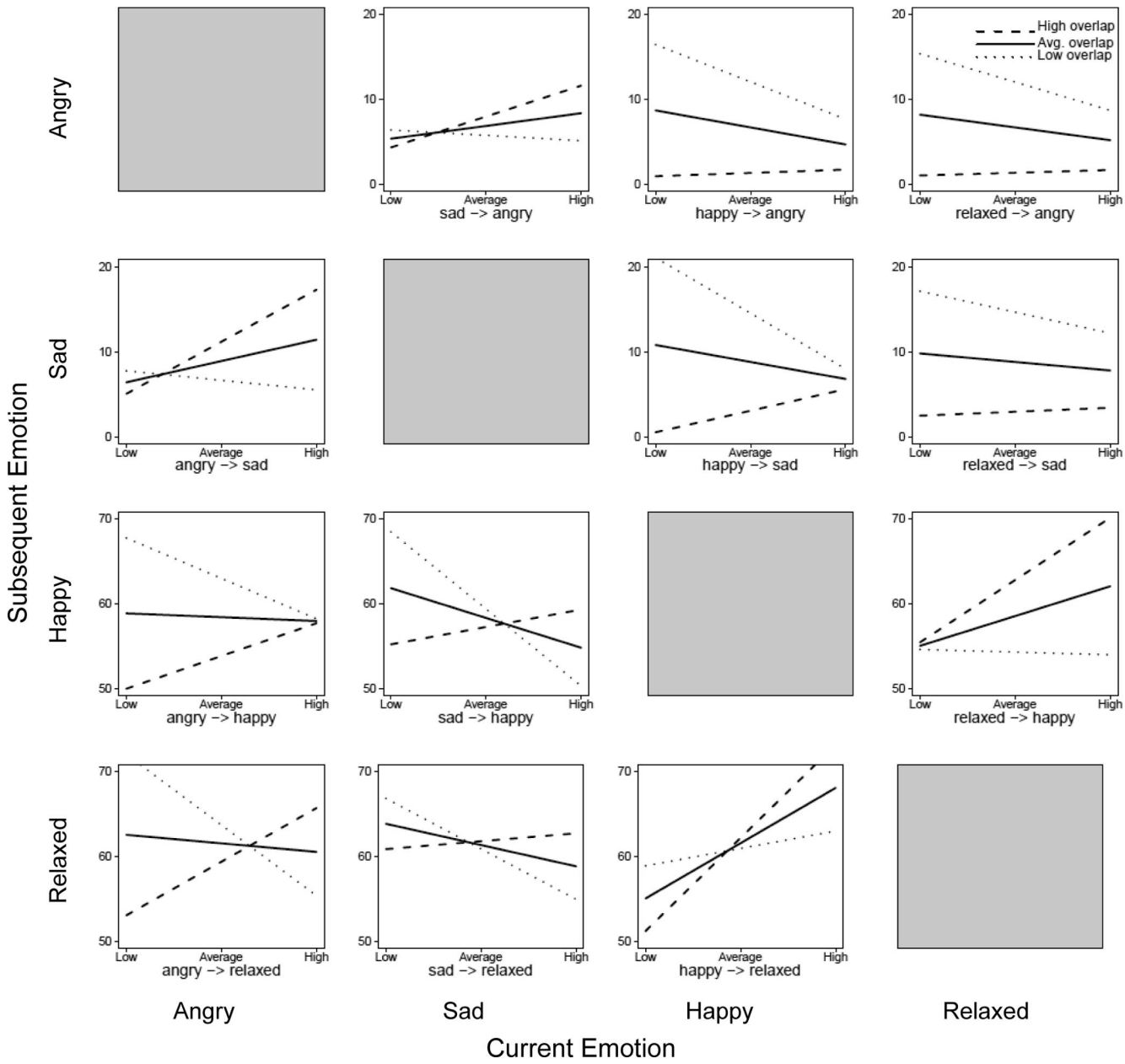

Figure 2. The moderating effect of appraisal overlap on the effect of a current emotion on the change in the experience of a subsequent emotion. Dashed, straight and dotted lines represent individuals with high appraisal overlap score (+2 *SD*), average appraisal overlap score (Mean = 0 due to centering of variables), and low appraisal overlap score (−2 *SD*), respectively.

strong main effects of valence regardless of arousal levels. However, valence is not sufficient for explaining the occurrence of augmentation and blunting between emotional states, as evidenced by the findings of similar-valence blunting and opposite-valence augmentation. Our results suggest that idiosyncratic appraisal overlap should be taken into account when explaining these phenomena. Our findings also verified other important proposals regarding appraisal theories of emotions. First, by showing that appraisal overlap moderates augmentation and blunting, we provide indirect support for the central tenet of appraisal theories of emotions that appraisals play a crucial role in emotional experience (Ellsworth & Scherer, 2003). Second, our results are in line with the hypothesis that patterns of appraisals associated with emotional experience are not universal, but are subject to individual differences (Kuppens & Tong, 2010). Finally, the findings corroborate the ATF (Lerner & Keltner, 2000) by showing that the occurrence of augmentation and blunting was indeed determined by the degree of similarity of the underlying appraisals between any two sequential emotions, suggesting that the appraisals of a current

emotional state may influence the experience of a subsequent emotional state, at least to some degree.

In general, augmentation between negative emotions could be considered to play a role in the comorbidity of negative emotional symptoms in mood disorders (e.g., Mineka, Watson, & Clark, 1998), while blunting between opposite-valence emotions could lie at the base of the buffering role of positive emotions on such symptoms. As our results suggest, individual differences in such phenomena depend on the extent to which people associate the particular emotional states with similar or divergent patterns of appraised meaning. Figure 2 provides many other stimulating examples that could inspire future research.

Despite its strengths, including the ecological assessment of emotional states and appraisals in daily life and the cross-lagged multilevel modeling of the resulting data, this study is not without its limitations. First, the present study did not include the reporting of emotion-eliciting events, which could shed light on how emotional experiences follow each other in response to both sustained and altering events. While it is not straightforward how this could be achieved in the context of an experience sampling study, future research examining how events play a role in augmentation and blunting is needed. Second, the calculation of idiosyncratic appraisal overlap was based on data that was gathered concurrently with the data used to analyze the cross-lagged temporal emotion relationships. While there is no obvious reason on how this could have influenced the results, it would add to the validity of the findings if the role of appraisal overlap could be replicated using appraisal information that was obtained independently from the data on emotions experienced in daily life. Third, for brevity, the current study only examined four emotions that represent the valence-arousal space. However, it is important for future studies to examine whether these findings hold for other specific emotion combinations as well. Finally, given the correlational nature, conclusions about causal relationships between appraisal overlap and augmentation/blunting of emotions cannot be drawn. To investigate this causal relationship, future studies may look into experimental research where appraisal overlap is manipulated or longitudinal studies examining whether changes in appraisal overlap influence the impact of one emotion on a subsequent emotion.

Augmentation and blunting may be part of the continuity we experience in our emotional lives. They may also lie at the core of various phenomena that reflect the lingering impact of our emotional experiences. The present study documented the patterns of augmentation and blunting between different emotions and showed that individual differences in appraisal-emotion relationships have direct bearing on the likelihood of experiencing consecutive emotions. In all, the findings are a testimony of how emotions should be considered as continuous and dynamic processes, and how these are a function of appraised meaning.

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