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# Effects of temperament and emotion regulation styles in determining negative emotional states

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**Introduction.** The interplay of reactive and regulatory temperamental processes appears to be essential for a better understanding of emotional states and disorders. In this study we explored the prospective relationship between reactive temperament (negative affect), regulatory temperament (effortful control), negative emotion regulation styles (rumination and suppression) and self-recorded anxiety, worry, and avoidance in naturalistic conditions.

**Method.** Thirty-two young adults were first assessed through questionnaires on negative affectivity, effortful control, and two forms of negative emotion regulation (rumination and suppression). After this they recorded anxiety, worry, and avoidance three times a day over 50 consecutive days through an on-line access electronic diary.

**Results.** High levels of negative affect and low levels of effortful control were associated with higher levels of anxiety, worry, and avoidance ( $p < .01$ ). The prospective association between negative affectivity and avoidance was moderated by effortful control (Total  $R^2 = .49$ ). Moreover, the brooding facet of rumination totally mediated the association between negative affect and anxiety with a significant indirect effect (Effect = .30, Boot CI 95% = .09 to .69).

**Conclusions.** Avoidance patterns are significantly determined by negative affect – effortful control interaction and rumination, especially brooding, totally mediates the relationship between negative affect and anxiety.

**Keywords:** Effortful control, Emotion regulation, Temperament, Negative affect, Anxiety, Self-record

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## Efectos del temperamento y los estilos de regulación emocional en la determinación de estados emocionales negativos

**Introducción.** La interacción entre los procesos temperamentales reactivo y regulatorio resulta esencial para una mejor comprensión de los trastornos emocionales. En este estudio exploramos la relación entre temperamento reactivo (afecto negativo), temperamento regulatorio (control intencional), estilos de regulación emocional negativos (rumiación y supresión) y el autorregistro en condiciones naturales de los niveles de ansiedad, preocupación y evitación.

**Método.** Treinta y dos adultos jóvenes fueron, en primer lugar, evaluados mediante cuestionario en afecto negativo, control intencional y dos formas de regulación emocional negativa (rumiación y supresión). Posteriormente, registraron sus niveles de ansiedad, preocupación y evitación tres veces al día durante 50 días consecutivos a través de un diario electrónico accesible en línea.

**Resultados.** Niveles elevados en afecto negativo y bajos en control intencional se asociaron a mayor ansiedad, preocupación y evitación ( $p < 0,01$ ). La asociación prospectiva entre afecto negativo y evitación estuvo moderada por el control intencional ( $R^2 \text{ total} = 0,49$ ) mientras que no se encontraron efectos de moderación del control intencional en la asociación entre afecto negativo, por una parte, y la ansiedad y preocupación por la otra. Además, la rumiación, en su componente de ensimismamiento, ejerció una mediación total de forma prospectiva en la asociación entre afecto negativo y ansiedad, con un efecto indirecto significativo (Efecto = 0,30; Boot IC95% = 0,09 a 0,69).

**Conclusiones.** Los patrones de evitación se vieron significativamente determinados por la interacción entre afecto negativo y control intencional y la rumiación, en especial el ensimismamiento, medió totalmente la relación entre afecto negativo y ansiedad.

**Palabras clave:** Control intencional, Regulación emocional, Temperamento, Afecto negativo, Ansiedad, Autorregistro

## INTRODUCTION

The interplay of reactive and regulatory temperamental processes appears to be essential for a better understanding of emotional disorders.<sup>1-3</sup>

The reactive temperament trait negative affectivity is widely recognised to be central in determining emotional states and emotional disorders.<sup>4,5</sup> Negative affectivity can be broadly defined as the proneness to experience an array of negative emotional states (that is, high negative affect), and to activate defensive motivational systems (p.49).<sup>6</sup>

Effortful control is a construct that includes the ability to voluntarily manage attention, to inhibit a dominant response and to activate a subdominant response while experiencing emotion.<sup>7,8</sup> It is increasingly claimed to be a regulatory facet of temperament playing an important role for the development of anxiety and depression.<sup>8,9</sup> High effortful control ability is seen as a moderating factor of negative affect that allows the deleterious effects of increased reactivity to be overridden.<sup>10,11</sup> The few studies conducted in adults have found that impaired effortful control is related to social anxiety<sup>12</sup> and general distress and depression.<sup>10</sup> Conversely, high effortful control combined with low negative affect predicts low anxiety.<sup>13</sup>

Beyond the aforementioned temperamental factors, some cognitive emotion regulation styles seem to be related with increased anxiety and depression.<sup>14</sup> Cognitive emotion regulation can be defined as the individual style of responding for managing the intake of emotionally arousing information.<sup>15</sup> Several studies<sup>16,17</sup> have reported that individuals with heightened negative affectivity are prone to engage in negative emotion regulation strategies, favouring perseverative cognitions such as rumination and worry, along with compensatory processes like suppression (attempts to remove unwanted intrusive thoughts).<sup>18,19</sup> Additionally, according to some studies, rumination – “the tendency to repetitively analyze one’s problems, concerns, and feeling of distress without taking action to make positive changes” (p.596)<sup>20</sup> – mediates the association between high negative affect and depressive symptoms<sup>11</sup> but there are no available data informing us if the same is true for anxiety.

Simultaneously studying effortful control and emotion regulation strategies could be one promising avenue of research<sup>21</sup> taking into account that temperamental self-regulatory capacities based on effortful control, may contribute to the deployment of different kinds of emotion regulation strategies. No previous research exists, to our knowledge, that has explored the interaction of negative affect and effortful control in prospectively determining the use of emotion regulation strategies on a daily basis.

Furthermore, research on the relationships among negative affect, effortful control, and daily emotional experiences, as anxiety, has never used self-records in naturalistic conditions.

Electronic diary methods have been used in naturalistic conditions to collect information about emotion-related phenomenon<sup>22</sup> including the use of emotion regulation strategies as perseverative cognitions (e.g.).<sup>23</sup> Electronic diaries provide some incremental advantages over pen-and-pencil and other diary methods, as preventing backfilling and aggregation of responses, ensuring that responses have been recorded in the appropriate moment and also to improve researchers’ data entry and accuracy<sup>21</sup> and could provide an added value to questionnaire and experimental laboratory assessment by collecting data in ecologically valid contexts.<sup>24</sup> For example, emotional state (e.g. anxiety) records in daily life through diaries have been shown to be more sensitive than traditional approaches in finding associations between vulnerabilities and affective states.<sup>25</sup>

The primary aim of the current study was to analyse the contribution of negative affect and effortful control in determining momentary anxiety and the engagement in two forms of emotion regulation, negative perseverative thinking (i.e. worry) and avoidance behaviors, in a sample of healthy young adults, as recorded along an extended period of time (50 days) in naturalistic conditions through online electronic diaries. As a secondary aim, we were interested in exploring if self-reported rumination and suppression would mediate the association between negative affect and self-recorded anxiety.

From the above rationale, it was first hypothesized that higher negative affect and lower effortful control would prospectively predict higher levels of self-recorded anxiety, worry, and avoidance, and that effortful control would moderate the association between negative affect and self-record measures. Secondly, it was hypothesized that both rumination and suppression would mediate the association between negative affect and self-recorded anxiety.

## METHOD

### Participants and procedure

Forty-two undergraduate students participated in the study. A brief description of the research purpose, along with information regarding the study’s approval by the university’s Bioethics Committee, was provided, and a written consent form was obtained. Participants were first assessed through questionnaires on negative affect, effortful control, and two forms of emotion regulation: rumination,

and suppression. After this, they were asked to record over 50 consecutive days, how anxious and worried they felt and to what degree they exhibited avoidance responses using an on-line access electronic diary (see measures section). Ten participants with three or more consecutive missing records were excluded from analyses. Then, the final sample consisted of 32 participants (Mean age = 22.58,  $SD = 4.38$ ; 21 women, 11 men).

## Measures

- **Negative Affect.** It was measured with the Spanish version<sup>26</sup> of the Positive and Negative Affect Schedule (PANAS),<sup>27</sup> a 20-item questionnaire (with 10 descriptors for each positive affect and negative affect scale). Participants were required to respond to each of the descriptors using a 5-point scale (1 = *very slightly or not at all*; 5 = *extremely*) indicating the extent to which the term properly describes their regular affective state. In the current study only data from the negative affect scale was used. Internal consistency of the Negative Affect Scale for our sample was  $\alpha = .86$ .
- **Effortful control.** The Effortful Control scale of the Adult Temperament Questionnaire -short form<sup>7</sup> was used. It comprises 19 items to be rated in a 7-point Likert scale (1 = *extremely untrue of you*; 7 = *extremely true of you*) measuring inhibitory control, attentional control and activation control. The Catalan version used in the current study retained the sound psychometric properties of the original version. Cronbach's  $\alpha$  in our sample was .80.

## Rumination and suppression

For assessing rumination we used the Spanish version<sup>28</sup> of the shortened Ruminative Response Scale<sup>29</sup> consisting of 10 statements to be rated in a 4-point scale (1 = *almost never*; 4 = *almost always*) according to the frequency in which ruminative responses are performed when experiencing a dysphoric mood. The instrument contains two subscales: reflection and brooding. In our sample internal consistency was  $\alpha = .74$  for the whole scale and  $\alpha = .77$  and  $\alpha = .72$  for the brooding and reflection scales respectively.

Thought suppression was assessed by means of the Spanish version<sup>30</sup> of the White Bear Suppression Inventory,<sup>31</sup> a 15-item questionnaire wherein respondents are asked to rate using a 5-point scale (1 = *strongly disagree*; 5 = *strongly agree*) to which extent each of the statements fits their typical behaviors. In our sample internal consistency was  $\alpha = .92$ .

## Daily anxiety, worry, and avoidance records

Participants rated their anxiety, worry and avoidance responses by mean of an online emotion rater available in Internet over 50 consecutive days. The online emotion rater is an online visual analogue scale consisting of three 100-points length horizontal lines to rate the following questions: (a) "Rate your current anxiety (from *completely relaxed* to *completely anxious*)"; (b) "Rate your current worry (from *not worried at all* to *completely worried*)"; (c) "Is your current mood making you avoid some conditions/situations? (from *I am not avoiding at all* to *I am avoiding a lot*). Participants were instructed to login into the system (using any Internet browser with Flash® Plugin installed) and to rate their emotional state on these three questions by placing a pointer across each scale (scrollbars with no marks) three times per day (morning – from waking-up to 11am at a maximum; noon – between 2pm and 4 pm; and evening – after 9pm to go to bed). Each time participants logged in they find the pointers in the center of the scale (scrollbar). These temporal criteria were favoured instead of narrower time periods or to the use of prompts at random times to facilitate participation and compliance, due to extremely different daily schedules of participants and not being able to carry on continuously electronic devices turned on for academic reasons. The system converts the position of the pointers into numbers in a scale ranging from 0 to 100 (the subjects never see these values) and store them associated with a time mark.

## Statistical analyses

Linear interpolation by means of the Matlab's time series toolbox was used for missing data from the online emotion rater records. Interpolation was only performed for those participants with no more than three consecutive missing data points in their complete series.

Pearson correlations were computed to analyze the associations between negative affect, effortful control, emotion regulation strategies and daily self-recorded anxiety, worry, and avoidance.

For testing the hypothesized moderation effect of effortful control on the association between negative affect and emotional states we used the regression approaches following recommendations by Hayes,<sup>32, 33</sup> and Ato and Vallejo<sup>34</sup> implementing centered values for the predictor and moderator variables to eliminate multicollinearity effects. When necessary post-hoc probing of significant interaction effects was conducted and also the Johnson-Neyman moderator value was obtained.

For testing the hypothesized mediation effect of rumination (brooding and reflection) and suppression on the association between negative affect and self-recorded anxiety a multiple mediator regression approach was conducted, with a bootstrapping procedure (10000 samples) to test the statistical significance of mediators' indirect effects. Both moderation and mediation analysis were conducted using a SPSS 19.0 macro entitled PROCESS, developed by Hayes.<sup>35</sup>

## RESULTS

### Descriptive statistics and preliminary analyses

The number of records on emotional states in the online emotion rater ranged from 59 to 150 ( $M = 117.31$ ,  $SD = 23.31$ ). Mean values for each of the available emotional state records were highly correlated ( $r = .99$  for all three records) with those obtained including interpolated data for missing values, and no significant differences between them (for anxiety  $t[31] = .31$  n.s., for worry  $t[31] = .27$  n.s., for avoidance  $t[31] = .54$  n.s.) were found. For that reason, analyses were conducted with interpolated data only. Shapiro-Wilk normality tests were conducted to all variables and results showed that only avoidance did not fit the normal distribution.

Mean scores and intercorrelations among all measures included in the study are depicted in Table 1. Negative affect was positively associated with all three self-recorded measures (anxiety, worry, and avoidance) and with self-reported rumination (the brooding subscale but not with reflection) and suppression. Conversely, effortful control was negatively associated with the same variables with which negative affect presented positive associations.

### Prospective relationship among negative affect, effortful control and self-recorded anxiety, worry, and avoidance: moderational models

A set of separate 3-step hierarchical regressions were performed with, respectively, self-recorded anxiety, worry, and avoidance as criterion variables, negative affect as predictor variable, and effortful control as a potential moderator. Regarding self-recorded anxiety, results revealed significant effects for negative affect, and effortful control, but interactions between negative affect and effortful control were not significant (see Table 2). An almost identical picture emerged for worry as a criterion variable.

Regarding avoidance significant effects were found for negative affect, effortful control and negative affect – effortful control interaction ( $B = -.29$ ,  $SE = .08$ ,  $t = -3.58$ ,  $p$

$< .01$ ). Post-hoc probes of moderational effects were then conducted. The “pick-a-point approach” was applied to effortful control as moderator variable, considering a standard deviation below the mean, the mean, and a standard deviation above the mean as points to test the statistical significance over the relationship between negative affect and self-recorded avoidance. These three values demarcate three potential points of significance of the effect of negative affect on avoidance along the continuum of the dimension measured by effortful control. Results indicated that there was statistical significance effect with minus one standard deviation and the mean, and no significance was obtained with plus one standard deviation.

An alternative approach when the moderator variable is a continuum is the Johnson-Neyman technique, which derives the value along the continuum of the moderator at which the effect of X on Y transitions between statistically significant and not significant at a chosen  $\alpha$ -level of significance. The advantage of this approach is that it does not require the researcher to arbitrarily operationalize low, moderate, or high (e.g.  $-SD$ , mean, and  $+SD$ ) in reference to values of the moderator. At a .05 level of significance, the Johnson-Neyman value for effortful control was .06 in z scores.

According with these results, it is concluded that effortful control exerted a moderating effect on the association between negative affect and avoidance.

### Prospective relationship among negative affect, emotion regulation styles, and self-recorded anxiety: mediational models

It was hypothesized that both rumination (by brooding and reflection) and suppression would mediate in parallel the association between negative affect and self-recorded anxiety. A multiple mediator linear regression approach was conducted to test this hypothesis. Table 3 summarizes the analytical procedure in four steps: 1) test the effect negative affect to self-recorded anxiety, 2) test the effect from negative affect to the three potential mediators considered, 3) test the effect of each mediator on the dependent variable but controlling the non-mediated effect of negative affect, and 4) test the indirect effects of each mediator variable by means of bootstrapping techniques.

As expected, at step 1, negative affect was positively and significantly related to anxiety self-records. At step 2, rumination (brooding subscale, not reflection) and suppression were also significantly predicted from negative affect. At step 3 results indicated that the prospective association between negative affect and anxiety was

Table 1		Bivariate correlations among negative affect, effortful control, brooding, reflection, suppression, and self-records on anxiety, worry and avoidance								
	1	2	3	4	5	6	7	M	DE	
1. Negative Affect	1							18.37	6.59	
2. Effortful Control	-.10	1						4.45	0.68	
3. Brooding	.51**	-.39*	1					12.32	3.35	
4. Reflection	.24	-.19	.11	1				11.97	3.10	
5. Suppression	.55***	-.34*	.65***	.27	1			44.16	14.34	
6. Anxiety	.59***	-.48**	.69***	.30	.55**	1		29.20	17.62	
7. Worry	.55**	-.48**	.59***	.14	.50**	.95***	1	32.05	18.64	
8. Avoidance	.42*	-.54**	.61***	.33	.46**	.69***	.65***	17.94	18.35	

\*p <0.05; \*\* p <0.01; \*\*\*p <0.001

Table 2		Regression analyses with negative affect as predictor variable, effortful control as moderator and self-recorded anxiety, worry and avoidance as dependent variables			
<b>Dependent variable 1: Self-recorded Anxiety</b>		<b>B</b>	<b>SE</b>	<b>t</b>	<b>CI95%</b>
Model summary: R <sup>2</sup> =.50, F(3,28)=15.88***					
	NA	.50	.12	4.10***	(.25, .75)
	EC	-.41	.14	-2.96**	(-.69, .13)
	Interaction NA x EC	-.11	.11	-1.02	(-.34, .11)
<b>Dependent variable 2: Self-recorded Worry</b>		<b>B</b>	<b>EE</b>	<b>t</b>	<b>IC95%</b>
Model summary: R <sup>2</sup> =.47, F(3,28)=13.64***					
	NA	.46	.13	3.46**	(.18, .74)
	EC	-.42	.14	-2.93**	(-.71, -.13)
	Interaction NA x EC	-.10	.12	-.85	(-.36, .15)
<b>Dependent variable 3: Self-recorded Avoidance</b>		<b>B</b>	<b>EE</b>	<b>t</b>	<b>IC95%</b>
Model summary: R <sup>2</sup> =.49, F(3,28)=12.87***					
	NA	.28	.13	2.19*	(.02, .53)
	EC	-.53	.14	-3.82***	(-.82, -.25)
	Interaction NA x EC	-.29	.08	-3.58**	(-.46, -.13)
<b>Post-hoc probes from mean (EC)</b>		<b>Efecto</b>	<b>EE</b>	<b>t</b>	<b>IC95%</b>
	-1.00 SD	.57	.16	3.65**	(.25, .89)
	0.00 SD	.28	.13	2.19*	(.02, .53)
	+1.00 SD	-.02	.15	-.12	(-.31, .28)
<b>Moderator Value Johnson-Neyman</b>		.06			

NA = Negative affect; EC = Effortful control  
\*p <.05; \*\* p <.01; \*\*\*p <.001

Table 3		Regression analyses procedure to analyze potential multiple mediators (Brooding, Reflection and Suppression) over the direct relationship between negative affect and self-recorded anxiety			
Independent variable	B	SE	t	CI95%	Dependent variable
Step 1. NA			R <sup>2</sup> =.34. F(1.30)=16.45***		
	.59	.14	4.06***	(.29, .88)	Anxiety
Step 2. NA					
	.61	.15	3.37**	(.24, .99)	Brooding
	.30	.22	1.37	(-.15, .75)	Reflection
	.69	.12	5.72***	(.44, .93)	Suppression
Step 3			R <sup>2</sup> =.53. F(4.27)=11.74***		
NA	.20	.26	.75	(-.35, .74)	Anxiety
Brooding	.49	.21	2.39*	(.07, .91)	Anxiety
Reflection	.07	.16	.43	(-.26, .40)	Anxiety
Suppression	.10	.23	.42	(-.37, .56)	Anxiety
Step 4		Efecto	Boot EE	Boot IC95%	Dependent variable
Total Indirect Effect		.39	.20	(.05, .79)	Anxiety
NA x Brooding		.30	.16	(.09, .69)	Anxiety
NA x Reflection		.02	.06	(-.05, .19)	Anxiety
NA x Suppression		.07	.16	(-.21, .44)	Anxiety

NA = Negative affect. \*p <.05; \*\*p <.01; \*\*\*p <.001

supposed to be mediated only by brooding ( $B = .49$ ,  $SE = .21$ ,  $t = 2.39$ ,  $p < .05$ ). Negative affect effect over anxiety diminished from .59 (step 1) to .20 (step 3), so 66% of variance of negative affect - anxiety relationship is explained by brooding and suppression  $[(.59-.20)/.59]$ . Given that the negative affect path coefficient was not statistically significant in the multiple regression at step 3, it also indicates that the mediation effect of brooding is complete.

Finally, at step 4, the indirect effects of potential mediators were tested by means of bootstrapping techniques. Results pointed out that only the effect of negative affect through brooding reached the statistical significance (Boot CI95%: .07 to .91). Therefore, enough empirical evidence has been obtained to consider that brooding was a complete mediating variable on the relationship between negative affect and self-recorded anxiety.

## DISCUSSION

We explored the role of negative affect and effortful control on anxiety levels and on two forms of negative emotion regulation (worry and avoidance) by means of self-

records in naturalistic conditions. We found that increased negative affect predicted high anxiety and greater engagement in worry and avoidance patterns. This is consistent with previous work showing that the use of negative emotion regulation strategies is greatly determined by negative affect and that emotion regulation mediates the association between negative affect and anxiety.<sup>17, 36</sup> But contrary to our first hypothesis, we did not find that effortful control moderated neither the relationship between negative affect and anxiety, as previously reported for depression in adolescents<sup>11</sup> or general distress in adults,<sup>10</sup> nor with worry. The moderating effect of effortful control was clear, however, for the association between negative affect and avoidance, with high negative affect being related to the proneness to engage in avoidance behaviors only for participants exhibiting low effortful control.

Returning to anxiety and worry, in spite of no effortful control moderational effects, the inclusion of effortful control in the models significantly increased its predictive power. Low effortful control capability affected participants in that they experienced higher subjective anxiety and to engage in negative emotion regulation strategies as worry.

The second aim of the study was to analyse if self-reported rumination and suppression mediate the association between negative affect and anxiety self-records. The brooding facet of rumination totally mediated the association between negative affect and anxiety. Results are in line of those reported by Verstraeten and colleagues<sup>11</sup> for depressive symptoms in adolescents. The brooding facet of rumination, and not reflection, was especially linked to anxiety and depression, as suggested previously.<sup>29</sup> Suppression was also closely associated with high negative affect and high anxiety levels but, although a clear trend appeared, it did not mediate the association between these two variables.

Our study has a number of limitations. Sample size was quite small and restricted to college students. Sample size was a serious limitation for both conducting moderational and mediational analyses with enough power and for developing analytical SEM approaches. For that reason these results need to be interpreted very cautiously, although we think they deserve to be communicated attending its relative novelty. Future research should be addressed to larger samples in general population, as well as to people exhibiting emotional disorders.

For collecting participant records on emotional states we used online software designed for first use in the current study. No previous validity study was available and, for that reason, there may be some doubts about the accuracy of the instrument and its psychometric properties. However, we consider that the strengths of using self-records in naturalistic conditions overcome the limitations in the self-recording procedure.

## CONCLUSIONS

The current study is one of the very first including emotional state self-records in naturalistic conditions for the analysis of negative affect – effortful control interactions in determining anxiety and the use of emotion regulation strategies, and for exploring the mediation of negative emotion regulation styles in the association between negative affect and subjective anxiety. Avoidance patterns are significantly determined by negative affect – effortful control interaction and the brooding facet of rumination totally mediates the relationship between negative affect and anxiety. These results provide new avenues for advancing the understanding of emotion regulation as a component of emotional disorders.

## AUTHORS NOTE

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