Psychology & Neuroscience

The Relationship Between the Rumination Style and Perceptual, Cognitive, and Behavioral Inhibition

Isabel Introzzi, María Laura Andrés, Lorena Canet-Juric, Florencia Stelzer, and María M. Richard's

Online First Publication, November 10, 2016. http://dx.doi.org/10.1037/pne0000068

Psychology & Neuroscience

1983-3288/16/$12.00 http://dx.doi.org/10.1037/pne0000068

The Relationship Between the Rumination Style and Perceptual, Cognitive, and Behavioral Inhibition

Isabel Introzzi, María Laura Andrés, Lorena Canet-Juric, Florencia Stelzer, and María M. Richard's
National Scientific and Technical Research Council (CONICET), Buenos Aires, Argentina, and National University of Mar del Plata

Rumination is defined as an emotion-regulation strategy that consists of focusing on negative thoughts and feelings. It is important to identify the factors that make some people prone to this response style. The goal of this study is to analyze the differential contribution of the principal inhibitory processes on 2 forms of rumination: reflection and brooding. For this purpose, we relied on a sample of 27 adults from a nonclinical population. The researchers evaluated perceptual, cognitive, and behavioral inhibition by means of computerized tasks and evaluation surveys on depression and rumination styles. The results provide evidence in support of the role of cognitive inhibition in both rumination styles and its greater contribution to maladaptive forms of rumination rather than to adaptive forms that are more oriented toward problem solving.

Keywords: rumination, behavioral inhibition, cognitive inhibition, perceptual inhibition

Depression is a common mental disorder characterized by a negative affective state and difficulty in experiencing positive emotions (American Psychiatric Association, 2013). It affects an estimated 350 million people worldwide and is considered the leading cause of disability in the world, possibly conducing the individual to suicide in the worst of cases (World Health Organization, 2016). Given the prevalence and the high personal and social costs associated with this disorder, recognizing its risk factors and underlying mechanisms is especially important in its diagnosis, prevention and treatment. Specifically, it has been shown that the way in which individuals experience negative events and regulate their emotions can significantly increase the risk of depression (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Teasdale, 1988) and other psychopathological disorders (Diener & Seligman, 2002; Garnefski, Kraaij, & Spinhoven, 2001). Rumination is an emotion-regulation strategy that consists of repeated and passive focalization of attention on negative emotions, their causes and consequences (Nolen-Hoeksema, 1991). Rumination is a key vulnerability factor for depression (Webb, Miles, & Sheeran, 2012). Individuals with a rumination style have a greater probability of developing a depressive disorder and of it being longer lasting and more intense (Just & Alloy, 1997; Nolen-Hoeksema & Morrow, 1991; Nolen-Hoeksema, Morrow, & Fredrickson, 1993; Nolen-Hoeksema, Parker, & Larson, 1994; Treynor, Gonzalez, & Nolen-Hoeksema, 2003).

Now then, why is it that in response to a negative emotional state some people initiate a cycle of self-destructive thoughts that increases their negative affective state and vulnerability to depression? Identifying the factors that cause some people to have a greater propensity to this response style is relevant to the study of the processes that lead to the predisposition and maintenance of depression (Joormann & Vanderlind, 2014; Joormann & Quinn, 2014).

Isabel Introzzi, María Laura Andrés, Lorena Canet-Juric, Florencia Stelzer, and María M. Richard's, National Scientific and Technical Research Council (CONICET), Buenos Aires, Argentina, and Faculty of Psychology, National University of Mar del Plata.

Correspondence concerning this article should be addressed to Isabel Introzzi, Faculty of Psychology, National University of Mar del Plata, Deán Funes 3250, Cuerpo V, Nivel III, 7600 Mar del Plata, Buenos Aires, Argentina. E-mail: isabelintrozzi@gmail.com

In recent years, research has made it possible to identify the role inhibition plays in maintaining the negative affective state of depression (e.g., Joormann, 2004, 2010). Inhibition is the executive process responsible for suppressing or diminishing the interference generated by behaviors and prepotent representations of individual objectives and goals (Friedman & Miyake, 2004; Nigg, 2000). This process creates a containment barrier against the interference of irrelevant or inappropriate thoughts, emotions and behaviors; thus, it has been theorized that this process is deficient in the ruminative styles of persons with depression. It is logical to assume that the persistent tendency to focus excessively on negative thoughts and problems is related with inhibitory deficits or failures.

Studies that have analyzed this relationship have effectively found that inhibition is associated with rumination. However, these studies do not specify the inhibitory types they evaluated nor do they control for the joint effect these types may have on rumination. For instance, Joormann (2004) found that participants with dysphoria and a history of depressive episodes showed a diminished capacity to inhibit words with negative emotional content. Goeleven, De-Raedt, Baert, and Koster (2006) found similar results using faces with emotional expressions. Joormann (2006) found that participants with a low rumination tendency demonstrated the ability to inhibit words with emotional content while participants with high rumination scores did not inhibit emotional words. Frings, Wentura, and Holtz (2007) found that participants with dysphoria were slow to say words with a positive valence that had to be previously ignored, and a contrary effect for words with a negative valence. Later, Joormann and Gotlib (2010) found that the difficulty in inhibiting negative material (words) in participants with depression was associated with a greater tendency toward rumination.

Furthermore, other researchers used experimental paradigms that combine recognition tasks with instructions to ignore previously learned stimuli, generally words. This modification of the original Stenberg task evaluates the ability to inhibit representations in working memory, which is known as cognitive inhibition (Nigg, 2000). Several researchers have found an association between cognitive inhibition and rumination; for example, Hester and Garavan (2005) found that rumination is associated with greater difficulty in blocking previously learned negative material from working memory. In the same vein, Joormann and Gotlib (2010) found that participants diagnosed with depression exhibited difficulties inhibiting content with a negative emotional valence from working memory, and Meiran, Diamond, Toder, and Nemets (2011) demonstrated that rumination is associated with an inability to inhibit previously learned emotional content from working memory in participants with depression, but not in control individuals without depression.

This inhibition type has also been evaluated through directed forgetting tasks, providing convergent evidence as to the implication of cognitive inhibition in ruminative behavior. Basically, this type of task calls on participants to inhibit (forget) previously learned material. Through the use of this paradigm, it was found that participants who presented high scores on a rumination measure had less capacity to forget negative emotional material (Joormann & Tran, 2009). Along the same lines, Power, Dalgleish, Claudio, Tata, and Kentish (2000) documented that participants diagnosed with depression demonstrated a facilitation effect for negative words after being instructed to forget them. Hertel and Gerstle (2003) also demonstrated this effect in participants with dysphoria, who demonstrated a tendency to remember more of the negative words that they were supposed to have forgotten.

In short, several studies have found a relationship between difficulties in inhibition capacity and a tendency toward rumination. However, these studies tended to evaluate one type of inhibition without controlling for the possible effect of the others. Additionally, they focused exclusively on the maladaptive aspects of rumination without considering the adaptive dimension of this process. Considering this dimension would help determine to what degree inhibition difficulties are exclusive and not shared with the adaptive and nonadaptive aspects of rumination.

Currently, there is a significant body of empirical evidence suggesting that inhibition constitutes a nonunitary construct, implying a set of processes with well distinguished and relatively independent functional properties and characteristics: perceptual inhibition, cognitive inhibition, and behavioral inhibition (Friedman & Miyake, 2004; Nigg, 2000). Although the terms

used to refer to these processes vary by author, the majority agree as to their principal operative characteristics (Friedman & Miyake, 2004; Diamond, 2013; Introzzi, Canet-Juric, Montes, López, & Mascarello, 2015). Perceptual inhibition is the process that enables one to focus on relevant environmental stimuli by mitigating the interference generated by other stimuli present in the context. Cognitive inhibition intervenes to diminish the activation level of prepotent mental representations of intrusive or irrelevant character to achieve goals. Lastly, behavioral inhibition suppresses or cancels conduct and behaviors that are too strong, prepotent or inappropriate. While the latter inhibitory type contributes to control behavior, the other two processes—cognitive and perceptual inhibition—are applied to cognition, because they intervene in the regulation of perceptions and representations.

Further, although rumination was initially regarded as a maladaptive strategy in the face of distress (Nolen-Hoeksema, 1991), adaptive forms of rumination have since been recognized. The dysfunctional or maladaptive form known as "brooding" is characterized by a perseverant tendency to excessively concentrate or focus on problems and negative thoughts, and on negative emotional states, which makes it difficult to execute an effective action plan to alleviate unease and distress. The adaptive form called "reflection" involves the manifestation of positive curiosity about oneself. In this respect, under self-regulation theories (Carver & Scheier, 1998; Duval & Wicklund, 1972; Martin & Tesser, 1996; Pyszczynski & Greenberg, 1987, in Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008), rumination is initiated when a person perceives a discrepancy between the actual state and a sought-after or desired state. From that perception, two possible responses emerge: (a) excessive focalization on the discrepancy, which does not drive or favor behaviors or thoughts oriented toward resolving the problem, or (b) a process of self-reflection that culminates in conduct that is instrumental in either resolving the discrepancy or abandoning the objective.

In support of this theoretical perspective, Joormann, Dkane, and Gotlib (2006) indicated that patients with depression scored higher in the maladaptive factor and manifested a greater attentional bias in the face of stimuli with a negative emotional valence than a nonclinical control group. Others (Treynor et al., 2003) demonstrated that the maladaptive factor presented higher correlations with symptoms of depression than the adaptive or reflective factor, and although the latter showed a short-term correlation with the symptoms of depression, it was associated with a diminishing of the symptoms and with behavior that was more focused on resolving the problem in the long term.

At the moment, however, the results and conclusions on this relationship are contradictory. While some explain rumination as a tendency linked to inhibitory deficits in general (Hester & Garavan, 2005; Shapiro, 2002; Watkins & Brown, 2002), others consider it linked only to specific inhibitory deficits in the face of negative events (Joormann, 2006), and, lastly, there are those who suggest a significant relationship among these constructs is absent (Goeleven et al., 2006). These differences may be due to the unitary vision of inhibition held by some of these researchers. In this respect, new studies that consider the three inhibitory aspects or types proposed by present-day inhibition models and include the reflective factor of rumination will be of value and serve to complement previous studies. For this reason, the present study's goal is to analyze the differential contribution of the principal inhibitory processes to the two forms of rumination—adaptive (reflective) and maladaptive (brooding)—in a sample of adults from a nonclinical population. We hope the results will represent a contribution to the literature that helps clarify the contradictory findings reported in previous studies by defining the specific contribution of the different forms of inhibition to rumination.

Methodology

Research Design and Participants

A transverse correlation design was used. The initial sample was selected by convenience and was comprised of 29 adult subjects from the city of Mar del Plata in Buenos Aires, Argentina. The following inclusion criteria were used: must be between 18 and 50 years of age, must not have a history of psychiatric or neurological problems and/or mental retardation and motor or sensory deficits, must have completed primary education, and must not be undergoing

psychopharmacological treatment during the administration of the instruments. The ages of the participants ranged from 18 to 50 years ($M = 30.13$; $SD = 9.1$), and 62.1% were female. At the time the instruments were administered, 13.8% of participants had completed their secondary education, 41.4% had completed or were enrolled in postsecondary studies, and 44.8% had completed or were enrolled in university studies.

Materials

Three experimental tasks from the Cognitive Self-Regulation Tasks battery (Introzzi et al., 2015) were used to analyze the functioning of the different inhibitory processes. Each task independently measures a specific inhibitory type (for a detailed description, see Introzzi et al., 2015).

Perceptual inhibition. Perceptual inhibition was evaluated using a visual search task based on the Treisman and Gelade (1980) conjunction visual search paradigm. In this task, the participant is to identify the presence or absence of a target stimulus that is shown mixed in with a set of similar distractors. The task starts with a cross fixed in the center of the screen for 200 ms. Then a matrix of stimuli appears and remains on the screen until the participant enters a response. All of the distractors share an attribute with the target (shape or color, for instance), which guarantees the similarity among the stimuli and the interference effect necessary to activate perceptual inhibition. The task is comprised of a block of 10 practice tests followed by three experimental blocks of 40 tests. Each experimental block contains four sets of 10 tests with 4, 8, 16, and 32 distractors. For each set, the target is present in half of the tests and absent in the other half. The participant has to respond as quickly and as precisely as possible by pressing the "Z" key if the target is present and the "M" key if it is absent. The index used to evaluate perceptual inhibition was the mean reaction time (based only on correct responses) in the display of 32 distractors (PI RT32). It was assumed that the quicker the reaction time and the greater the percentage of correct responses, the more efficient the perceptual inhibition.

Cognitive inhibition. Cognitive inhibition was evaluated using a task based on Oberauer's (2001) modification of Sternberg's (1969) experimental paradigm. This task consists of 32 trials that are structured in three successive phases: learning, cue, and recognition test. In the learning phase, the participant has to memorize two lists of abstract figures distributed in rows of one or three elements, with the first located in the upper half of the screen and the second in the lower half. The list in the upper half of the screen is always shown in red and the list in the lower half is always shown in blue. Then, in the cue phase, the participant is notified about which list will be the target list. If the signal consists of a blue rectangle, it indicates that the recognition test will evaluate the blue list and if the signal is a red rectangle, it indicates that the test will evaluate the red list. In 50% of the tests, the rectangle is blue and in the other 50%, it is red; these are distributed randomly throughout the task. Lastly, in the recognition test, the rectangle remains on the screen and in the center a white, abstract figure appears: the test item. The participants must now indicate, as quickly and precisely as possible, if the item was included in the relevant list or not by pressing the "S" key (to indicate the item was included in the target list) or the "N" key (to indicate the item was not included in the target list). There are three types of test items: relevant items, intrusive items, and new items. Half of the items presented are relevant items (items from the target list) and the other half are not from the target list (intrusive and new items). Of the latter, half are intrusive (belonging to the nontarget list) and half are new (not belonging to either list; see Figure 2). Each test begins with a fixed point that appears on the screen for 200 ms; then the two lists with abstract figures are presented (in the upper and lower halves of the screen). How long the lists remain on screen depends on the number of stimuli, and is calculated by multiplying the total number of figures in the test by 1,300 ms. Afterward, the lists disappear and 800 ms later, a rectangle appears (blue or red) in the center of the screen for 200 ms. The signal then disappears and 900 ms later, the test item appears in white within the rectangle. The principal performance index is the mean reaction time (calculated based only on correct responses) in the recognition of intrusive items such that

the greater the reaction time, the less efficient the mean response time in recognizing intrusive items (CogI RTI). This measure represents the capacity of the participant to eliminate the intrusive items from the irrelevant list from working memory.

Behavioral inhibition. Behavioral inhibition was measured using a task based on the stop signal paradigm. The task was comprised of two practice blocks of 32 trials and one experimental block of 128 trials. The first practice block presented only *go* trials. Each trial began with a fixed cross appearing in the center of the screen for 500 ms. Then the cross disappeared and a red arrow pointing either to the left or right appeared for 1,000 ms. The participant was to press the left or right key that corresponded to the orientation of the arrow on the screen as quickly as possible. The arrows were distributed randomly, 16 pointing to the left and 16 pointing to the right. This task was referred to as the primary task. The second practice block was presented next. Participants were to perform the same trials in the previous block (primary task), but in this block they were told to stop their response (pressing the key) each time they heard an audio signal (stop signal). Hence, while executing the primary task, they were to occasionally stop their response (the secondary stop task) whenever they heard an audio signal (stop signal). The stop signal was presented unexpectedly on 25% of the tests and at varying intervals following the presentation of the arrow (stop signal interval [SSI]). All the tests (eight with the stop signal and 24 with execution) were presented randomly. The SSI for the first stop test was fixed, with the audio signal sounding 250 ms after the stimuli was presented for all participants, but afterward the interval was adjusted based on the subject's performance. This dynamic-adjustment procedure consisted of increasing the interval by 50 ms on the next test if the response was inhibited and decreasing it by 50 ms if the participant responded (indicating an inhibitory failure; see Logan, Schachar, & Tannock, 1997). This is one of the most widely used and reliable methods for calculating the principal performance index for this task: stop signal reaction time (SSRT). This index reflects the delay in stopping a response in a stop trial, thus constituting an estimate of the latency of the inhibitory process. The third block of 128 trials was the one that made it possible to obtain the various performance indices to calculate SSRT. With the exception of the number of tests, this block had the same characteristics as the prior block. The following indices were derived from this block: (a) mean reaction time for the go trials (75% of trials) and (b) the mean of the SSI without inhibitory failures (response emitted in stop trials). Finally, SSRT is calculated by subtracting the SSI mean from the reaction time (RT) mean obtained in *go* trials.

Rumination

To evaluate the ruminative response style, this study used the Hervás (2008) Spanish-language version of the Ruminative Responses Scale (RRS; Nolen-Hoeksema & Morrow, 1991). This scale has adequate levels of reliability and validity (Hervás, 2008). The instrument evaluates the frequency with which different ruminative response style behaviors are produced. Its inventory is comprised of 22 items that inquire as to how a person feels and acts in situations in which they are dejected, sad or depressed. Participants respond using a 4-point Likert scale to indicate the frequency with which these behaviors occur. The response options are 1(*almost never*), 2 (*sometimes*), 3 (*often*), and 4 (*almost always*). In addition to the total score for the overall scale, the RRS items are grouped in three subscales: Reflection, Brooding, and Depression. The first two correspond to the two components that have been identified in rumination: the tendency to reflect, which is defined as an adaptive response to negative events or emotional states, and the prejudicial tendency to brooding, which is described as a maladapted response and is more closely linked to the risk of depression (pondering). The Reflection subscale includes items such as "Analyze recent events to understand why you are depressed," "Go off by yourself to think about why you feel this way," and "Write down what you are thinking and analyze it." Examples of items from the Brooding subscale are "Think about what you have done to deserve this," ". . . why you always react this way," and " . . . a recent situation hoping it would have turned out

better." Typical Depression subscale items include "Think only about what you are feeling," " . . . about your feelings of weariness and annoyance," and " . . . about how hard it is for you to concentrate."

Depression

The goal of this study is to analyze the relationship between inhibitory processes and rumination in persons without symptoms of depression. Therefore, the Sanz, García Vera & Vasquez, 2003 Spanish-language version of the Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996) was administered to the entire sample. The BDI-II is a self-reporting instrument designed to evaluate the severity of symptoms of depression in adults and adolescents of at least 13 years of age. Scores are interpreted based on criteria or cutoff scores that define several categories or levels of severity for symptoms of depression, such as minimal, mild, moderate, and severe depression (Sanz, Gutiérrez, Gesteira, & García-Vera, 2014). Table 1 shows the indices used to measure the different variables and their corresponding acronyms.

Procedure

Participants in this study were required to sign an informed consent form that detailed the objectives of the study and described the confidentiality of the data. The instruments were administered individually by a trained researcher in a space that was prepared and designated for that purpose. The data were processed and analyzed with the SPSS program (19 version).

Prior to analyzing the data associated with the study's hypothesis and objectives, we verified that the inhibitory tasks met the internal validity criteria for each paradigm and analyzed the depression inventory scores. No participant presented clinically significant values; all the scores were below 14 (the lowest level). Then, we proceeded to analyze the effect of each inhibitory type on the principal components of rumination—reflection/brooding—through a multiple linear regression.

Results

Preliminary Analyses

Verification of assumed internal validity of inhibition tasks. The experimental paradigm that serves as the basis for the perceptual inhibition task is Treisman and Gelade's (1980) conjunction visual search. The paradigm predicts two principal effects: the target presence/absence effect and the number of distractors effect (Treisman & Sato, 1990). The target presence/absence effect is defined by the existence of greater RT when the target is absent versus when it is present, while the number of distractors effect is characterized by increased RT as the number of distractors increases. The presence of these effects in the study's sample was verified using a repeated measures analysis of variance (ANOVA). The repeated-measures ANOVA indicated that target presence, $F(1) = 1{,}807.316$ $p < .01$, and the number of distractors, $F(4) = 251.788$, $p < .01$, had significant effects on RT, both in the expected direction (see Table 2). The principal expected effect in the cognitive inhibition task was a response pattern characterized by greater RT for intrusive items versus the new items due to the greater interference they generate (Joormann & Gotlib, 2008; Oberauer, 2001). The repeated measures ANOVA verified this result, $F(1) =$

Table 1
Performance Indices and Acronyms for Inhibitory Processes and Rumination Styles

Process/Variable	Index	Acronym
Perceptual inhibition	Mean reaction time with 32 distractors	PI RT32
Cognitive inhibition	Mean reaction time in recognizing intrusive items	CogI RTI
Behavioral inhibition	Stop signal reaction time (SSRT): difference between the stop signal interval and the reaction time mean obtained in go trials	BehavI SSRT
Ruminative style	Reflection	RRef
	Brooding	RBro

Table 2
Descriptive Statistics for the Various Performance Indices

Index	Acronym	*M* (*SD*)	Minimum	Maximum	Kolmogorov Smirnov*
Perceptual inhibition	PI RT32	1,283.86 (268.88)	851	2,206	.73
Cognitive inhibition	CogI RTI	1,671.51 (641.28)	15.50	1,885.95	.20
Behavioral inhibition	BehavI SSRT	563.62 (641.28)	253.58	691.95	.42
Ruminative style	RRef	7.28 (3.21)	5	17	.00
	RBro	7.41 (2.42)	5	14	.09
Depression	Dep	7.02 (5.43)	0	10	.01

* $p < .05$.

20.886 $p < .01$, and it was thus concluded that the task fulfills this criterion. With respect to the behavioral inhibition task, the principal criterion was the percentage of correct responses with a stop signal. Given the type of procedure used to estimate braking time (see dynamic adjustment method under the task descriptions), the expectation was that participants would achieve a correct response rate of approximately 40% to 60% (see Logan et al., 1997; Verbruggen, Logan, & Stevens, 2008). This procedure guaranteed the validity of the relative inferences for the functioning of each inhibitory type.

Analysis of the assumptions of the linear regression models. Both models met the assumptions of the linear regression model. The residual analysis showed a typical estimation error of 1.75 (Model 1) and 2.75 (Model 2), which indicates a good fit between the regression line and the point cloud. In both cases, the typified residuals fit a normal distribution, given that 95% were in the [−1.96, +1.96] range, and 99.9% were in the [−3, +3] range, which indicates the existence of small residuals in the majority of cases. Additionally, the analysis of residual independence performed using the Durbin–Watson statistic showed independence of the residuals for both models (Model 1 = 1.67, Model 2 = 1.60), and the scatter plot of the residuals and the typified prognostics verified their uniformity for the full range of prognosticated values (assumed homoscedasticity of the residuals). The partial regression plots showed a tendency of a linear and positive relationship only for CogI RTI and the dependent variables (Rumination Scale's Brooding factor [RBro] and Reflection factor [RRef]; see Figures 1 and 2). However, as can be appreciated from the figures, although the coefficients were important (especially in the case of the RBro variable) the point clouds did not follow a perfect diagonal alignment (assumed linearity).

With respect to the number of independent variables, we considered including at least 15 to 20 observations for each independent variable estimated a priori in the model ($n = 29$), because a lesser number could result in Type II errors. In the end, collinearity diagnostics were carried out for the purpose of analyzing if high correlations existed between the independent variables of the two regression equations. The results showed tolerance values between .98 and .99, indicating that each independent variable shared less than 2% of the variance with the other independent variables. Further, we detected variance inflation factors <10 in all variables. Lastly, the collinearity diagnostics showed some eigenvalues close to zero and condition indices <15 for the majority of eigenvalues. In short, the preliminary analyses met the assumptions of the regression models, guaranteeing their validity and interpretation.

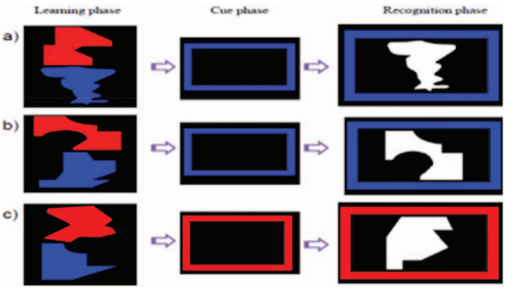

Figure 1. Cognitive inhibition task. (a) Trial with relevant items. (b) Trial with intrusive item. (c) Trial with new item. See the online article for the color version of this figure.

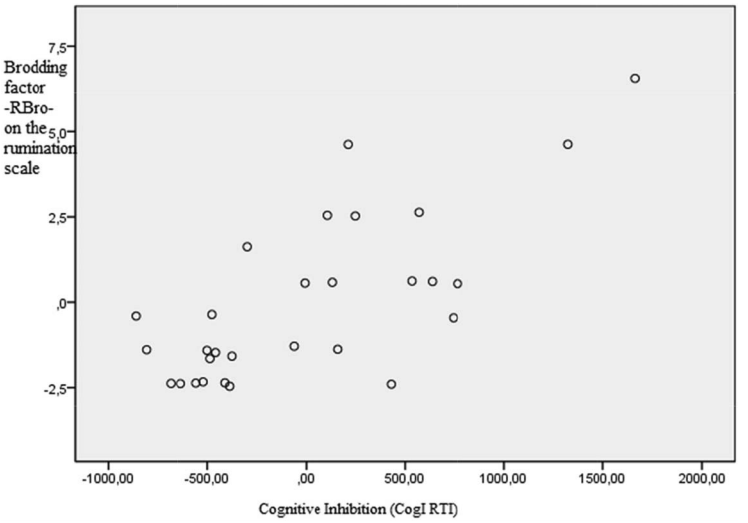

Figure 2. Partial regression plot for cognitive inhibition and the Brooding factor on the Rumination Scale (RBro). CogI RTI = Mean response time in recognizing intrusive items.

Descriptive Statistics

Table 2 shows descriptive statistics for all inhibition tasks, the RRS scale, and its factors—Reflection, Brooding, and Depression.

Relationships between inhibitory functioning and rumination. The multiple linear regression analysis technique was used to analyze the predictive power of the two models that included the inhibitory measures as the principal predictor variables. Model 1 included the three inhibitory measures (PI RT32, CogI RTI, and BehavI SSRT; see Table 1) and RBro as dependent variables; Model 2 incorporated the same three predictor measures and RRef as dependent or predictor variables.

With respect to Model 1 (see Figure 2), the results showed that taken jointly, the inhibitory measures explained 53.5% of the variance in RBro ($R^2 = .369, 5$), $F(3.29) = 9.59$, $p < .001$. However, although the model explained more than half of the dependent variable's variance, the critical levels associated with the t tests showed that of the set of potential predictors, only CogI RTI ($\beta = .73$, $t = 5.36$, $p < .001$) contributed significantly to the variability of the dependent variable (BehavI: $\beta = -.06$, $t = -49$, $p > .05$, and PI RT32: $\beta = -.06$, $t = -46$, $p > .05$). Similarly, a comparison of the standardized coefficients (β) showed the greater weight of CogI RTI in the regression equation with respect to the other two variables.

With respect to Model 2 (see Figure 3), the results were equivalent to those of Model 1, although the percentage of variance explained was 34.7% ($R^2 = .34, 7$), $F(3, 29) = 4,42$, $p < .05$. In terms of the weight of each inhibitory measure, the data indicated that once again the CogI RTI variable ($\beta = .57$, $t = 3.57$, $p < .05$) contributed more significantly than the other two predictor measures (BehavI: $\beta = .03$, $t = .21$, $p > .05$, and PI RT32: $\beta = -.20$, $t = -1. 28$, $p > .05$). To summarize, CogI RTI is the only variable that contributes significantly to explain what is occurring with the dependent variables RBro and RRef.

Discussion

Rumination is one of the most distinctive characteristics of depression and a vulnerability factor linked to the etiology, maintenance and recurrence of the depressive disorder. The literature distinguishes between the adaptive form of rumination, which culminates in the development of strategies aimed at resolving the problem and its consequences, and a maladaptive form, which repeatedly focuses on negative thoughts and feelings, and hinders the genera-

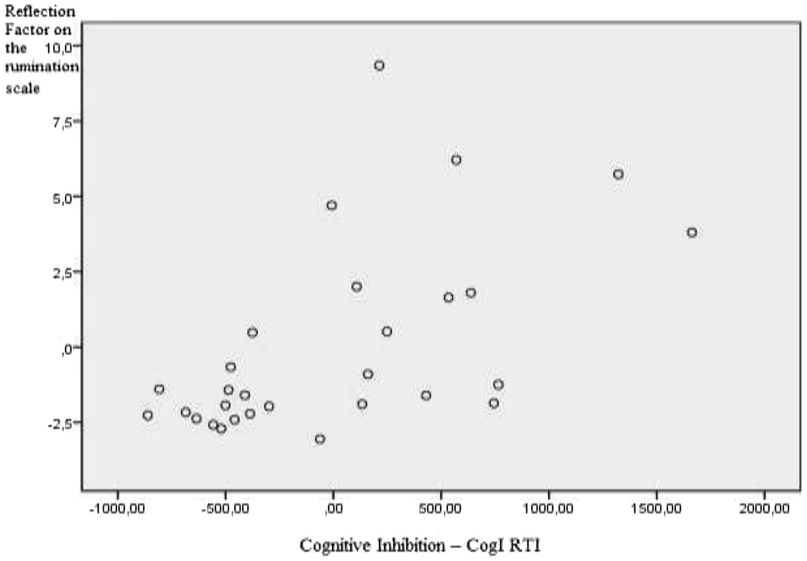

Figure 3. Partial scatter plot for Cognitive Inhibition and the Reflection factor on the rumination scale.

tion of thoughts and behaviors that could lead to a resolution. Persons diagnosed with depression or elevated levels of depressive symptomatology tend to use the maladaptive form of rumination with greater frequency. This finding has led to research into the potential risk factors linked to rumination. Which cognitive factors favor a tendency toward rumination? Is there a relationship between cognitive control and rumination? This study continues this line of research and proposes an analysis of the relationship between rumination and one of the principal processes of cognitive control: inhibition. Hence, the study's main interest is to explore the specific contribution of each inhibitory type—cognitive, behavioral, and perceptual—to the adaptive and maladaptive forms of rumination.

First, with the objective of analyzing the validity of the data obtained through inhibitory tasks, we carried out varying analyses that allowed us to verify the assumptions associated with each experimental paradigm. This procedure made possible the elaboration of valid inferences about the functioning of each inhibitory process. Second, for the purpose of verifying the predictive capability of the different inhibitory indices on the Reflective (adaptive form—Model 1) and Brooding (maladaptive form—Model 2) factors, we conducted a linear regression analysis that revealed the poor predictive value of behavioral and perceptual inhibition, and the significant weight of cognitive inhibition in the two types of rumination. This result is consistent with the principal operative properties that distinguish the different inhibitory types. In the case of behavioral inhibition, its field of action consists of behavioral habits and responses that tend to impose themselves as a result of their practice or firmly established habits. In the case of perceptual inhibition, its principal operative domain is defined by environmental stimuli that generate a strong attraction or attentional capture. Finally, the application environment for cognitive inhibition is the thoughts and/or internal representations that present with great force and intensity, and that can be therefore experienced as intrusive.

As previously mentioned, the principal characteristic of the ruminative phenomenon is the recycling, repetition and recurrence of thoughts and ideas, and it is precisely for this reason that cognitive inhibition plays a leading role in controlling them, as the results demonstrate. In short, of the different inhibitory types, cognitive inhibition seems to be most involved in rumination. The greater the efficiency of cognitive

inhibition, the lesser the use of rumination strategies in both its adaptive and maladaptive forms. In general, this implies that the inefficient functioning of cognitive inhibition favors the manifestation of ruminative tendencies, because it is unable to adequately put a stop to negative feelings and thoughts linked to the problem, thus blocking the implementation of other types of more adaptive strategies (Nolen-Hoeksema et al., 2008).

Another finding was the differential weight that cognitive inhibition carries in the two forms of rumination: adaptive and maladaptive. Cognitive inhibition carries greater weight in maladaptive rumination than in adaptive rumination. In other words, cognitive inhibition has greater predictive weight in the Brooding factor than in the Reflection factor. What explains this? Self-regulation theories (Carver & Scheier, 1998; Duval & Wicklund, 1972; Martin & Tesser, 1996; Pyszczynski & Greenberg, 1987) consider that the principal difference between adaptive and maladaptive rumination (Trapnell & Campbell, 1999; Treynor et al., 2003) is the perseverance of negative thoughts and problems. Thus, persons who manifest high levels of maladaptive rumination tend to focus excessively on the discrepancy between a desired or sought-after state and the actual state. The expectation is that reflection on this discrepancy would lead to instrumental behavior oriented toward resolving the problem or abandoning the sought-after objective. If the person persists in focusing on the discrepancy and the thoughts it provokes, negative feelings increase and instrumental behavior is blocked.

Therefore, as the results suggest, the greater the efficiency of cognitive inhibition, the less intense the manifestation of maladaptive rumination as measured by the Brooding factor. Conversely, the results indicate it has a lesser role in adaptive rumination. Confrontation theories (Endler & Parker, 1994; Folkman & Lazarus, 1980; Moos & Billings, 1982), consider that in this type of strategy, thoughts are more oriented toward a resolution to the problem than the management of emotions, which probably imposes fewer demands on cognitive inhibition; our results bear this out. In this case, because thoughts and representations are more closely tied to a solution, we can assume a lesser level of activation and thus reduced participation on the part of the inhibitory process.

In summary, the study provides empirical evidence in favor of the relevant assumptions, on the one hand, of the greater participation of cognitive inhibition in relation to the other two inhibitory types proposed by the nonunitary approach, and, on the other hand, of the greater participation of inhibition in the maladaptive forms than in the adaptive forms that are more oriented toward resolving problems.

However, these results are preliminary and exploratory; therefore, they should be considered with care. One of the major limitations of this study was its sample size. For this reason, we recommend the replication of this study with larger samples. The larger the sample, the lesser the confidence interval range for the same confidence level and population parameter accuracy (Clark-Carter, 2002). This would increase the study's external validity and yield more reliable results.

Additionally, the tasks we employed use neutral stimuli, while numerous other studies employ tasks with neutral and emotional stimuli (e.g., Hester & Garavan, 2005; Joormann & Gotlib, 2008; Meiran et al., 2011). Employing tasks with neutral stimuli is useful when attempting to more precisely determine the role of inhibitory mechanisms and control for possible congruence effects between the emotional state and the nature of the stimuli (e.g., Varner & Ellis, 1998). Future studies that compare the differential functioning of the three inhibitory types in terms of the nature of the stimuli on both forms of rumination would benefit from including both types of stimuli when designing their tasks.

Further, it would be interesting to include persons diagnosed with depression in the sample because, as several studies have found, they tend to present higher scores in the Brooding factor (Nolen-Hoeksema et al., 2008). Nonetheless, analyzing the relationships between these variables in nonclinical populations is of value because the results show that even in a population that has been diagnosed without depression, cognitive inhibition plays a role in the tendency toward rumination; consequently, the results can guide the design of training programs to control inhibition to prevent a tendency toward rumination. This would increase the variability of the results, thus providing a clearer understanding of the relationships between inhibitory processes and rumination.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: Author.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Manual for the Beck Depression Inventory–II*. San Antonio, TX: Psychological Corporation.

Carver, C. S., & Scheier, M. F. (1998). *On the self-regulation of behavior*. New York: Cambridge University Press.

Clark-Carter, D. (2002). *Investigación Cuantitativa en Psicología: Del diseño experimental al reporte de investigación* [Quantitative Research in Psychology: From experimental design to the research report]. New York, NY: Oxford University Press.

Diamond, A. (2013). Executive functions. *Annual Review of Psychology, 64,* 135–168.

Diener, E., & Seligman, M. E. (2002). Very happy people. *Psychological Science, 13,* 81–84. http://dx.doi.org/10.1111/1467-9280.00415

Duval, S., & Wicklund, R. A. (1972). *A theory of objective self awareness*. Oxford, United Kingdom: Academic Press.

Endler, N. S., & Parker, J. D. A. (1994). Assessment of multidimensional coping: Task, emotion, and avoidance strategies. *Psychological Assessment, 6,* 50–60. http://dx.doi.org/10.1037/1040-3590.6.1.50

Folkman, S., & Lazarus, R. S. (1980). An analysis of coping in a middle-aged community sample. *Journal of Health and Social Behavior, 21,* 219–239. http://dx.doi.org/10.2307/2136617

Friedman, N. P., & Miyake, A. (2004). The relations among inhibition and interference control functions: A latent-variable analysis. *Journal of Experimental Psychology: General, 133,* 101–135. http://dx.doi.org/10.1037/0096-3445.133.1.101

Frings, C., Wentura, D., & Holtz, M. (2007). Dysphorics cannot ignore unpleasant information. *Cognition and Emotion, 21,* 1525–1534. http://dx.doi.org/10.1080/02699930601054042

Garnefski, N., Kraaij, V., & Spinhoven, P. (2001). Negative life events, cognitive emotion regulation and depression. *Personality and Individual Differences, 30,* 1311–1327. http://dx.doi.org/10.1016/S0191-8869(00)00113-6

Goeleven, E., De Raedt, R., Baert, S., & Koster, E. H. W. (2006). Deficient inhibition of emotional information in depression. *Journal of Affective Disorders, 93,* 149–157. http://dx.doi.org/10.1016/j.jad.2006.03.007

Hertel, P. T., & Gerstle, M. (2003). Depressive deficits in forgetting. *Psychological Science, 14,* 573–578. http://dx.doi.org/10.1046/j.0956-7976.2003.psci_1467.x

Hervás, G. (2008). Adaptación al castellano de un instrumento para evaluar el estilo rumiativo: La escala de respuestas rumiativa [Spanish adaptation of an instrument to assess ruminative style: Rumiativa scale responses]. *Revista de Psicopatología y Psicología Clínica, 13,* 111–121.

Hester, R., & Garavan, H. (2005). Working memory and executive function: The influence of content and load on the control of attention. *Memory & Cognition, 33,* 221–233. http://dx.doi.org/10.3758/BF03195311

Introzzi, I., Canet-Juric, L., Montes, S., López, S., & Mascarello, G. (2015). Procesos inhibitorios y flexibilidad cognitiva: Evidencia a favor de la Teoría de la Inercia Atencional [Inhibitory processes and cognitive flexibility: Evidence for the theory of attentional inertia]. *International Journal of Psychological Research, 8,* 60–74.

Joormann, J. (2004). Attentional bias in dysphoria: The role of inhibitory processes. *Cognition and Emotion, 18,* 125–147. http://dx.doi.org/10.1080/02699930244000480

Joormann, J. (2006). The relation of rumination and inhibition: Evidence from a negative priming task. *Cognitive Therapy and Research, 30,* 149–160. http://dx.doi.org/10.1007/s10608-006-9035-8

Joormann, J. (2010). Cognitive inhibition and emotion regulation in depression. *Current Directions in Psychological Science, 19,* 161–166. http://dx.doi.org/10.1177/0963721410370293

Joormann, J., Dkane, M., & Gotlib, I. H. (2006). Adaptive and mal-adaptive components of rumination? *Behavior Therapy, 37,* 269–280. http://dx.doi.org/10.1016/j.beth.2006.01.002

Joormann, J., & Gotlib, I. H. (2008). Updating the contents of working memory in depression: Interference from irrelevant negative material. *Journal of Abnormal Psychology, 117,* 182–192. http://dx.doi.org/10.1037/0021-843X.117.1.182

Joormann, J., & Gotlib, I. H. (2010). Emotion regulation in depression: Relation to cognitive inhibition. *Cognition and Emotion, 24,* 281–298. http://dx.doi.org/10.1080/02699930903407948

Joormann, J., & Quinn, M. E. (2014). Cognitive processes and emotion regulation in depression. *Depression and Anxiety, 31,* 308–315. http://dx.doi.org/10.1002/da.22264

Joormann, J., & Tran, T. (2009). Rumination and intentional forgetting of emotional material. *Cognition and Emotion, 23,* 1233–1246. http://dx.doi.org/10.1080/02699930802416735

Joormann, J., & Vanderlind, W. M. (2014). Emotion regulation in depression: The role of biased cognition and reduced cognitive control. *Clinical Psychological Science, 2,* 402–421. http://dx.doi.org/10.1177/2167702614536163

Just, N., & Alloy, L. B. (1997). The response styles theory of depression: Tests and an extension of the theory. *Journal of Abnormal Psychology, 106,*

221–229. http://dx.doi.org/10.1037/0021-843X.106.2.221

Logan, G. D., Schachar, R. J., & Tannock, R. (1997). Impulsivity and inhibitory control. *Psychological Science, 8,* 60–64. http://dx.doi.org/10.1111/j.1467-9280.1997.tb00545.x

Martin, L. L., & Tesser, A. (1996). Some ruminative thoughts. In R. S. Wyer (Ed.), *Advances in social cognition* (Vol. IX, pp. 1–47). Mahwah, NJ: Erlbaum.

Meiran, N., Diamond, G. M., Toder, D., & Nemets, B. (2011). Cognitive rigidity in unipolar depression and obsessive compulsive disorder: Examination of task switching, Stroop, working memory updating and post-conflict adaptation. *Psychiatry Research, 185,* 149–156. http://dx.doi.org/10.1016/j.psychres.2010.04.044

Moos, R. H., & Billings, A. G. (1982). Conceptualizing and measuring coping resources and coping processes. In L. Goldberger & S. Breznitz (Eds.), *Handbook of stress: Theoretical and clinical aspects* (pp. 212–230). New York, NY: Free Press.

Nigg, J. T. (2000). On inhibition/disinhibition in developmental psychopathology: Views from cognitive and personality psychology and a working inhibition taxonomy. *Psychological Bulletin, 126,* 220–246. http://dx.doi.org/10.1037/0033-2909.126.2.220

Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology, 100,* 569–582. http://dx.doi.org/10.1037/0021-843X.100.4.569

Nolen-Hoeksema, S., & Morrow, J. (1991). A prospective study of depression and posttraumatic stress symptoms after a natural disaster: The 1989 Loma Prieta Earthquake. *Journal of Personality and Social Psychology, 61,* 115–121. http://dx.doi.org/10.1037/0022-3514.61.1.115

Nolen-Hoeksema, S., Morrow, J., & Fredrickson, B. L. (1993). Response styles and the duration of episodes of depressed mood. *Journal of Abnormal Psychology, 102,* 20–28. http://dx.doi.org/10.1037/0021-843X.102.1.20

Nolen-Hoeksema, S., Parker, L. E., & Larson, J. (1994). Ruminative coping with depressed mood following loss. *Journal of Personality and Social Psychology, 67,* 92–104. http://dx.doi.org/10.1037/0022-3514.67.1.92

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science, 3,* 400–424. http://dx.doi.org/10.1111/j.1745-6924.2008.00088.x

Oberauer, K. (2001). Removing irrelevant information from working memory: A cognitive aging study with the modified Sternberg task. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 27,* 948–957. http://dx.doi.org/10.1037/0278-7393.27.4.948

Power, M. J., Dalgleish, T., Cláudio, V., Tata, P., & Kentish, J. (2000). The directed forgetting task: Application to emotionally valent material. *Journal of Affective Disorders, 57,* 147–157. http://dx.doi.org/10.1016/S0165-0327(99)00084-1

Pyszczynski, T., & Greenberg, J. (1987). Self-regulatory perseveration and the depressive self-focusing style: A self-awareness theory of the development and maintenance of reactive depression. *Psychological Bulletin, 102,* 122–138. http://dx.doi.org/10.1037/0033-2909.102.1.122

Sanz, J., García-Vera, M. P., & Vázquez, C. (2003). Adaptación española del inventario para la Depresión de Beck-II (BDI-II): 1. Propiedades psicométricas en estudiantes universitarios [Spanish adaptation of Beck Depression inventory II (BDI-II): Psychometric properties in university students]. *Análisis y notificación de conducta, 29,* 239–288.

Sanz, J., Gutiérrez, S., Gesteira, C., & García-Vera, M. P. (2014). Criterios y baremos para interpretar el "Inventario de depresión de Beck-II" (BDI-II) [Criteria and standards for interpreting the " Beck Depression Inventory II" (BDI II)]. *Behavioral Psychology/Psicología Conductual, 22,* 37–59.

Shapiro, A. M. (2002). Attentional biases for negative information in depression: Rumination and deficient inhibitory processes. *Dissertation Abstracts International B: The Sciences and Engineering, 62,* 3815.

Sternberg, S. (1969). Memory-scanning: Mental processes revealed by reaction-time experiments. *American Scientist, 57,* 421–457.

Teasdale, J. D. (1988). Cognitive vulnerability to persistent depression. *Cognition and Emotion, 2,* 247–274. http://dx.doi.org/10.1080/02699938808410927

Trapnell, P. D., & Campbell, J. D. (1999). Private self-consciousness and the five-factor model of personality: Distinguishing rumination from reflection. *Journal of Personality and Social Psychology, 76,* 284–304. http://dx.doi.org/10.1037/0022-3514.76.2.284

Treisman, A. M., & Gelade, G. (1980). A feature-integration theory of attention. *Cognitive Psychology, 12,* 97–136. http://dx.doi.org/10.1016/0010-0285(80)90005-5

Treisman, A., & Sato, S. (1990). Conjunction search revisited. *Journal of Experimental Psychology: Human Perception and Performance, 16,* 459–478. http://dx.doi.org/10.1037/0096-1523.16.3.459

Treynor, W., Gonzalez, R., & Nolen-Hoeksema, S. (2003). Rumination reconsidered: A psychometric analysis. *Cognitive Therapy and Research, 27,*

247–259. http://dx.doi.org/10.1023/A:1023910315561

Varner, L. J., & Ellis, H. C. (1998). Cognitive activity and physiological arousal: Processes that mediate mood-congruent memory. *Memory & Cognition, 26,* 939–950. http://dx.doi.org/10.3758/BF03201174

Verbruggen, F., Logan, G. D., & Stevens, M. A. (2008). STOP-IT: Windows executable software for the stop-signal paradigm. *Behavior Research Methods, 40,* 479–483. http://dx.doi.org/10.3758/BRM.40.2.479

Watkins, E., & Brown, R. G. (2002). Rumination and executive function in depression: An experimental study. *Journal of Neurology, Neurosurgery, and Psychiatry, 72,* 400–402. http://dx.doi.org/10.1136/jnnp.72.3.400

Webb, T. L., Miles, E., & Sheeran, P. (2012). Dealing with feeling: A meta-analysis of the effectiveness of strategies derived from the process model of emotion regulation. *Psychological Bulletin, 138,* 775–808. http://dx.doi.org/10.1037/a0027600

World Health Organization. (2016). *Depression: Fact sheet*. Retrieved from http://www.who.int/mediacentre/factsheets/fs369/en/

Received August 2, 2016
Accepted October 5, 2016 ■