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Repetitive thinking, executive functioning, and depressive mood in the elderly

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ABSTRACT

Objectives: Previous findings and the depressive-executive dysfunction hypothesis suggest that the established association between executive functioning and depression is accounted for by repetitive thinking. Investigating the association between executive functioning, repetitive thinking, and depressive mood, the present study empirically tested this mediational model in a sample of older adults, while focusing on both concrete and abstract repetitive thinking. This latter distinction is important given the potential protective role of concrete repetitive thinking, in contrast to the depletive effect of abstract repetitive thinking.

Method: A sample of 43 elderly volunteers, between 75 and 95 years of age, completed tests of executive functioning (the Stroop test, the Trail Making test, and the Fluency test), and questionnaires of repetitive thinking and depression.

Results: Positive correlations were observed between abstract repetitive thinking and depressive mood, and between concrete repetitive thinking and executive functioning; a negative correlation was observed between depressive mood and executive functioning. Further, mediational analysis evidenced that the relation between executive functioning and depressive mood was mediated by abstract repetitive thinking.

Conclusion: The present data provide, for the first time, empirical support to the depressive-executive dysfunction hypothesis: the lack of executive resources would favor a mode of abstract repetitive thinking, which in turn would deplete mood. It suggests that clinical intervention targeting depression in the elderly should take into consideration repetitive thinking modes and the executive resources needed to disengage from rumination.

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Executive functions; rumination; repetitive thinking; depression; elderly

Since the seminal work of Susan Nolen-Hoeksema (1991, 2000), it is well established that mental rumination, a negative and evaluative mode of repetitive thinking (RT), is the main psychological process that precipitates and maintains depressive mood. In an extensive literature review, Watkins (2008) has distinguished two modes of RT: abstract/evaluative RT versus concrete/experiential RT. The former implies thinking repetitively in an abstract mode with a focus on self-evaluation and on the cause and consequence of one's mood state, for example 'what will happen to me if I continue to have such a bad sleep? Why can't I relax?' This mode is characteristic of depressive rumination. Indeed, a wealth of research has demonstrated that abstract/evaluative RT is causally related to mood depletion, predicts later depression, poor response to psychological intervention, and is related to procrastination and poor interpersonal problem solving (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Watkins et al., 2011). In contrast, concrete/experiential RT focuses on how the present experience unfolds and how it relates to the individual's needs and goals, for example 'what sensation do I feel in my body now? What is the issue at stake, now?' This RT mode has been shown to restore positive mood, to activate goal-directed behaviors, and to promote better interpersonal problem solving (Watkins, 2008; Watkins et al., 2011). Based on these findings, a new psychological treatment of depression has been suggested, the Rumination-Focused Cognitive Behaviour Therapy (Watkins, 2015) that aims at preventing abstract/evaluative RT and at developing concrete/experiential thinking.

Developing concrete/experiential thinking necessitates systematic training. Indeed, concrete/experiential thinking requires important executive control resources (Dalgleish et al., 2007). In particular, concrete/experiential thinking implies the capacity to focus on specific, precise information defining the present experience and the capacity to disengage from other information, such as judgments or general thoughts that are automatically activated. In other words, concrete/experiential thinking requires extensive attention control resources in order for the individual to remain focused on the immediate data of the present experience and goal, and to prevent automatic capture by judgments or other distracting thoughts. Conversely, experimental evidence has shown that abstract/evaluative RT hampers executive resources in people with depleted mood (Philippot & Brutoux, 2008; Watkins & Brown, 2002).

Interestingly, ample empirical evidence has demonstrated that depression is characterized by a depletion of executive resources (Castaneda, Tuulio-Henriksson, Marttunen, Suvisaari, & Lönnqvist, 2008; Fossati, Ergis, & Allilaire, 2002; Hasselbalch, Knorr, & Kessing, 2011). A model relating abstract/evaluative RT, executive capacities, and depression has been suggested (Belzung, Willner, & Philippot, 2015). Specifically, according to this model, exposure to stressors, such as life events or daily hassles, is likely to trigger abstract/evaluative RT, especially in people who lack the executive resources needed to engage in concrete experiential thinking. An abstract/evaluative RT would in turn precipitate and maintain

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depressive mood. A further feedback loop would be instantiated by the fact that depressive mood would hamper executive resources, heightening the vulnerability to abstract/evaluative RT that in turn maintains depression.

This cognitive model of depression has a particular relevance for geriatric depression. Indeed, old age is characterized by a decline of cognitive capacities, especially the more complex and elaborated or more fluid cognitive functions (Baltes, 1987). Executive functions (EF) seem particularly vulnerable in old age (Johnson, Lui, & Yaffe, 2007). It follows that the older adults present a higher risk of developing abstract/evaluative RT, given their potentially challenged EF. This might account for the positive association between age and depression (Knight, McMahon, Green, & Skeaff, 2004) or the high prevalence of depression in the elderly (Beekman et al., 1995). In line with this hypothesis, Ricarte, Ros, Serrano, Martínez-Lorca, and Latorre (2015) reported a relation between brooding (a form of abstract RT) and depressive mood in an elderly sample. Also congruent with this view, Opdebeeck, Nelis, Quinn, and Clare (2014) have observed that mood and rumination explain a significant amount of variance in cognitive test scores in elderly people with lower levels of cognitive reserve.

Synthetizing these ideas, Alexopoulos (2003) has proposed the depressive-executive dysfunction hypothesis to account for geriatric depression. According to that hypothesis, aging would impact negatively on the executive control of attention. The poorer capacity of executive control would favor the development of abstract/evaluative RT, which in turn would deplete mood. The depressive state so induced would further handicap the executive control of attention, hence locking a feedback loop maintaining depression.

Current study

The association between EF, abstract and concrete RT, and depressive mood has not been systematically investigated yet. Previous findings and the depressive-executive dysfunction hypothesis suggest a mediational model where the association between EF and depression is accounted for by RT. Our goal was to empirically test this mediational model in a sample of older adults, while focusing on both concrete and abstract RT. This study constitutes, to our knowledge, the first empirical test of Alexopoulos' (2003) depressive-executive dysfunction hypothesis. Further, the distinction between both forms of RT is important given the potential protective role of concrete RT, in contrast to the depletive effect of abstract RT.

Method

Participants

A final sample of 43 volunteers (39 women), aged 75−95 (M = 83.21; SD = 5.88), was used in the study. They were recruited from elderly homes (77%), the geriatric outpatient consultation of a general hospital (14%), and acquaintances (9%). To be included in the study, participants had to be 75 years old or more, to be physically able to carry out the testing, (i.e. functional motor control, hearing, and vision after correction when needed), and to present no signs of dementia or poor memory performance (as diagnosed by a neurologist and indexed by scores below the 10th percentile for free recall and cued recall at the Buschke 16 test; Grober & Buschke, 1987). From the original sample (N = 53), ten participants were excluded based on these criteria: six because of their poor performance at the Buschke 16, and four because of physical problems (e.g. inability to hold a pen, poor sight).

Procedure

Potential candidates for the study were first given a written presentation of the study. Those who manifested interest to participate were met by the experimenter who gave full explanation of the study and invited them to give a written informed consent to participate. Testing was then carried individually in a quiet room, alone with the experimenter, in one or two sessions according to the alertness capacity of the participants. The experimenter was a last year master student in psychology, with clinical experience in geriatrics, and a proper training in neuropsychological testing. The study protocol was approved by the ethical committee of Mont-Godinne University Hospital.

Measures

The measures were presented in the same order to the participants, as follows:

Socio-demographic variables. Participants indicated their age, sex, and level of educational attainment.

Neuropsychological tests

The Stroop test (Stroop, 1935) proceeds in three parts. First, participants have to name colors of printed colored rectangles (denomination). Second, they have to read the names of colors printed in black (lecture). Third, they have to name the color of the ink of color words that do not match the color of their ink (interference). The final score is the number of errors during the interference part.

For the Trail Making Test (TMT, Reitan, 1958), the subjects had to link in ascending order with a pen, without holding it from the sheet, a set of letters and numbers printed in random spaces. In a first section, the participants had to link only numbers (1-2-3…) or letters (a-b-c…). In a second section, participants must alternate numbers and letters (1-a-2-b-3-c…). If a mistake was observed by the experimenter, a correction was requested on line. The final score was the number of errors while performing section 2.

The Fluency test (Cardebat, Doyon, Puel, Goulet, & Joanette, 1990) requires the participants to produce as many words (a) beginning by the same letter (phonetic part) and (b) belonging to the same semantic category (semantic part). The total number of correct words produced was used to compute the two scores of phonetic and of semantic flexibility, respectively. Performing this test implies the activation of effective search strategies in semantic memory.

These neuropsychological tests allowed us to compute an EF composite. First, each cognitive indicator was transformed to z-scores. Then, the final EF score was computed as the standardized average of the four indicators (Cronbach's alpha = .82).

Questionnaires

Depressive symptomatology. As a measure of depressive mood, the participants filled out the short version of the Geriatric Depression Scale (GDS, Sheikh & Yesavage, 1986). This scale contains 15 items requiring a 'yes' or 'no' answer. It

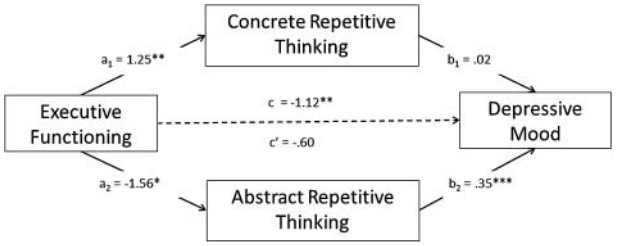

Figure 1. The multiple mediation model of the association between executive functioning and depressive mood via concrete and abstract repetitive thinking unstandardized regression coefficients from a bootstrap procedure are presented. $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$; $R^2 = .40^{***}$ (direct effect model).

presents good psychometric properties (Cronbach's alpha = .75) and demonstrated concurrent and discriminant validity (Freidman, Heisel, & Delavan, 2005).

Repetitive thoughts. The Mini Cambridge-Exeter Repetitive Thought Scale (Douilliez et al., 2014) is a 15-item self-report inventory that assesses two dimensions of ruminative thinking: concrete and abstract RT. Items were rated on a 4-point scale from 1 (*almost never*) to 4 (*almost always*). The internal consistency, as measured by Cronbach's alpha, is weak to good for the subscales concrete RT (Cronbach's alpha = .61) and unconstructive repetitive abstract RT (Cronbach's alpha = .80; Douilliez et al., 2014).

Data analysis

We examined the association between EF and depressive mood and the mediational role of concrete and abstract RT using a multiple mediation model (Figure 1) estimated by the SPSS PROCESS macro (Hayes, 2013). This macro tests the significance of the association between EF and the two indicators of RT (paths a_1 [concrete RT] and a_2 [abstract RT]), between the mental rumination and depressive mood (paths b_1 and b_2), and between EF and depressive mood (paths *c* and *c*'). The difference between path *c* (total effect) and path *c*' (direct effect) is that *c*' is estimated while adjusting for the two mediator variables (i.e. concrete and abstract RT). The indirect effects of EF on depressive mood via concrete and abstract RT (path a_1 × path b_1 and path a_2 × path b_2) were estimated using a bootstrapping approach ($N = 1000$).[1] Given the cross-sectional nature of the data we also examined the same multiple mediation model with EF as an outcome and depressive mood as a predictor.

Results

The means, standard deviations, and the inter-correlations between all the study variables are presented in Table 1. It can be seen that depressive mood is strongly related to abstract/evaluative RT, but not to concrete experiential thinking. Further, depressive mood is strongly and negatively related to EF.

The results of the mediation analysis are presented in Table 2. It includes the bootstrapped estimates and 95% bias-corrected confidence intervals (CI) for the total, direct, and indirect effects of EF on depressive mood. As expected, EF was positively associated with concrete RT, $a_1 = 1.25$, SE = .431, $p = .006$, and negatively associated with abstract RT, $a_2 = -1.56$, SE = .599, $p = .013$. In turn, abstract RT was significantly associated with depressive mood, $b_2 = .35$, SE = .088, $p < .001$. Higher levels of abstract RT correspond to higher levels of depressive mood. The indirect effect of EF on depressive mood via abstract RT was significant, estimate = −.54, SE = .254, $p = .034$, effect size (percent mediation) = .48. The direct effect was not significant, estimate = −.60, SE = .391, $p = .131$, which according to the traditional statistical approach to test mediational models based on causal steps (Baron & Kenny, 1986) would imply the existence of a full mediation (Figure 1). When the same mediational model was estimated with EF as an outcome, the indirect effects of depressive mood via abstract and concrete RT were not significant estimates : −.03, SE = .039, $p = .411$; −.02, SE = .022, $p = .300$, respectively.

Table 1. Means, standard deviations, and inter-correlations among the study variables ($n = 43$).

	M (SD) or %	1	2	3	4	5	6	7	8	9	10
(1) Age	83.21 (5.88)										
(2) Sex (women)	90.7%	.002									
(3) Education											
Primary school	37.2%										
Secondary school	51.2%	.002	.003								
Higher education	11.6%										
(4) Semantic fluency	18.44 (7.08)	−.16	−.01	.34*							
(5) Phonemic fluency	10.30 (4.94)	−.06	−.05	.58***	.70***						
(6) TMT	3.21 (2.43)	−.22	.16	.13	.54***	.56***					
(7) Stroop	5.43 (5.67)	−.06	.10	.13	.50**	.49**	.52***				
(8) Executive functioning	0 (1.00)	−.14	.06	.37*	.84***	.84***	.80***	.78***			
(9) Abstract RT	18.30 (4.14)	.11	−.26	−.07	−.21	−.34*	−.34*	−.39*	−.38*		
(10) Concrete RT	15.74 (3.03)	−.14	−.05	−.02	.35*	.24	.33*	.42**	.41**	−.23	
(11) Depressive mood	4.60 (2.73)	.20	−.19	.21	−.23	−.34*	−.42**	−.46**	−.41**	.60***	−.19

Note: *M* = mean; SD = standard deviation.
$^{***}p < .001$; $^{**}p < .01$; $^{*}p < .05$.

Table 2. Total, direct, and indirect effects of executive functioning on depressive mood.

	Bootstrap estimate	SE	95% BC CI lower	95% BC CI upper
Total effect	−1.12	.388	−1.904	−.336
Direct effect	−.60	.391	−1.392	.188
Indirect effect concrete RT	.02	.161	−.415	.259
Indirect effect abstract RT	−.54	.230	−1.063	−.155

Note: Based on 1000 bootstrap samples; SE = standard error; BC CI = bias-corrected confidence intervals; RT = repetitive thinking.

Discussion

In the present data, depressive mood was clearly related to abstract/evaluative RT, while the relation with concrete/experiential RT did not reach significance ($r = -.19$, p (one tail) $<.11$). Previous studies, conducted in student and adult populations, have systematically evidenced a positive correlation between depressive mood and abstract/evaluative RT (ranging from .44 to .53, according to the study) while the reverse correlation for concrete/experiential RT was not systematically reaching statistical significance, albeit always negative, ranging from −.12 to −.39 (Di Schiena, Luminet, Philippot, & Douilliez, 2012; DiSchiena, Luminet, & Philippot, 2011; Douilliez et al., 2014; Douilliez & Philippot, 2012; Heeren & Philippot, 2011). The present study thus replicates in a sample of adults over 75 years of age what has been observed in samples of younger adults: depressive mood is strongly associated with abstract/evaluative RT, even more so in the present sample. In contrast, the reverse relation with concrete experiential thinking is much weaker. As suggested by many authors (Nolen-Hoeksema, 1991; Teasdale, 1993; Watkins, 2008, 2015), depression is specifically associated with a mode of abstract, overgeneralizing and judgmental thinking, mostly about the self. This is true along the whole lifespan, and the present study is the first to observe this specific relation in people over 75 years of age. In the present data, concrete/experiential RT does not appear to be a significant protective factor against depression. This latter mode of RT might be more protective against anxiety than depression (Douilliez et al., 2014).

As reported by many previous studies in the adult population (Hasselbalch et al., 2011), depressive mood is also clearly related to executive dysfunction in the present elderly sample. In the present data, it should be noted that executive capacities are equally related to both modes of RT, positively so with concrete/experiential RT, and negatively so for abstract/evaluative RT. This pattern of results is congruent with the notion that concrete/experiential RT is an effortful process, requiring the capacity to disengage from automatically activated information and to willfully elaborate information relevant for the target task (Dalgleish et al., 2007). In contrast, abstract/evaluative RT would be favored by the lack of such executive control in RT and would represent a more automatic mode of RT.

Importantly, the mediational hypothesis revealed a pattern of results that is consistent with the notion that the relationship between executive dysfunction and depressive mood is partially mediated by abstract/evaluative RT. People with less executive resources would be more vulnerable to abstract/evaluative RT, which in turn concurs to depressive mood. This pattern of results corroborates Alexopoulos' (2003) depressive-executive dysfunction hypothesis. It suggests that training elderly people to disengage from abstract/evaluative RT might be a fruitful strategy to alleviate depressive mood, as already established in younger adults (Watkins, 2015). In elderly people, this training might more particularly entail a specific cognitive training of the executive resources needed to disengage from automatically activated verbal information.

The correlational nature of the present data prevents firm causal interpretations. However, the fact that the reverse mediational model (EF as a mediator of the effect of RT on depressive mood) was not significant strengthens the support to our directional hypothesis. Future studies might investigate this issue by examining how training EF in the elderly might impact on their RT and, consecutively on their depleted mood.

The present study did not include a comparative sample of young adults. Hence, it cannot be determined whether abstract/evaluative RT is more present in elderly people than in young adults, and whether differences in EF might account for such a difference. Still, a comparison can be made with the data reported by Douilliez et al. (2014) for a normative sample of 243 adults aged between 18 and 75 years. In that sample, abstract/evaluative thinking reached a mean of 18.93, very similar to the mean of 18.30 observed in the present sample. For concrete/experiential thinking, the normative adults' sample ($M = 17.06$, $SD = 3.71$) is slightly higher than the one observed in the present elderly sample ($M = 15.74$, $SD = 3.03$). Yet, a recent study comparing young and old adults suggests less brooding (a form or RT) in the latter (Ricarte et al., 2015). This question requires further attention by future research.

A limit of the present study is that the sample is mostly constituted by women. While this reflects the demography of this age group, future studies should ascertain that the same patterns of covariations are observed in men. Another limit is that all the data have been collected at the same time. A better test of the mediational hypothesis would be to conduct a longitudinal study, examining how the causal cascade unfolds in time.

In sum, the present study is the first to examine the relationship between executive capacities, two modes of RT, and depressive mood in a sample over 75 years of age. Like in their younger counter-parts, elderly people show a strong relation between abstract/evaluative RT and depressive mood. Further, the present data provide, for the first time, empirical support to Alexopoulos' (2003) depressive-executive dysfunction hypothesis. It suggests that clinical intervention targeting depressive mood in the elderly should take into consideration abstract/evaluative RT and the executive resources needed to disengage from it.

Note

1. The same pattern of results was obtained when age, sex, and education were included as covariates.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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