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Imbalance between abstract and concrete repetitive thinking modes in schizophrenia

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Abstract

Objective: Repetitive thoughts can be divided in two modes: abstract/analytic (decontextualized and dysfunctional) and concrete/experiential (problem-focused and adaptive). They constitute a transdiagnostic process involved in many psychopathological states but have received little attention in schizophrenia, as earlier studies only indexed increased ruminations (related to dysfunctional repetitive thoughts) without jointly exploring both modes. This study explored the two repetitive thinking modes, beyond ruminations, to determine their imbalance in schizophrenia.
Methods: Thirty stabilized patients with schizophrenia and 30 matched controls completed the Repetitive Response Scale and the Mini Cambridge-Exeter Repetitive Thought Scale, both measuring repetitive thinking modes. Complementary measures related to schizophrenic symptomatology, depression and anxiety were also conducted.
Results: Compared to controls, patients with schizophrenia presented an imbalance between repetitive thinking modes, with increased abstract/analytic and reduced concrete/experiential thoughts, even after controlling for comorbidities. Schizophrenia is associated with stronger dysfunctional repetitive thoughts (i.e. abstract thinking) and impaired ability to efficiently use repetitive thinking for current problem-solving (i.e. concrete thinking).
Conclusion: This imbalance confirms the double-faced nature of repetitive thinking modes, whose influence on schizophrenia's symptomatology should be further investigated. The present results also claim for evaluating these processes in clinical settings and for rehabilitating the balance between opposite repetitive thinking modes.
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1. Introduction

The presence of recurring thoughts focused on personal concerns constitutes a widespread habit in healthy adults [1]. Initial theoretical assumptions [2] have distinguished two classes of repetitive thoughts, ruminations (i.e. compulsive thoughts focused on the variables underlying negative feelings) [3] and worries (i.e. cognitive involvement in reflections about upcoming negative events) [4]. However, later works have shown the difficulty to separate ruminations and worries [5]. It has thus been suggested to classify repetitive thoughts on the basis of their underlying cognitive mode rather than of their content, leading to differentiate abstract/analytic and concrete/experiential modes [6]. The Abstract/Analytic repetitive Thinking mode (AAT) refers to evaluative thoughts associated with the global causes, significance and consequences of one's life experiences in a general, high-level and cross-situational way. Consisting of non-concrete thoughts (e.g., "Why is my life going so bad?"), this thinking mode favors dysfunctional and deleterious overgeneralization when facing negative life

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events [7,8].[1] AAT is related to poorer cognitive functioning, increased negative emotions and affective disturbances [7]. Conversely, Concrete/Experiential repetitive Thinking mode (CET) is related to low-level, specific and contextual thoughts focusing on actual problem solving and identifying the context/evolution of this problem (e.g., "How can I react to a specific ongoing event?"). This adaptive and functional thinking mode reduces emotional impairments, enhances mood regulation [9] and promotes adaptive behaviours under stress [10].

Beyond their frequency and intensity, the crucial factor regarding repetitive thoughts is thus the AAT-CET balance. Increased AAT and/or reduced CET are involved in the development and maintenance of depression [8], anxiety [11] and substance abuse [12]. Repetitive thinking modes are thus considered as an essential transdiagnostic process in psychiatry [13]. This AAT-CET imbalance can be modified by interventions, efficiently reducing psychopathological symptoms. For example, training the use of concrete thinking mode: (a) improves social problem solving [14] and alleviates depressive symptoms [15] in depression; (b) increases self-esteem in generalized anxiety [16].

While constituting a key feature in psychiatry, repetitive thinking modes have been little explored in schizophrenia. Theoretical assumptions [17] initially suggested that ruminations might increase positive symptoms by eliciting intrusive thoughts, themselves favouring hallucinations. This proposal was nevertheless exclusively tested among healthy populations. Early direct investigations in schizophrenia have focused on ruminations, confirming the high intensity of ruminative thoughts in patients and their deleterious influence on positive [18] and negative [19] symptoms. Rumination intensity is also correlated with sleeping disturbances [20] and self-reported distress engendered by positive symptoms [21]. However, these studies exclusively focused on dysfunctional repetitive thinking measures, ignoring the role of adaptive repetitive thinking modes. Indeed, these earlier works used the Ruminative Response Scale (RRS, specifically evaluating rumination in depression) [22], directly transferring the conceptualization of depressive ruminations to schizophrenia. As this tool focuses on sadness-related items and on the deleterious impact of ruminations, it is not adapted to evaluate repetitive thinking modes outside depression. Further, these studies did not control for the potentially moderating impact of comorbid anxiety and depression. The literature regarding repetitive thinking modes in schizophrenia thus currently presents three limitations: (a) dysfunctional ruminations in schizophrenia have only been explored with content-focused questionnaires targeting depression; (b) while self-reflection and introspective thinking deficits have been documented [17], suggesting that schizophrenia might be associated with reduced CET, adaptive repetitive thinking modes remain unexplored; (c) the moderating effects of comorbid anxiety and depression have not been controlled for. A deeper exploration of repetitive thinking modes is thus needed in schizophrenia, simultaneously measuring AAT and CET, beyond the exclusive use of the RRS. The Mini Cambridge-Exeter Repetitive Thought Scale (CERTS) [23], a theoretically-grounded questionnaire dissociating AAT and CET without referring to a specific mood or content of these thoughts, constitutes an ideal tool to achieve this goal.

This study aimed to simultaneously measure Abstract/Analytic and Concrete/Experiential repetitive thinking modes in schizophrenia, while controlling for psychological comorbidities. We hypothesized that, compared to matched controls, patients with schizophrenia would present a double dissociation between increased Abstract/Analytic and reduced Concrete/Experiential modes, reflecting an imbalance between repetitive thoughts.

2. Material and methods

2.1. Participants

Thirty inpatients (15 women), diagnosed with paranoid schizophrenia according to DSM-IV criteria, by means of an interview conducted by a trained psychiatrist and independently confirmed by a second interview (conducted by another trained psychiatrist and a psychologist with expertise in psychiatry research), were recruited in two Belgian psychiatric hospitals. All patients with schizophrenia (SP) had been stabilized for at least 6 months using antipsychotic medication, and 24 were still under medication (two under first-generation antipsychotic drugs, 13 under second-generation drugs, nine under both). The mean disease duration among SP was 26.4 years (S.D.: 11.13) and the mean number of previous episodes was 4.62 (S.D.: 3.89). No SP was in a first episode phase at testing time. Patients were matched for age, gender and education level with 30 control participants (CP) who reported to be free of any history of psychiatric disorder and psychotropic medication. Controls were recruited among the hospital staff, among the relations of the investigators or through the "participant pool" of the Faculty of Psychology (Université catholique de Louvain), containing several hundreds of healthy participants presenting a wide range of demographic characteristics and whom agree to take part in psychological experiments. Exclusion criteria for both groups included major medical problems, current or past neurological disease, other psychiatric diagnosis, substance abuse/dependence, age above 60, and difficulties to speak or read in French. Psychopathology was assessed in patients with the Positive and Negative Syndrome Scale (PANSS) [24], evaluating the presence of positive symptoms, negative symptoms and general psychopathology. Moreover, both groups were assessed using psychological measures to evaluate the presence of depression (Beck Depression Inventory, BDI, short version) [25] and anxiety (State and Trait Anxiety

[1] The AAT has to be distinguished from the "abstract thinking" term used in cognitive psychology, referring to the ability to efficiently think in terms of concepts and general principles and to infer global rules. Indeed, the AAT is not related to cognitive or intellectual abstracting abilities, but rather to a tendency to present global and unspecific self-focused thoughts.

Table 1
Demographic and psychopathological characteristics of schizophrenic (SP) and control (CP) participants: mean (SD).

	SP (N = 30)	CP (N = 30)	Group comparison (p-value)
Demographic measures			
Gender ratio (M/F)	15/15	15/15	1
Age (in years)	46.63 (9.93)	47.30 (9.78)	0.794
Education level (in years)	11.13 (2.97)	12.37 (2.44)	0.084
Psychopathological measures			
BDI[a]	11.67 (10.40)	4.40 (4.46)	0.001
STAI-A[b]	42.90 (10.14)	37.33 (14.97)	0.097
STAI-B	48.60 (9.05)	39.80 (11.15)	0.001
PANSS[c] – positive symptoms	21.67 (8.19)	/	/
PANSS – negative symptoms	24.07 (9.35)	/	/
PANSS – general psychopathology	50.70 (17.32)	/	/

[a] BDI = Beck Depression Inventory [25].
[b] STAI = State (A) and Trait (B) Anxiety Inventory [26].
[c] PANSS = Positive and Negative Syndrome Scale [24].

Inventory, STAI, forms A and B) [26]. Validated French versions were used [27,28]. Participants' characteristics are presented in Table 1. Participants were informed with full details regarding the aims of the study, provided written informed consent and were tested individually. The study was approved by the Ethical Committee of the Medical School (Université catholique de Louvain). Participants were not paid. This experiment was part of a larger project investigating emotional processing in schizophrenia, data acquisition took place between November 2011 and April 2013.

2.2. Repetitive thinking measures

- The RRS [22] is a self-report questionnaire assessing ruminative thoughts, conceptualized as the way people repeatedly think when feeling depressed. Participants rated 22 items exploring the presence of reflection (e.g., "*When you are sad or depressed, you write down what you are thinking and analyse it"*), brooding (e.g., "*When you are sad or depressed, you think about a recent situation, wishing it had gone better*") or depression-related (e.g., "*When you are sad or depressed, you think about how passive and unmotivated you feel*") ruminations on a 4-point Likert scale. The score for each subscale is the sum of the scores for each item of the subscale divided by the total number of items for this subscale.
- The CERTS [23] is a short and easy to administrate self-report questionnaire assessing AAT and CET occurring in various contexts during which participants are confronted with negative life events. While it has up to now not been used in schizophrenia, this questionnaire, initially developed and validated in healthy populations, has proven its efficiency as a transdiagnostic tool able to precisely measure repetitive thinking modes in a large range of psychiatric populations. Participants rated 15 items exploring the presence of abstract/analytic (e.g., "*I focus on why things happened the way they did*") and concrete/experiential (e.g., "*My thoughts move in new and interesting directions*") repetitive thinking modes on a 4-point Likert scale, regarding how they typically think when facing a difficult situation. The score for each subscale is the sum of the scores for each item of the subscale divided by the total number of items for this subscale.

2.3. Data analytic plan

Statistical analyses were performed using IBM SPSS Statistics 22. There were no missing values. First, between-groups comparisons were performed on demographic and psychopathological characteristics. Second, two analyses of variance (ANOVA) were conducted with groups (SP, CP) as between-subjects factor and (a) the three subscales of the RRS; (b) the two subscales of the CERTS, as dependent variables. This analysis was first conducted without covariates and then recomputed including the psychopathological variables for which significant group differences had been observed as covariates. For each ANOVA, significant main effects and interactions were followed by univariate contrasts (post-hoc *t*-tests).

3. Results

3.1. Demographic and psychopathological measures

As shown in Table 1, there were no significant group differences for age [$t(58) = 0.26$, $p = 0.79$], gender [$\chi^2(1, n = 60) = 0$, $p = 1$], education level [$t(58) = 1.76$, $p = 0.08$] and state anxiety [$t(58) = 1.69$, $p = 0.10$], but SP presented significantly higher depression [$t(58) = 3.52$, $p = 0.001$] and trait anxiety [$t(58) = 3.36$, $p = 0.001$] levels than CP.

3.2. Outcome measures

- *RRS*: A main group effect was found [$F(1,58) = 5.89$; $p = 0.02$; $\eta_p^2 = 0.09$], SP presenting higher scores than CP. No main subscale effect was found [$F(2,116) = 0.85$;

$p = 0.43$; $\eta_p^2 = 0.01$]. Centrally, a subscale × group interaction was found [$F(2,116) = 6.05$; $p = 0.003$; $\eta_p^2 = 0.09$], as SP presented significantly higher scores than CP for brooding [$t(58) = 2.94$; $p = 0.005$] and depression-related [$t(58) = 2.89$; $p = 0.005$] repetitive thoughts, but not for reflection [$t(58) = 0.29$; $p = 0.77$]. However, when depression and trait anxiety were included as covariates, the main group effect disappeared [$F(1,56) = 0.30$; $p = 0.58$; $\eta_p^2 = 0.005$], as well as the subscale × group interaction [$F(2,112) = 0.82$; $p = 0.44$; $\eta_p^2 = 0.01$].

- *CERTS*: No main group effect was found [$F(1,58) = 0.80$; $p = 0.37$; $\eta_p^2 = 0.01$]. A main subscale effect was found across groups [$F(1,58) = 9.14$;$p = 0.004$;$\eta_p^2 = 0.14$], CET globally leading to higher scores than AAT. Centrally, a subscale × group interaction was found [$F(1,58) = 23.78$; $p < 0.001$; $\eta_p^2 = 0.29$], as SP presented significantly higher scores than CP for AAT [$t(58) = 2.08$; $p = 0.042$], and conversely significantly lower scores for CET [$t(58) = 3.93$; $p < 0.001$]. This significant interaction persisted when depression and trait anxiety were included as covariates [$F(1,56) = 6.99$; $p = 0.011$; $\eta_p^2 = 0.11$]. These results are illustrated in Table 2.

3.3. Complementary analyses

Pearson's correlations were performed in the SP group to test the links between:

- *Outcome measures and current symptoms*: no significant correlations were found between current symptomatology (measured by the three classical factors of the PANSS) and RRS-CERTS subscales among SP ($r < 0.25$; $p > 0.17$). In order to deepen the exploration of the links between PANSS items and repetitive thinking, complementary correlational analyses were conducted between RRS-CERTS results and: (1) the more recent five-factorial structure of the PANSS [29], separating positive, negative, disorganization/concrete, excitation and depression symptoms; (2) each PANSS item, on an item-per-item basis. Here again, no significant correlation was observed among SP ($r < 0.36$; $p > 0.12$).
- *Outcome measurers and education level*: No significant correlations were found between years of education and RRS-CERTS subscales ($r < 0.21$; $p > 0.19$).
- *Outcome measures and psychopathological measures*: State anxiety was not correlated with outcome measures ($r < 0.32$; $p > 0.08$). Trait anxiety was significantly correlated with brooding ($r = 0.44$; $p = 0.014$) and depression ($r = 0.53$; $p = 0.003$) subscales of the RRS, but not with reflection ($r = 0.01$; $p = 0.953$), nor with CERTS subscales (AAT: $r = 0.18$; $p = 0.34$; CET: $r = -0.27$; $p = 0.156$). Depression was correlated with brooding ($r = 0.52$; $p = 0.003$) and depression-related ($r = 0.39$; $p = 0.031$) subscales of the RRS, and with AAT ($r = 0.51$; $p = 0.004$) subscale of the CERTS, but not with reflection ($r = 0.28$; $p = 0.13$) and CET ($r = 0.32$; $p = 0.084$).
- *RRS and CERTS results*: no significant correlations were found between CET and RRS subscales (brooding: $r = -0.24$; $p = 0.06$; depression: $r = -0.16$; $p = 0.22$; reflection: $r = 0.11$; $p = 0.42$), but AAT was significantly correlated with brooding ($r = 0.44$; $p < 0.001$), depression ($r = 0.52$; $p < 0.001$) and reflection ($r = 0.28$; $p = 0.03$), suggesting that the RRS is centrally focused on depressive/dysfunctional repetitive thoughts and does not measure concrete/experiential and functional repetitive thinking mode.

Table 2
Outcome measures for schizophrenic (SP) and control (CP) participants: mean (SD).

	SP (N = 30)	CP (N = 30)	Group comparison ANOVA[a]	Group comparison ANCOVA[b]
Mini Cambridge Exeter Repetitive Thought Scale (CERTS)				
Abstract/analytic thinking	2.23 (0.66)	1.91 (0.55)	0.042	0.047
Concrete/experiential thinking	2.07 (0.55)	2.60 (0.49)	<0.001	0.001
Ruminative Responses Scale (RRS)				
Reflection	2.14 (0.43)	2.09 (0.74)	0.767	0.294
Brooding	2.39 (0.59)	1.91 (0.65)	0.005	0.970
Depression-related	2.31 (0.66)	1.80 (0.69)	0.005	0.875

[a] p-Values for post-hoc *t*-tests on raw data.
[b] p-Values for post-hoc *t*-tests with anxiety and depression as covariates.

4. Discussion

The present study offered the first exploration of the AAT-CET imbalance in schizophrenia and showed that: (a) the increased presence of abstract repetitive thoughts among SP is not the mere consequence of comorbid depression; (b) schizophrenia is also linked with significant decrease of concrete/experiential repetitive thoughts. Our results confirm earlier ones [30,31] regarding the increased presence of deleterious perseverative thinking in schizophrenia (i.e. brooding and depression subscales of the RRS, AAT subscale of the CERTS). Counter-productive ruminations are thus at the heart of schizophrenia [19,21] and their reduction should constitute a clinical target. Moreover, the present data go beyond this simple replication by comparing the negative repetitive thoughts measures proposed by RRS and CERTS, and by exploring the influence of comorbid psychopathologies. First, the RRS is not unidimensional but rather multidimensional, as SP have increased brooding and depression-related ruminations but not reflective ones. As suggested earlier [22], this scale actually contains two subscales measuring depressive ruminations (brooding and depression-related) and one presenting a more ambiguous status (reflection), as increased reflection scores predict reduced depression at two-years follow-up but are also related to increased suicidal ideations [32]. Second, group differences regarding the RRS totally

disappeared when depression and anxiety were included as covariates, suggesting that increased brooding and depression-related thoughts are related to these comorbidities rather than to schizophrenia per se (which is reinforced by the correlations between depression-anxiety score and RRS subscales). In contrast, increased AAT was still present following the inclusion of these covariates, suggesting a genuine intensification of abstract-analytic repetitive thinking, independently of their depressive content. The CERTS is thus more effective than the RRS to measure adaptive repetitive thoughts (totally ignored by the RRS), but also to evaluate dysfunctional repetitive thinking modes in psychopathological populations which are not centrally characterized by depressive state.

We also offered the first investigation of adaptive repetitive thinking in schizophrenia, SP presenting less CET than CP, even when results were controlled for depression and anxiety. Schizophrenia is thus not only related to more prominent dysfunctional repetitive thoughts, but also to less frequent or intense functional ones. Repetitive thinking in this population is thus characterized by an AAT-CET imbalance, independently of the depression-anxiety contribution. Importantly, this imbalance is independent from education and current symptoms (i.e. PANSS scores computed using a three- or five-factor model, or even explored in an item-by-item way). While longitudinal studies should directly address this question, notably by exploring the links between repetitive thinking modes and psychopathological symptoms among psychiatric and healthy populations in larger samples, this suggests that imbalanced repetitive thinking modes might constitute a core feature of schizophrenia, independent of the fluctuations observed among observable symptoms. Earlier studies in psychiatric and healthy populations have found that this AAT-CET imbalance is related to lower attentional, executive and problem-solving abilities [33–35], and these disturbed repetitive thinking modes might thus be involved in the cognitive impairments repeatedly reported in schizophrenia. As a whole, this study proposes an in-depth rethinking for the conceptualization of repetitive thinking in schizophrenia: While earlier works [17,21] have suggested that negative and dysfunctional ruminations play a role in schizophrenia, the present results rather propose that the influence of repetitive thinking modes on schizophrenia should be theorized as an AAT-CET imbalance, with a crucial role of reduced adaptive repetitive thinking.

Future studies should thus deepen the exploration of AAT and CET in schizophrenia, notably to explore the generalization of the present results in larger SP samples presenting different characteristics (e.g. younger SP enduring a first episode, non-stabilized SP, SP with various history of recurring episodes), as well as the links between repetitive thinking modes and key deficits observed in schizophrenia, notably regarding: (1) interpersonal abilities, as it has been for example suggested that Theory of Mind, which is strongly impaired in schizophrenia, might be reduced in people presenting increased AAT [36]; (2) metacognition, which is a central deficit in schizophrenia [37] and has been found to mediate the AAT-CET imbalance in depression and anxiety [38]; (3) cognitive functioning, as the intense executive deficits repeatedly described in SP might favor a mode of abstract repetitive thinking, as observed in healthy populations [39].

Beyond these perspectives for future research, our results already bare several implications. At the fundamental level, they offer further support to the AAT-CET dissociation proposal [40]. This distinction had already been confirmed in mood disorders [6,7], and in other non-clinical (e.g. perfectionism) [41] or clinical (e.g. alcohol-dependence) [42] states, but our data extend this confirmation by showing a double dissociation in schizophrenia. At the clinical level, this study clearly claims for a simultaneous therapeutic intervention on AAT and CET. Several works have already tried to modify repetitive thoughts and insight abilities in schizophrenia. However, these studies conceptualized repetitive thoughts as being related to negative ruminations, and thus aimed at reducing the frequency of these thoughts by mindfulness [43], meditation [44] or cognitive remediation [45]. Our clinical recommendation is rather to reduce the AAT-CET imbalance, and to switch from a global reduction of repetitive thoughts to a joint AAT reduction and CET improvement, as allowed by recent intervention programs [9,46].

5. Conclusion

This study was the first to simultaneously explore abstract-analytic and concrete-experiential repetitive thoughts in schizophrenia. We showed a double modification in SP (increased AAT and reduced CET), even when depression and anxiety were controlled for. Schizophrenia is thus not merely associated with a global increase of negative repetitive thoughts, as suggested earlier, but rather with an imbalance between pervasive negative ruminations and conversely reduced constructive repetitive thoughts. This result should lead to a global reinterpretation of repetitive thinking in schizophrenia, at theoretical and therapeutic levels.

Declaration of interest

All authors report no competing financial interests or potential conflicts of interest, and no connection with pharmaceutical industries.

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