# Investigating the relationship between depression severity and cognitive rigidity through the use of cognitive errors

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## Summary

**Aim.** This study examined the association between depression severity and an indicator of the diversity of cognitive errors (CEs) used by individuals with major depressive disorder (MDD).
**Methods.** One early and one late therapy sessions for 42 patients were taken from the Jacobson et al. [1, 2] study, transcribed and rated for cognitive errors.
**Results.** Results revealed that the level of diversity of CEs is not significantly associated with depression severity.
**Discussion.** While previous studies [3] have shown that cognitive inflexibility is associated with psychopathology, our findings suggest that rigidity in the CEs used by depressed individuals is not.

cognitive errors / cognitive rigidity / flexibility / depression / Cognitive Error Rating Scale

## INTRODUCTION

According to Beck [4, 5] and to most cognitive behavioural therapists and theoreticians [6, 7, 8, 9, 10], depression is associated with negative thinking about the self, the world, and the future. Beck suggested that depressed individuals feel the way they do as a result of biased thinking towards events and experiences, and that depression can partially be maintained as a result of these cognitive biases [11]. These biases include, for instance, a tendency to focus solely on negative happenings and ignore positive ones [12]. Not only do depressed individuals focus more often on negative happenings, they also are thought to have increased accessibility to negative memories/cognitions and de-

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creased accessibility to positive memories/cognitions, which in turn is believed to increase their depressed state [10, 13, 14].

Indeed, the focus on negative views of the self and future is thought to prevent "reality testing of one's ideas, an active exploration of problem-solving alternatives and an appropriate use of other people as resources" [15]. Preliminary research findings suggest that this, along with other poor executive functioning abilities (e.g. working memory updating), is due to a rigid means of processing information [16], that is the individuals' cognitive functioning is often characterized by a lack of information processing alternatives. Previous studies have determined that physiological, behavioural, and cognitive rigidity are all factors that contribute to the development of psychological disorders [17]. Research has shown, for example, that individuals with major depressive disorder (MDD) are cognitively inflexible and rigid in their negatively held schemas [18]. **Furthermore, rigidity in depression is said to originate from a focused adher**ence to specific goals, which further perpetuates

a depressogenic state when the individual is neither able to attain those goals or substitute them for more probable ones [19]. Further support for the importance of cognitive inflexibility comes from Fresco and colleagues [17], whose findings showed that increased levels of depression are associated with explanatory inflexibility (difficulty forming numerous explanation for events) when individuals are confronted with negative life experiences. Their findings also showed that explanatory flexibility moderates the relationship between negative life events and degrees of self-reported depressive symptoms ensuing an 8 week period; the association found was strong amongst individuals with low explanatory flexibility and non-existent in individuals with high explanatory flexibility [17]. In addition, findings suggest cognitive rigidity in depressed individuals may partially be rooted in neurological predispositions. Research demonstrates for example that patients with MDD have an underactive prefrontal cortex, a region responsible for completing tasks of cognitive flexibility such as planning and decision making [20]. Further support for neurological explanations is demonstrated through the concept of 'executive dysfunction' associated with suicidality in depressed individuals, which is also linked to poor prefrontal cortex activation [21].

It is no surprise, then, that numerous studies link psychological *flexibility* to mental health [22, 23, 24], as it involves "recognizing and adapting to various situational demands, shifting mindsets or behavioural repertoires when strategies compromise personal or social functioning, and maintaining a balance among important life domains" [25]. It has been shown that it can mediate change in psychopathological symptoms, such as in cases of depression [3, 26, 27], where higher levels of flexibility are found to predict better mental health [22, 23, 24].

It remains however unclear to what extent flexibility, or lack thereof, in cognitions per se is related to depression. A "cognition" is a broad term that is defined as both the content of thought and the processes involved in thinking [28, 29]. Modes of perceiving and processing material, as well as problem solving attitudes and strategies are all considered aspects of cognition [29]. In depressed individuals, thinking and preoccupations are characterized by inaccurate and

exaggerated ways of viewing oneself and events [30]. According to Beck [4, 31, 32], the errors in their thinking are thought to derive from the frequent irrelevance and inappropriateness of their cognitions to the reality of situations, and also the constant negative bias against oneself. Explanatory flexibility is relevant to understand what cause individuals ascribe to these particular negative life events.

The aim of the present study was thus to further investigate the use of cognitive errors in individuals with major depression. More specifically, this study examined rigidity in cognitive errors and how it relates to depression severity and to change in depression through cognitive therapy.

## METHOD

### Participants

Participants were selected from a previous study [1, 2]. The original sample consisted of 152 participants who met criteria for major depressive disorder according to the Diagnostic and Statistical Manual of Mental Disorder (3rd edition, revised; DSM-III-R) [33]. Participants were recruited from two areas: eighty percent (80%) of the participants were referred directly to the study from Group Health Cooperative, a large health maintenance organization (HMO) in the United States; the remainder were recruited via public service announcements [1]. Exclusion criteria for the original study was based on the following: concurrent psychiatric disorders (i.e. bipoplar or psychotic subtpyes of depression, panic disorder, current alcohol or other substance abuse, past or present schizophrenia or schizophreniform disorder, organic brain syndrome, and mental retardation), already in psychotherapy or receiving psychotropic medication, and those needing to be hospitalized due to imminent potential for harm (i.e. suicide). In the original study, participants were randomly assigned to one of three treatment arms (Behavioural Activation-BA, Activation and the modification of dysfunctional thoughts- AT, or a Cognitive Therapy condition-CT); each treatment involved 20 sessions. For the purpose of this study the third and second to last sessions were used from the

CT arm (*n*=42). The CT arm was chosen in order to further investigate the use of cognitive errors, and therapy sessions 3 (after intake) and 19 (before termination) were chosen to capture the before and after effect of that therapy. The sample for the current study thus consisted of 33 women and 9 men undergoing CT, with a mean age of 38.72 (*SD*=8.92). Most participants were Caucasian (76.2%), 7.1% were Native American, 4.8% were African American, and 2.4 % were Asian. Participants were excluded from the present study if they had a missing BDI score either at time 1 or time 2 or if cognitive error scores were missing.

## Measures

Depression was assessed using the *Beck Depression Inventory (BDI)* [34]. Past studies have shown the validity of the measure [35, 36, 37]. Cognitive errors were assessed using the *Cognitive Errors Rating Scale (CERS-3rd edition)* [38]. The CERS is an observer-rated measure that uses codified procedures to identify cognitive errors as they occur or are reported by participants. Cognitive errors (CEs) are defined in the CERS as verbal statements that reflect information processing biases in comparison to normative means of evaluating that same material. The CERS assesses 15 CEs originating from the work of A.T. Beck and colleagues [39], J.S. Beck [40], and DeRubeis, Tang, and Beck [41], including: Fortune telling, Labeling, Over-generalization, All-or-nothing thinking, Magnification/Minimization, Mental filter, Should and must statements, Tunnel vision, Jumping to conclusions, Mind-reading, Personalization, Inappropriate blaming/crediting of self, while ignoring the roles of others, and Inappropriate blaming/crediting of other, while ignoring the role of self. Previous studies have shown the reliability and validity of this measure [e.g., 38, 42].

All 84 therapy sessions (42 participants, each with one early and one late session) were transcribed verbatim then rated for CEs by trained raters using the CERS. Raters were blind as to session number. Inter-rater reliability was assessed on 26% of all cases. Inter-rater reliability was good with a mean Intra-class coefficient (ICC 2, 1) of 0.81.

## Data analysis

Dispersion scores were calculated to quantify flexibility in relation to participants' use of cognitive errors [43, 44], using the Gini concentration C measure [see also 45] as follows:

$$\text{Dispersion} = C = \frac{1 - \sum (\text{squared probabilities of ratings in each level})}{C_{max} \text{ Maximum value of C}}$$

**Table 1.** Formulas for Computations of $C_{max}$

| Number of CE ratings in one subject's transcript | Value of $C_{max}$ |
|---|---|
| If (n ≤ 15) | $1 - n \times [(1/n)^2]$ |
| If (n ≥ 16 & n ≤ 30) | $1 - \{(n-15) \times (2/n)^2 + [15 - (n-15)] \times (1/n)^2\}$ |
| If (n ≥ 31 & n ≤ 45) | $1 - \{(n-30) \times (3/n)^2 + [15 - (n-30)] \times (2/n)^2\}$ |
| If (n ≥ 46 & n ≤ 60) | $1 - \{(n-45) \times (4/n)^2 + [15 - (n-45)] \times (3/n)^2\}$ |

Tab. 1 presents the formulas used to calculate the value of $C_{max}$. Within the table, *n* represents the number of cognitive errors rated in one session for one research participant. A Dispersion score of 0 indicates an inflexible use of different cognitive errors, maximum rigidity, whereas a Dispersion score of 1.0 indicates a wide use of the different cognitive errors and maximum flexibility.

Paired samples t-tests were computed to examine change in BDI scores as well as in dispersion from session 3 to session 19. Spearman correlations were used to examine the relationship between BDI and dispersion at time 1 and time 2, then to examine the relationship between change in depression and intake dispersion scores.

## RESULTS

Descriptive statistics can be found in Tab. 2 (*see the next page*); detailed results from the correlation analyses are displayed in Tab. 3 (*see the next page*) with Bonferroni corrections applied (*p* value was set at 0.025 for *α*=0.05). Over the course of therapy a significant decrease in depression severity was found, $t(41)=10.25$, $p<0.001$. At time 1, the mean BDI score was 23.45 (*SD*=8.41); at termination it decreased to 11.92 (*SD*=10.62). An increase in cognitive flexibility was found from time 1 (dispersion time 1=0.65, *SD*=0.17) to time 2 (dispersion time 2=0.71, *SD*=0.27); however, this increase was non-sig-

nificant following the Bonferroni correction, $t(41)=-1.35$, $p=0.18$. Cognitive flexibility and depression severity were not significantly correlated at either session 3 or session 19, $r(41)=0.08$, $p=0.60$ and $r(41)=0.29$, $p=0.07$, respectively. In addition, cognitive flexibility at session 3 was not found to be significantly correlated to change in depression severity over the course of therapy, $r(41)=-0.026$, $p=0.86$.

**Table 2.** Means and Standard Deviations for Beck Depression Inventory at time 1 (session 3), 2 (termination), difference between times 1 and 2, and dispersion scores at session 3 and termination

|                        | N  | Mean  | SD    |
|------------------------|----|-------|-------|
| BDI difference         | 42 | 11.53 | 7.30  |
| Dispersion time 1      | 42 | 0.65  | 0.26  |
| Dispersion time 2      | 42 | 0.71  | 0.27  |
| BDI total scores time 1| 42 | 23.45 | 8.47  |
| BDI total scores time 2| 42 | 11.92 | 10.62 |

SD: standard deviation

**Table 3.** Spearman correlations for Beck Depression Inventory scores at session 3 and termination with dispersion scores from time 1 and 2 and their differences

|                 | Dispersion Time 1 | Dispersion Time 2 |
|-----------------|-------------------|-------------------|
| BDI Time 1      | 0.10              | 0.29              |
| BDI Time 2      | 0.15              |                   |
| BDI Difference  | -0.19             |                   |

p value was set at 0.025 for $\alpha=0.05$

## DISCUSSION

Findings suggest that depression severity is not largely associated with rigidity in the participants' use of cognitive errors. Despite a significant decrease in depression severity, only a small non-significant increase in cognitive flexibility occurred over the course of therapy, which was unrelated to depression severity. Previous studies [46, 47] suggest that cognitive flexibility is associated with lesser psychopathology, including decreased severity of depression. That was not the case here. It is possible that therapy would have to extend beyond 19 sessions in order to fully address cognitive patterns that were more difficult to target and for a significant relationship between depression severity and cognitive flexibility to be observed. An alternative explanation for our results may be that the method in which individuals with depression process information and distort their reality is not of great relevance to depression severity but that their level of coping flexibility is what is important. Williams [48] supports this notion, as it was found that individuals who exhibit lower levels of coping flexibility and a cognitive vulnerability to depression (i.e. rumination) display significant increases in depression symptoms when confronted with negative life events across the span of six weeks. Furthermore, residual increases in depression symptoms were found to be significantly predicted by lower levels of coping flexibility apart from their cognitive risk status [48]. As long as individuals have the means to cope with their stressors, it is possible that cognitive vulnerability will not affect depression severity and the promise for its reduction. Individuals with depression do indeed express rigidity in different areas of their functioning (i.e. Beck's cognitive triad); however, our findings suggest that cognitive errors may not be the primary source of this rigidity.

These findings also suggest that further investigating should take place in order to better understand the mechanisms of depression and to help clinicians formulate more effective treatment plans for their depressed patients. For future research it would be beneficial to compare findings to a healthy control group, as research does suggest they too present cognitive errors [49].

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