

# **Cognitive (in)flexibility: potential risk factor for internalizing psychopathology across development?**

Laura Visu-Petra<sup>2</sup> & Oana Mărcuș<sup>1,2</sup>

<sup>1</sup>Human Behaviour and Development Research Lab, Lucian Blaga University of Sibiu, Sibiu,  
Romania;

<sup>2</sup>Research in Individual Differences and Legal Psychology (RIDDLE) Lab, Babeş-Bolyai  
University, Cluj-Napoca, Romania

Correspondence concerning this chapter should be addressed to Oana Mărcuș, Lucian Blaga University of Sibiu, Human Behaviour and Development Research Lab, 3 Brutarilor Street, Sibiu 550201, Romania, E-mail: [oana.marcus@ulbsibiu.ro](mailto:oana.marcus@ulbsibiu.ro)

Chapter published in Buchwald, P., Moore, K., Kaniasty, K. & Arenas-Landgrave, P. (2019). *Stress and Anxiety: Contributions of the STAR Award Winners*, Berlin: Logos Verlag.

Reference: Visu-Petra, L. & Mărcuș, O. (2019). Cognitive (in)flexibility: potential risk factor for internalizing psychopathology across development? In Buchwald, Moore, Kaniasty, & Arenas-Landgrave (Eds). *Stress and Anxiety. Contributions of the STAR Award Winners*, (pp. 125-134), Berlin: Logos

## Introduction

*Cognitive flexibility* enables us to swiftly adjust our thoughts and actions according to current goals and opportunities. Cognitive flexibility can be conceptualized as a superordinate construct, building upon working memory and inhibition processes (Diamond, 2013). During everyday contexts, individuals rely on this ability when they approach a difficult problem in various ways until finding a solution (thinking outside the box), revise a behaviour that is no longer productive, or try alternative strategies when solving a conflict. Higher levels of cognitive flexibility are related to superior math (Blair & Razza, 2007), and reading abilities in childhood (Engel de Abreu et al., 2014), better creativity in adulthood (Chen et al., 2014), and increased quality of life in older adults (Davis, Marra, Najafzadeh, & Liu-Ambrose, 2010). Greater cognitive flexibility in processing emotional material has been associated with superior emotion regulation skills (Martins, Mărcuş, Leal, & Visu-Petra, 2018), better academic achievement in early school age children (Wilson, Derryberry, & Kroeker, 2006) and increased resilience to stress and negative life events in adults (Genet & Siemer, 2011).

Across the lifespan, cognitive flexibility ensures optimal performance on a variety of tasks, and predicts functionality across a wide range of domains. It is only when this ability fails, that we become truly aware of the major role it plays in many aspects of daily life. When flexibility fails, people adopt a rigid repertoire of cognitive and behavioural responses and exhibit poor emotion regulation skills which could easily get them stuck in dysfunctional thinking loops (such as worrying or ruminating). These flexibility failures are among the defining hallmarks of people who experience emotional disorders (Kashdan & Rottenberg, 2010).

In this chapter, we aim to review the emerging body of literature looking at the relation between cognitive flexibility and emotional disorders (anxiety and depression) during early development to determine if the lack of flexibility is a risk factor for emotional disorders. There are few preliminary attempts to systematize research on (in)flexibility as a risk factor for emotional disorders (e.g., Coifman & Summers, 2019; Palm Reed, Cameron, & Ameral, 2018; Stange, Alloy, & Fresco, 2017) and they mainly focus on adult research. Coifman and Summers (2019) suggest that “it is also imperative to integrate and build upon findings from the developmental literature on emotional flexibility (or inflexibility). Indeed, one of the shortcomings of this burgeoning area of research is the relative absence of a developmental framework to inform these three lines of research on emotional inflexibility (Coifman & Summers, 2019, p. 8)”, referring to: (1) the capacity to use and vary deliberate emotion regulation strategies, (2) the context sensitivity of spontaneous emotional responses, and (3) flexibility in the appraisal of emotional events and experiences. While such ecological investigation of flexibility in everyday contexts are of highest relevance for developing a mechanistic view of inflexibility as a precursor to individual differences in psychopathology (vulnerability towards anxiety or depression), we argue that very focused studies, which isolate the specific reaction to sometimes individual threatening stimuli, often only achievable in lab settings, are fundamental in order to identify the developmental origins of individual variation in cognitive flexibility, which is what our chapter aims to do.

## **Cognitive (in)flexibility in anxiety: Emotionally-neutral information**

People who experience *anxiety* choose to avoid different contexts in which they don't feel comfortable and often show behavioural rigidity by spending a disproportionate amount of time in a place where they feel safe, instead of considering other alternatives (e.g., spending time with friends, engaging in rewarding activities) to deal with their symptoms. They also engage in inflexible patterns of worry and have problems shifting attention away from this negative content (Molina, Borkovec, Peasley, & Person, 1998). Worry helps anxious individuals to endure short-term anxiety by distracting themselves. According to the Cognitive Avoidance Theory (Sibrava & Borkovec, 2006) worry is negatively reinforced by the short-term reduction of distress. Indeed, intrusive worrisome thoughts are considered the primary source of anxiety and they could be explained by a deficient ability to deploy attention away from inner emotional thought content and to engage optimally in cognitive demanding tasks (Sibrava & Borkovec, 2006), even if such tasks lack an emotional content.

So far, studies looking at this relation have employed various task switching paradigms (for reviews see Braem & Egner, 2018; Kiesel et al., 2010; Vandierendonck, Liefvooghe, & Verbruggen, 2010). In this paradigm, a cue is presented prior to or concurrently with the trial stimulus, informing participants about the rule that needs to be applied. The cue signals what type of task set the participants need to employ on each trial (e.g., to discriminate the colour or the shape of the stimulus). Results across a large number of studies have demonstrated that responses are less accurate and slower following a switch in tasks, compared to when the same task is repeated (e.g., Rogers & Monsell, 1995). This switch cost has been taken to reflect the additional work needed to reconfigure the cognitive system to perform a new task.

Several studies conducted with adults provide support for the hindering role of high levels of anxiety on cognitive flexibility performance. For example, Derakshan, Smyth, and Eysenck (2009) showed that highly anxious individuals were significantly slower to switch between tasks compared to performing the same task, whereas those lower in anxiety demonstrated similar reaction times in both conditions. Several studies offer additional support for the presence of anxiety related effects in cognitive flexibility (Ansari, Derakshan, & Richards, 2008; Goodwin & Sher, 1992). However, there are also investigations that fail to report the same pattern of results when looking at the link between anxiety and cognitive flexibility (e.g., Kofman, Meiran, Greenberg, Balas, & Cohen, 2006). In this study, two groups of students were tested: one group was more stressed and anxious than the other because they were tested before the start of an examination period. Findings however, indicated that there were no significant differences between the two groups in switching costs (in terms of reaction times). In another study (Edwards, Moore, Champion, & Edwards, 2015), results showed that the interaction between trait anxiety and situational stress predicted the presence of impairments in cognitive flexibility performance (in terms of reaction times). Also, individual differences in working memory capacity further moderated this relation. Another clarifying study (Edwards, Edwards, & Lyvers, 2015) indicated that the link between trait anxiety and cognitive flexibility is found in specific circumstances: when mental effort is high, or when this effort is reduced, but situational stress is high. Lastly, a recent study suggests that trait anxiety may not be associated with general cognitive flexibility deficits but rather that, anxiety-related effects (in terms of greater switch costs) become visible when individuals must efficiently switch their attention away from an effortful established task set (Gustavson, Altamirano, Johnson, Whisman, & Miyake, 2017).

Taking a look at the developmental research, there are only a handful of studies which investigated (mostly clinical) anxiety-related impairments while children were performing a cognitive flexibility task with emotionally-neutral contents. One such study conducted with children with current separation anxiety disorder or overanxious disorder (6 – 18 years olds) showed that participants demonstrated poorer cognitive flexibility compared to a control group (Toren, Sadeh, & Wolmer, 2000). Furthermore, another study conducted with preschoolers found anxiety related cognitive flexibility deficits in a prospective memory task requiring switching (Cheie, Miclea, & Visu-Petra, 2014). Additional support comes from a study conducted with preschoolers, which revealed that greater levels of cognitive flexibility (measured as accuracy performance on the post-switch trials during the Dimensional Change Card Sort task) were a protective factor against developing anxiety problems in children with high levels of behavioural inhibition (White, McDermott, Degnan, Henderson, & Fox, 2011). Moreover, a recent longitudinal study reveals a strong link between cognitive flexibility deficits in preschoolers and greater anxiety/depression severity 3.5/5.5 years later (Kertz, Belden, Tillman, & Luby, 2016). Even though these studies seem to indicate that anxiety-related effects in terms of decreased flexibility manifest themselves in both nonclinical and clinical levels of anxiety, some findings are at odds with these results. For instance, one study failed to offer support for the presence of anxiety-related individual differences in cognitive flexibility in preschoolers (Țincaș, Dragoș, Ionescu, & Benga, 2007).

### **Affective (in)flexibility in anxiety: Emotional information**

According to the Attentional Control Theory of anxiety (ACT; Eysenck, Derakshan, Santos, & Calvo, 2007; see also Berggren & Derakshan, 2013; Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011) high anxious individuals should exhibit a deficit in cognitive flexibility, particularly in disengaging attention from emotional stimuli. When presented with an angry face, or any given piece of negative information, an anxious individual may take longer to disengage attention away from this content, compared to a non-anxious individual. Importantly, the ACT theory suggests that the effect of anxiety on cognitive flexibility is most striking when task demands are high and when participants are presented with threat-related distracting stimuli (that are not the direct focus of attention).

In what follows, we will discuss studies that have looked at anxiety related deficits in cognitive flexibility when emotional information is processed – ability that we henceforth call *affective flexibility*. Affective flexibility has been defined as the ability to flexibly deploy attention when processing emotional information and is considered crucial for the successful use of emotion regulation skills such as cognitive reappraisal (Malooly, Genet, & Siemer, 2013). To look at the basic precursors of this ability, different emotional versions of the task-switching paradigm were used across studies to capture the effects of anxiety upon the ability to deploy attention to different emotions. One such study indicated that participants with high self-report levels of spider fear, easily shifted from the non-emotional rule to the emotional rule, and had higher difficulty to disengage from the emotional rule (Paulitzki, Risko, Oakman, & Stolz, 2008). However, Johnson (2009) found that participants with higher levels of anxiety and worry exhibited a flexibility deficit by taking longer to switch from a non-emotional rule to an emotional rule. This result could be explained by the fact that the task used did not require participants to disengage attention from threat specifically as compared to Paulitzki et al. (2008), but rather from an emotional mental set that was not valence specific as the task only included

neutral faces. According to Johnson (2009), these results offer partial support for the hypothesis of the Attentional Control Theory "because individuals high in anxiety exhibited a generalized switching deficit and the switch costs were not significantly different regarding their relationship to trait anxiety" (Johnson, 2009, p. 687).

Only a small number of developmental studies have related individual differences in internalizing symptoms to affective flexibility. For instance, Mocan, Stanciu, and Visu-Petra (2014) used an emotional task switching paradigm to assess affective flexibility in a sample of 7-11 years old children. Children with high levels of internalizing symptoms (anxiety and depression) displayed a surprising impaired performance on repetition emotional trials and not on switching trials, this effect being present only in the feedback version of this task. The unexpected pattern of results was explained by an automatic exogenous process through which attention is drawn preferentially to emotional stimuli (Vuilleumier, Armony, Driver, & Dolan, 2002) thus hindering performance on a task that explicitly requires the repeated employment of the emotional rule. In an older sample (11-14 years olds), affective flexibility was related to individual differences in trait anxiety (Mărcuș, Stanciu, MacLeod, Liebrechts, & Visu-Petra, 2016) while participants completed an emotional version of the Flexible Item Selection Task (EM-FIST) and the standard version of the same task. Anxiety affected performance (in terms of longer reaction times) only on the EM-FIST task and only in trials requiring greater flexibility (flexible trials). Taken together, these studies offer preliminary support to the predictions advanced by the Attentional Control Theory in a developmental sample and suggest that individual differences in internalizing (especially anxiety) symptoms play a crucial role in children's affective flexibility performance.

### **Cognitive and affective (in)flexibility in depression**

In the case of *depression*, clinical observations suggest that individuals display a rigid behaviour by giving up their daily routine or by rejecting rewarding opportunities that come along and instead choosing to stay in bed all day. At a cognitive level, these individuals tend to ruminate about the various aspects of daily life that contribute to their depressed mood. This rumination is characterised by repetitive and perseverative thoughts with infrequent shifts in the topic of their inner monologue, which acts as a vulnerability factor for depression (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008).

To date, a small number of studies have investigated the relationship between depressive symptoms and cognitive flexibility or affective flexibility across the life span. Studies indicate the presence of affective flexibility impairments taking the form of larger switch costs (in terms of reaction times) in individuals who have a tendency to engage in rumination (de Lissnyder, Koster, Derakshan, & de Raedt, 2010). Findings revealed the absence of depression-related effects on affective flexibility performance when adults had to process non-emotional and emotional information. However, there was an association between depression scores and affective flexibility impairments only when comparing a small subgroup of individuals with moderate-severe depression levels to non-depressed individuals. When focusing on a sad face or a piece of negative information, a depressed individual may take longer to shift attention away from this content, compared to a non-depressed individual. This rigidity or inflexibility could also be reflected in an impaired ability to switch attention from unpleasant or negative thoughts to more pleasant or positive thoughts, usually taking the form of rumination. It is considered that deficits in cognitive control over emotional material can contribute to creating and maintaining a

depressed mood (De Raedt & Koster, 2010; Koster, De Lissnyder, Derakshan, & De Raedt, 2011).

The developmental studies have mostly focused on cognitive flexibility and highlight the presence of cognitive impairments in depressed adolescents as compared to a control group (Wilkinson & Goodyer, 2006). Another study found that in a sample of children at risk (with anxious or depressed parents) for depressive and anxiety disorders, symptoms of current major depression were associated with deficits in cognitive flexibility, whereas current anxiety was not associated with such impairments (Micco et al., 2009). This is partly in agreement with a previous study showing that children with depression and anxiety exhibited difficulties in cognitive flexibility (Emerson, Mollet, & Harrison, 2005). Nevertheless, Vilgis, Silk, and Vance (2015) conducted a review in which they looked at executive functioning in children and adolescents with depression. According to this review only a few studies (three out of ten) showed poorer cognitive flexibility in children with depression relative to a control group which is in line with the studies reviewed above. However, several studies failed to replicate these findings even though they used the same measures to tap into cognitive flexibility (the trail making test, the Wisconsin Card Sorting Test and the intra/extradimensional set-shift task from the CANTAB). In this review, the authors conclude that there is little support for executive functioning deficits in paediatric depression and they discuss a set of methodological problems that may contribute to the null findings. Furthermore, they speculate that the chronicity or severity of depression symptoms could explain the inconsistency between cognitive deficits displayed in adult samples and children with depression (Vilgis et al., 2015).

Moving on to children with nonclinical depression, a study showed that the younger group (4-6 years old children) displayed an increasing tendency to be derailed by perceived failure during a cognitive flexibility task. Also, they experienced higher levels of negative affect which suggest a depressive temperamental style (parental report) one year later (Luciana, Gunnar, & Davis, 2005). Even though the abovementioned studies indicate that depression is associated with cognitive flexibility impairments, a recent study indicated that high levels of rumination and inflexibility predict the onset of the first major depression episode in adolescence (Stange et al., 2017). This study offers support for the claim that inflexibility represents an antecedent and not a consequence of depression. To our knowledge, there aren't research studies looking at affective flexibility and depression symptoms during an even earlier developmental window.

### **Connecting the dots: A new perspective on affective (in)flexibility**

Emotional disorders are among the most common forms of psychopathology in children and adolescents. In light of the detrimental impact associated with greater levels of anxiety or depression vulnerability during development, and the possibility for these symptoms to become a lifelong burden on society and the individual, investigators have sought to identify the cognitive factors that explain the onset of such vulnerability. Developing a deeper understanding of the interaction between emotion (anxiety, depression) and cognition during early development is essential, not just for understanding how the mind works but mostly for illuminating the root causes of emotional disorders.

The studies reviewed so far attempted to uncover the underlying mechanisms of affective symptoms by suggesting that inflexibility could act as a vulnerability factor for the onset and maintenance of different forms of psychopathology. Taken together, developmental studies

looking at the link between anxiety and cognitive flexibility seem to indicate the presence of a detrimental effect of anxiety with only one study failing to replicate this consistent pattern of findings (Țincaș, Dragoș, Ionescu, & Benga, 2007). If we take a look at the studies conducted with adults, most of them indicate the same results (but see also Kofman et al., 2006 for a different pattern of findings) even though recent studies pinpoint to a more complex relation in which we should also account for different factors (e.g., situational stress, mental effort, working memory capacity) that contribute to the link between anxiety and cognitive flexibility. An important issue that none of the developmental studies investigated is how the presence of common comorbidities of anxiety (such as depression disorders) may impact the presence of individual difference in cognitive flexibility abilities in anxiety.

When looking at affective flexibility and anxiety during development and in adult samples, studies show a consistent pattern of findings by indicating the presence of anxiety-related effects in terms of affective flexibility impairments when emotional information is processed. When looking at the link between depression and cognitive flexibility in children the literature is inconsistent across studies which may be attributed to the chronicity or severity of the depression symptoms (Vilgis et al., 2015). In terms of analyzing the association between depression and affective flexibility during childhood, to our knowledge, there isn't any study investigating this association. However, in adults studies seem to indicate that affective flexibility is affected mostly when the levels of depression are very high and the same pattern of results is found when looking at cognitive flexibility performance (Stange et al., 2017).

Importantly, some preliminary studies seem to indicate that inflexibility may be an antecedent and not a consequence of anxiety (Kertz et al., 2016) and depression (Kertz et al., 2016; Stange et al., 2017). These studies highlight the importance of an early assessment of cognitive flexibility, in order to identify children and adolescents at risk for developing such emotional disorders. In terms of developing successful interventions, one possibility is cognitive therapy taking the form of teaching children and adolescents with mood disorders to be more flexible in the way in which they apply different emotional regulation skills. However, more basic strategies such as training children or adolescents to switch attention away from threat (Attention Bias Modification training - ABM, MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002) may potentially reduce vulnerability to anxiety or depression. In a review paper focused on the efficacy of ABM training in children and adolescents experiencing anxiety, Lowther and Newman (2014) concluded that this type of intervention represents a promising avenue for decreasing anxiety disorders. Lastly, another option would be to develop and test effective cognitive training programs for children with anxiety or depression symptoms. In light of this, a recent study offers some preliminary promises regarding the efficacy of cognitive training interventions by showing that adaptive working memory training reduces sub-clinical symptoms of anxiety and depression in adolescents (Beloe & Derakshan, 2019). Importantly, this effect was found immediately after the completion of the cognitive training but it was also stable across a one month period.

## **Acknowledgements**

This project was financed from the Lucian Blaga University of Sibiu research grants LBUS-IRG-2018-04 and by a grant from the Ministry of Research and Innovation, CNCS - UEFISCDI, project number PN-III-P1-1.1-TE-2016-2170, within PNCDI III.

## References

- Ansari, T. L., Derakshan, N., & Richards, A. (2008). Effects of anxiety on task switching: Evidence from the mixed antisaccade task. *Cognitive, Affective and Behavioral Neuroscience*, 8(3), 229–238. <https://doi.org/10.3758/CABN.8.3.229>
- Beloe, P., & Derakshan, N. (2019). Adaptive working memory training can reduce anxiety and depression vulnerability in adolescents. *Developmental Science*, e12831. <https://doi.org/10.1111/desc.12831>
- Berggren, N., & Derakshan, N. (2013). Attentional control deficits in trait anxiety: Why you see them and why you don't. *Biological Psychology*, 92(3), 440–446. <https://doi.org/10.1016/j.biopsycho.2012.03.007>
- Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development*, 78(2), 647–663. <https://doi.org/10.1111/j.1467-8624.2007.01019.x>
- Braem, S., & Egner, T. (2018). Getting a Grip on Cognitive Flexibility. *Current Directions in Psychological Science*, 27(6), 470–476. <https://doi.org/10.1177/0963721418787475>
- Cheie, L., Miclea, M., & Visu-Petra, L. (2014). What was i supposed to do? Effects of individual differences in age and anxiety on preschoolers' prospective memory. *International Journal of Behavioral Development*, 38(1), 52–61. <https://doi.org/10.1177/0165025413506132>
- Chen, Q., Yang, W., Li, W., Wei, D., Li, H., Lei, Q., ... Qiu, J. (2014). Association of creative achievement with cognitive flexibility by a combined voxel-based morphometry and resting-state functional connectivity study. *NeuroImage*, 102(P2), 474–483. <https://doi.org/10.1016/j.neuroimage.2014.08.008>
- Coifman, K. G., & Summers, C. B. (2019). Understanding emotion inflexibility in risk for affective disease: Integrating current research and finding a path forward. *Frontiers in Psychology*, 10(FEB). <https://doi.org/10.3389/fpsyg.2019.00392>
- de Lissnyder, E., Koster, E. H. W., Derakshan, N., & de Raedt, R. (2010). The association between depressive symptoms and executive control impairments in response to emotional and non-emotional information. *Cognition and Emotion*, 24(2), 264–280. <https://doi.org/10.1080/02699930903378354>
- De Raedt, R., & Koster, E. H. W. (2010). Understanding vulnerability for depression from a cognitive neuroscience perspective: A reappraisal of attentional factors and a new conceptual framework. *Cognitive, Affective and Behavioral Neuroscience*, 10(1), 50–70. <https://doi.org/10.3758/CABN.10.1.50>
- Derakshan, N., & Eysenck, M. W. (2009). Anxiety, processing efficiency, and cognitive performance: New developments from attentional control theory. *European Psychologist*, 14(2), 168–176. <https://doi.org/10.1027/1016-9040.14.2.168>
- Derakshan, N., Smyth, S., & Eysenck, M. W. (2009). Effects of state anxiety on performance using a task-switching paradigm: An investigation of attentional control theory. *Psychonomic Bulletin and Review*, 16(6), 1112–1117. <https://doi.org/10.3758/PBR.16.6.1112>
- Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, 64, 135–168. <https://doi.org/10.1146/annurev-psych-113011-143750>
- Edwards, E. J., Edwards, M. S., & Lyvers, M. (2015). Cognitive trait anxiety, situational stress, and mental effort predict shifting efficiency: Implications for attentional control theory. *Emotion*, 15(3), 350–359. <https://doi.org/10.1037/emo0000051>



- Edwards, M. S., Moore, P., Champion, J. C., & Edwards, E. J. (2015). Effects of trait anxiety and situational stress on attentional shifting are buffered by working memory capacity. *Anxiety, Stress and Coping*, 28(1), 1–16. <https://doi.org/10.1080/10615806.2014.911846>
- Emerson, C. S., Mollet, G. A., & Harrison, D. W. (2005). Anxious-depression in boys: An evaluation of executive functioning. *Archives of Clinical Neuropsychology*, 20(4), 539–546. <https://doi.org/10.1016/j.acn.2004.10.003>
- Engel de Abreu, P. M. J., Abreu, N., Nikaedo, C. C., Puglisi, M. L., Tourinho, C. J., Miranda, M. C., ... Martin, R. (2014). Executive functioning and reading achievement in school: a study of Brazilian children assessed by their teachers as "poor readers"; *Frontiers in Psychology*, 5(June), 1–14. <https://doi.org/10.3389/fpsyg.2014.00550>
- Eysenck, M. W., & Derakshan, N. (2011). New perspectives in attentional control theory. *Personality and Individual Differences*, 50(7), 955–960. <https://doi.org/10.1016/j.paid.2010.08.019>
- Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: Attentional control theory. *Emotion*, 7(2), 336–353. <https://doi.org/10.1037/1528-3542.7.2.336>
- Genet, J. J., & Siemer, M. (2011). Flexible control in processing affective and non-affective material predicts individual differences in trait resilience. *Cognition and Emotion*, 25(2), 380–388. <https://doi.org/10.1080/02699931.2010.491647>
- Goodwin, A. H., & Sher, K. J. (1992). Deficits in set-shifting ability in non-clinical compulsive checkers. *Journal of Psychopathology and Behavioral Assessment*, 14, 81–92. <http://dx.doi.org/10.1007/BF00960093>
- Gustavson, D. E., Altamirano, L. J., Johnson, D. P., Whisman, M. A., & Miyake, A. (2017). Set shifting really impaired in trait anxiety? Only when switching away from an effortfully established task set. *Emotion*, 17(1), 88–101. <https://doi.org/10.1037/emo0000212>
- J. C. , D., C. A., M., M., N., & T., L. - A. (2010). The independent contribution of executive functions to health related quality of life in older women. *BMC Geriatrics*, 10, 16. Retrieved from:<http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L360232908>
- Johnson, D. R. (2009). Emotional attention set-shifting and its relationship to anxiety and emotion regulation. *Emotion*, 9(5), 681–690. <https://doi.org/10.1037/a0017095>
- Kashdan, T. B., & Rottenberg, J. (2010). Psychological flexibility as a fundamental aspect of health. *Clinical Psychology Review*, 30(4), 467–480. <https://doi.org/10.1016/j.cpr.2010.03.001>
- Kertz, S. J., Belden, A. C., Tillman, R., & Luby, J. (2016). Cognitive Control Deficits in Shifting and Inhibition in Preschool Age Children are Associated with Increased Depression and Anxiety Over 7.5 Years of Development. *Journal of Abnormal Child Psychology*, 44(6), 1185–1196. <https://doi.org/10.1007/s10802-015-0101-0>
- Kiesel, A., Steinhauser, M., Wendt, M., Falkenstein, M., Jost, K., Philipp, A. M., & Koch, I. (2010). Control and interference in task switching-a review. *Psychological Bulletin*, 136(5), 849–874. <https://doi.org/10.1037/a0019842>
- Kofman, O., Meiran, N., Greenberg, E., Balas, M., & Cohen, H. (2006). Enhanced performance on executive functions associated with examination stress: Evidence from task-switching and Stroop paradigms. *Cognition and Emotion*, 20(5), 577–595. <https://doi.org/10.1080/02699930500270913>
- Koster, E. H. W., De Lissnyder, E., Derakshan, N., & De Raedt, R. (2011). Understanding

- depressive rumination from a cognitive science perspective: The impaired disengagement hypothesis. *Clinical Psychology Review*, 31(1), 138–145. <https://doi.org/10.1016/j.cpr.2010.08.005>
- Lowther, H., & Newman, E. (2014). Attention bias modification (ABM) as a treatment for child and adolescent anxiety: A systematic review. *Journal of Affective Disorders*, 168, 125–135. <https://doi.org/10.1016/j.jad.2014.06.051>
- Luciana, M., Gunnar, M. R., & Davis, E. P. (2005). Children's "Catastrophic Responses" to negative feedback on CANTAB'S ID/ED set-shifting task: relation to indices of a depressive temperament style CHILDREN ' S " CATASTROPHIC RESPONSES " TO NEGATIVE FEEDBACK ON CANTAB ' S ID / ED SET-SHIFTING TASK : RELA. 343–361.
- MacLeod, C., Rutherford, E., Campbell, L., Ebsworthy, G., & Holker, L. (2002). Selective attention and emotional vulnerability: Assessing the causal basis of their association through the experimental manipulation of attentional bias. *Journal of Abnormal Psychology*, 111(1), 107–123. <https://doi.org/10.1037/0021-843X.111.1.107>
- Malooly, A. M., Genet, J. J., & Siemer, M. (2013). Individual differences in reappraisal effectiveness: The role of affective flexibility. *Emotion*, 13(2), 302–313. <https://doi.org/10.1037/a0029980>
- Mărcuş, O., Stanciu, O., MacLeod, C., Liebrechts, H., & Visu-Petra, L. (2016). A FISTful of emotion: Individual differences in trait anxiety and cognitive-affective flexibility during preadolescence. *Journal of Abnormal Child Psychology*, 44(7), 1231–1242. <https://doi.org/10.1007/s10802-015-0110-z>
- Martins, E. C., Mărcuş, O., Leal, J., & Visu-Petra, L. (2018). Assessing hot and cool executive functions in preschoolers: affective flexibility predicts emotion regulation. *Early Child Development and Care*, 0(0), 1–15. <https://doi.org/10.1080/03004430.2018.1545765>
- Micco, J. A., Henin, A., Biederman, J., Rosenbaum, J. F., Petty, C., Rindlaub, L. A., ... Hirshfeld-Becker, D. R. (2009). Executive functioning in offspring at risk for depression and anxiety. *Depression and Anxiety*, 26(9), 780–790. <https://doi.org/10.1002/da.20573>
- Mocan, O., Stanciu, O., & Visu-Petra, L. (2014). Relating individual differences in internalizing symptoms to emotional attention set-shifting in children. *Anxiety, Stress and Coping*, 27(5), 509–526. <https://doi.org/10.1080/10615806.2014.888419>
- Molina, S., Borkovec, T. D., Peasley, C., & Person, D. (1998). Content analysis of worrisome streams of consciousness in anxious and dysphoric participants. *Cognitive Therapy and Research*, 22, 109–123. doi:10.1023/A:1018772104808
- Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking Rumination. *Perspectives on Psychological Science*, 3(5), 400–424. <https://doi.org/10.1111/j.1745-6924.2008.00088.x>
- Palm Reed, K. M., Cameron, A. Y., & Ameral, V. E. (2018). A Contextual Behavior Science Framework for Understanding How Behavioral Flexibility Relates to Anxiety. *Behavior Modification*, 42(6), 914–931. <https://doi.org/10.1177/0145445517730830>
- Paulitzki, J. R., Risko, E. F., Oakman, J. M., & Stolz, J. A. (2008). Doing the unpleasant: How the emotional nature of a threat-relevant task affects task-switching. *Personality and Individual Differences*, 45(5), 350–355. <https://doi.org/10.1016/j.paid.2008.05.003>
- Rogers, R. D., & Monsell, S. (1995). Costs of a Predictable Switch Between Simple Cognitive Tasks. *Journal of Experimental Psychology: General*, 124(2), 207–231. <https://doi.org/10.1037/0096-3445.124.2.207>
- Sibrava, N. J., & Borkovec, T. D. (2006). The cognitive avoidance theory of worry. In: G. C. L.

- Davey & A. Wells (Eds.), *Worry and its psychological disorders: theory, assessment and treatment* (pp. 239–258). West Sussex, England: Wiley & Sons
- Stange, J. P., Alloy, L. B., & Fresco, D. M. (2017). Inflexibility as a Vulnerability to Depression: A Systematic Qualitative Review. *Clinical Psychology: Science and Practice*, *24*(3), 245–276. <https://doi.org/10.1111/cpsp.12201>
- Toren P, Sadeh M, Wolmer L, et al. (2000). Neurocognitive correlates of anxiety disorders in children: a preliminary report. *Journal of Anxiety Disorders*, *14*, 239–247. [https://doi.org/10.1016/S0887-6185\(99\)00036-5](https://doi.org/10.1016/S0887-6185(99)00036-5)
- Tincas, I., Dragoş, R., Ionescu, T., & Benga, O. (2007). Attentional set-shifting in preschoolers: Anxiety-related response patterns. *Cognition, Brain, and Behavior*, *XI*(3), 553–570.
- Vandierendonck, A., Liefoghe, B., & Verbruggen, F. (2010). Task Switching: Interplay of Reconfiguration and Interference Control. *Psychological Bulletin*, *136*(4), 601–626. <https://doi.org/10.1037/a0019791>
- Vilgis, V., Silk, T. J., & Vance, A. (2015). Executive function and attention in children and adolescents with depressive disorders: a systematic review. *European Child and Adolescent Psychiatry*, *24*(4), 365–384. <https://doi.org/10.1007/s00787-015-0675-7>
- Vuilleumier, P., Armony, J. L., Driver, J., & Dolan, R. J. (2002). Effects of Attention and Emotion on Face Processing in the Human Brain. *Neuron*, *30*(3), 829–841. [https://doi.org/10.1016/s0896-6273\(01\)00328-2](https://doi.org/10.1016/s0896-6273(01)00328-2)
- White, L. K., McDermott, J. M., Degnan, K. A., Henderson, H. A., & Fox, N. A. (2011). Behavioral inhibition and anxiety: The moderating roles of inhibitory control and attention shifting. *Journal of Abnormal Child Psychology*, *39*(5), 735–747. <https://doi.org/10.1007/s10802-011-9490-x>
- Wilkinson, P. O., & Goodyer, I. M. (2006). Attention difficulties and mood-related ruminative response style in adolescents with unipolar depression. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *47*(12), 1284–1291. <https://doi.org/10.1111/j.1469-7610.2006.01660.x>
- Wilson, B. J., Derryberry, D., & Kroeker, R. (2006). A computerized task for investigating the relation between attentional and emotional processes in children. *The Journal of Genetic Psychology*, *167*(4), 415–431. <https://doi.org/10.3200/GNTP.167.4.415-432>