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Impairment in planning tasks of children and adolescents with anxiety disorders

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ABSTRACT

Anxiety disorders are associated with poor neuropsychological performance in attention and memory. However, little is known about the impact of these difficulties on other cognitive functions, such as planning. The ability to plan, including attention, working memory and set-shifting components, can be assessed by the Tower of Hanoi task (ToH). This study evaluated seventy-one participants, aged from 7–17 years. Thirty-seven subjects met DSM-IV diagnostic criteria for at least one anxiety disorder and 34 individuals comprised the controls. The neuropsychological tests used were: the ToH, a problem-solving task, involves planning ability and other executive functions (working memory, attentional control and cognitive flexibility); for the assessment of processing speed and problem-solving, the Vocabulary/Matrix Reasoning subtests of the Wechsler Abbreviated Scale of Intelligence was used to measure for estimated-IQ in both groups. The groups were compared with a generalized linear model controlling for age, IQ and ADHD comorbidity. Compared with controls, anxiety disorders subjects made more errors and required more time to complete the ToH. Children and adolescents with anxiety disorders have poorer planning ability compared to subjects without anxiety disorders, and the difficulty in planning is affected by interference from other cognitive functions, such as attention, working memory, cognitive flexibility and problems-solutions.

1. Introduction

Planning is a cognitive component related with executive functioning and it is defined as any behavior specifically created by the individual with the intention of preparing to reach some goal, and the testing of the end state must involve some real choice or selection (Lezak et al., 2012; Kreitler and Kreitler, 1987). Some authors have proposed that the ability to plan arises only through the combination of certain mental components such as attention, working memory and set-shifting (Friedman et al., 1987). This cognitive ability is assessed by problem-solving tasks like the Tower of Hanoi task (ToH) and its derivatives (Borys et al., 1982; Spitz et al., 1985).

Klahr (1994) has noted the important role of counter-intuitive moves in TOH performance. Counter-intuitive moves are those that do not move toward the end-state goal, requiring planning and inhibition of the prepotent move directed at the end-state goal. These prepotent moves are problematic as the participant must make additional moves to reproduce the desired end-state configuration, and this ultimately may lead to an incorrect solution of the individual tower problem. Mental flexibility or shifting may also be important, as the participant must shift flexibly among subgoals or move to achieve the configuration.

Other cognitive processes are likely to contribute to ToH performance (see Fig. 1). Verbal working memory, as defined by Barkley, is implicated in the ToH because the task elicits an inner monologue in children. Working memory, which includes verbal working memory, is a necessary element in planning, which is purposeful strategic effort directed at meeting a goal (Barkley, 1997). Nonverbal (spatial) working memory is also required by the task because sequences of moves must be kept in mind to achieve correct solutions.

Unterrainer et al. (2018) assessed the planning performance with the Tower of London task (similar to the TOH) in adults, related to self-reported anxiety and depression. Higher anxiety ratings were associated with lower planning performance independent of age. When directly

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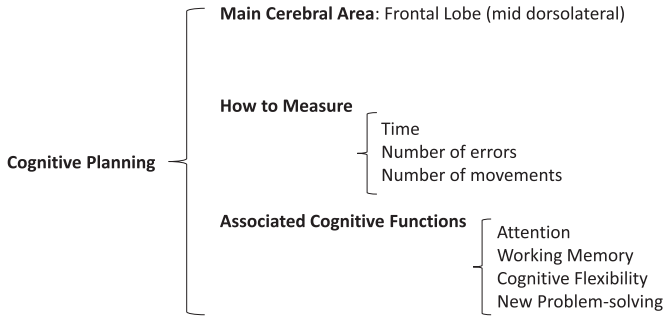

Fig. 1. Cognitive processes involved in the Tower of Hanoi task.

comparing the predictive value of depression and anxiety on cognition, only anxiety attained significance. Thus, subclinical levels of anxiety showed negative associations with cognitive functioning independent of age.

In a sample of 860 children withdrawn from a large community study, Mogg and colleagues compared children with anxiety disorders to disorder-free children. The authors suggested that executive attention is impaired in children with anxiety disorders (excluding specific phobias), relative to disorder-free children (subjects with nonclinical anxiety). Furthermore, executive attention was less efficient in disorder-free children who have high, relative to low, levels of anxiety symptoms. Thus, the impaired executive attention in children (reflected by difficulty inhibiting processing of task-irrelevant information) was not fully explained by general psychopathology, but instead showed specific associations with anxiety disorders (other than specific phobia), as well as with high levels of anxiety symptoms in non-clinical anxiety (Mogg et al., 2015).

Psychiatric disorders affecting young people may impair cognitive functioning. In terms of anxiety disorders, studies of anxious children have shown detrimental effects on neuropsychological performance, such as executive function, memory, attention, and learning (Eysenck and Calvo, 1992; Gunther et al., 2004; Lee et al., 2012; Vloet et al., 2010; Weems et al., 2007). Studies that specifically addressed working memory have shown that anxiety adversely affects this cognitive function in children. In one of these studies, Hadwin et al. (2005) have suggested that anxious youngsters are less efficient on verbal working memory tasks in terms of increased mental effort and increased time taken to complete tasks (Hadwin et al., 2005; Ng and Lee, 2010; Owens et al., 2012; Owens et al., 2008). Taken together, these studies suggest that pathological anxiety may have a negative impact on cognitive functioning and on academic performance (Eysenck et al., 2007; Mazzone et al., 2007; Robinson et al., 2013).

In a cohort study, White et al. (2017) assessed 9498 participants (aged 8–21 years) and found differences in the strength of associations between the specific executive function components and symptom levels within and across clinical domains. For example, for anxious-misery and fear symptoms, attentional vigilance and working memory had more robust relations to symptoms than response inhibition or conceptual flexibility. Snyder et al. (2015) found that different studies support the relationship between attentional shift and panic, social anxiety and generalized anxiety. Moreover, research in non-clinical samples suggests that trait anxiety, and especially anxious apprehension (worry) is associated with impairments in a specific aspect of executive function, inhibiting competing responses (Snyder et al., 2010, 2014) and there have been reports of impaired visuospatial working memory in individuals with panic disorder (Boldrini et al., 2005), and impaired verbal working memory manipulation, but not maintenance, in individuals with generalized anxiety disorder (Christopher and MacDonald, 2005). Iorfino et al. (2016) conclude that there is a relationship between anxiety disorders (for example, social anxiety disorder), and poor executive functioning, such as cognitive inflexibility and verbal memory.

However, there are no studies that specifically evaluate planning ability in anxious youngsters. One study has evaluated planning ability in subjects with Obsessive-Compulsive Disorder [OCD; until the publication of the DSM-5, OCD was considered part of the anxiety disorders chapter (American Psychiatric Association, 2000)]. In a series of neuropsychological tests, which compared 14 OCD children to 24 healthy developing children of similar ages and intellectual abilities, Ornstein et al. (2010) found deficits in cognitive flexibility and planning ability in OCD children.

The evaluation and the identification of potential deficits in anxious youngsters may be a major step toward the understanding of the relationship between anxiety disorders and planning ability. Thus, the purpose of this study was to evaluate the performance in planning tasks of children and adolescents with anxiety disorder. We hypothesized that the performance in the ToH would be lower in youngsters with anxiety disorders when compared to healthy control subjects.

2. Methods

This study was carried out as part of the Child and Adolescent Anxiety Program at the University of São Paulo Hospital in Brazil and involved subjects recruited through media advertisement. Thirty-seven participants between 7 and 17 years of age met the DSM-IV diagnostic criteria for at least one of the following anxiety disorders: generalized anxiety disorder (GAD), separation anxiety disorder (SAD) or social phobia (SP) and were considered eligible to participate in the study. They comprised the anxiety group. These subjects took part in a psychopharmacological trial published elsewhere (da Costa et al., 2013). Thirty-four individuals, aged from 7 to 17 years, comprised the healthy control group.

Exclusion criteria included the presence of: attention-deficit/hyperactivity disorder (ADHD) as a primary disorder or the need for and/or use of psychostimulants; current comorbid major depressive episode; previous or current diagnoses of bipolar, obsessive-compulsive, eating, or post-traumatic stress disorders; substance abuse; psychotic or conduct disorders; neurological disorders; any organic brain disease; suicidal ideation; any current treatment for anxiety; pregnancy; and overall intelligence quotient (IQ) below 70. The study was approved by the Research Ethics Committee of the Hospital das Clinicas of the University of São Paulo Medical School. Written informed consent (0953/08) was obtained from the parents or legal guardians for all participants, as well as assent from each participant (child or adolescent).

2.1. Measures

All subjects (patient and control groups) were clinically evaluated by a licensed child and adolescent psychiatrist using the following instruments: the Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS) for the assessment of current and lifetime DSM-IV psychiatric diagnoses (Ambrosini, 2000) and the National Institute of Mental Health (NIMH) Clinical Global Impression scale (CGI) for the assessment of severity of symptoms.

Both groups were submitted to neuropsychological assessments through the following tests: the Tower of Hanoi task (ToH) (with 3 and 4 disks); and two subtests of the Wechsler Abbreviated Scale of Intelligence (Wechsler, 1999): the Vocabulary and the Matrix Reasoning for measures of estimated Intelligence Quotient (IQ).

The ToH (Simon, 1975) requires participants to transform an arrangement of disks into a different configuration in as few moves as possible. The start state is the arrangement of disks of different sizes that a participant must modify by moving one disk at a time in as few steps as possible, in order to reach the end-state configuration.

The ToH was administered by means of one board containing three or four graduated disks arranged on three pegs. After the presentation of the goal arrangement by the examiner (end state), the participant

was asked to rearrange the display in as few moves as possible. The examiner stated two rules for the test: (1) the subject was permitted to move only one disk at a time; and (2) he/she was not allowed to place a larger disk over a smaller disk. Next, the ToH was repeated 5 times with each of the disk sets (3 and 4 disks) and this task ended when both sets of problems were administered. For each puzzle, planning time (time between the first and the last move made by the participant) was measured by stopwatch. Three types of score were obtained: mean performance time for each disk set; mean of movements performed; total number of errors made (number of rule breaks).

2.2. Statistical analyses

All variables of interest were assessed for normality with the Kolmogorov-Smirnov test. For those in which the null hypotheses of normality were not rejected, Student's *t*-test was performed to compare the means. For the remaining variables, the Mann-Whitney nonparametric test was used. Correlation between total scores of neuropsychological ratings with the ToH was measured with Pearson's coefficient. The ToH scores were compared between groups with a generalized linear model (Nelder and Wedderburn, 1972), controlling for age, IQ and ADHD comorbidity. Families chosen were Gamma for movement and time measurement and Poisson for errors. All analyses were conducted on SPSS v.17 and type I error was set at 5%.

3. Results

Table 1 shows descriptive data from subjects with anxiety disorders ($n = 37$). Thirty of them (81.1%) had one or more comorbid anxiety disorder.

Concerning the individuals without comorbidity, 57.1% ($n = 4$) were diagnosed with GAD, 28.6% ($n = 2$) with SAD, and 14.3% with SP ($n = 1$). Regarding the severity of anxiety symptoms, according to CGI scores (Guy, 1976), 15.6% of individuals in the study group were considered severely ill (CGI = 6), 68.8% markedly ill (CGI = 5), and 15.6% moderately ill (CGI = 4).

Table 2 shows the sociodemographic description on both groups. There is no evidence that the groups have different distributions on these variables except for IQ (in which controls present a slightly higher mean than subjects from the study group). When comparing ToH variables, controlling for age and IQ, children and adolescents with anxious disorders required more moves ($p = 0.019$ for 3 pieces, and $p = 0.051$ for 4 pieces), more time (3 pieces: $p = 0.007$; 4 pieces: $p < 0.001$) and made more mistakes ($p < 0.001$ for 4 pieces) in completing the task. There was no difference among groups regarding the number of errors in the three-piece puzzle.

4. Discussion

To our knowledge, this is the first controlled study to provide evidence of planning ability impairment in children and adolescents with anxiety disorders.

In the present study, subjects with anxiety disorders, compared to a control group, showed significantly more difficulty in performing the ToH, as they required more moves and more time to execute the task, and made more errors in the most complex stage of the task (with 4 pieces). Our results suggest that some cognitive functions involved in the TOH were impaired in these individuals. For instance, with the occurrence of errors and the difficulty in recalling actions in progress and the rules of the activity, attention and working memory were compromised. In addition, cognitive flexibility was also affected by the challenge of changing the course of action, as the group of anxious subjects made errors and a greater number of movements in the task. Thus, these observations suggest difficulties in set-shifting and inhibition of response. Furthermore, new problem-solving ability (fluid intelligence) was also impaired, as observed by the greater number of movements associated to the amount of time to accomplish the task.

Our study is aligned with the neurobiological models of Eysenck and colleagues' attentional control theory (Eysenck et al., 2007). According to the authors, this theory makes various predictions about the effects of anxiety on the functioning of the goal-directed attentional systems, leading to: (a) reduced ability to inhibit incorrect prepotent responses; (b) increased susceptibility to distraction; (c) impaired performance on secondary tasks in dual-task situations; and (d) impaired task-switching performance. Indeed, the results observed in our study can be explained in the context of this theory.

We found no reports that utilized the TOH to assess similar populations with the one evaluated in the present study (children and adolescents with anxiety disorders). Nevertheless, when contrasted with other studies carried out with the same instrument of evaluation (ToH) in distinct populations (adults and youngsters with OCD), similar results were observed. Taken together, these studies show that subjects with OCD need more moves to solve the ToH task (Cavedini et al., 2001; Cavallaro et al., 2003) or increased time for completion of the task without differences in the number of movements. Although these are considered distinct disorders since the publication of the DSM-5, OCD was considered primarily an anxiety disorder.

A major limitation of this study is related to the restricted number of participants. The difficulty of including subjects within the strict inclusion criteria adopted (particularly for subjects without comorbid conditions) has contributed to its small sample size. However, the criteria employed may have helped to increase reliability in the assessment of symptoms of anxiety, given the exclusion of youngsters with comorbidities such as ADHD (as a primary disorder) and major depression, clinical conditions which may interfere in cognitive processes. In addition, we were unable to test differences in planning impairments based on developmental factors, as the age range of subjects was fairly wide, nor differences in impairments based on the type of anxiety. It is also important to note that we could not establish the direction of the relationship between anxiety and cognitive deficits. Thus, it was not possible to claim that the neuropsychological deficits could be cause (risk factor) or the effect (consequence) of the anxiety disorders.

5. Conclusion

By studying a sample of Brazilian children and adolescents with anxiety disorders, our study shows that these subjects have impaired planning ability. Indeed, it has been suggested that working memory, attention, and processing speed-all cognitive functions associated with planning ability – have been affected by the presence of anxiety. Thus, in order to better establish the relationship between anxiety disorders and cognitive deficits, additional controlled studies, with larger samples and longitudinal delineation, are warranted. In the transition from childhood to adolescence, cognitive flexibility meets a critical period of development. Deficits in cognitive functioning in this period of life may influence the course of this development. Thus, early detection and introduction of appropriate interventions for young people suffering from anxiety disorders are essential.

Table 1
Frequency of comorbid anxiety disorders in the anxiety group.

DSM-IV Diagnoses	*N*	%
Separation anxiety disorder	20	54
Social phobia	18	48,6
Specific phobia	15	40.5
Generalized anxiety disorder	13	35.1
Panic disorder	08	21.6
Attention-deficit / hyperactivity disorder	08	21.6
Obsessive-compulsive disorder	02	5.4
Depressive disorder	01	2.7

Table 2
Demographic data and cognitive performance of both groups.

Variables	Anxiety Group *(n = 37)* Mean (SD)	Control Group *(n = 34)* Mean (SD)	*p***	*Effect size* ***
Age (in years)	12.0 (2.9)	12.4 (3.4)	0.620**	0.187***
Male gender (%)	57.9	38.2	0.096**	
Years of schooling	7.0 (2.7)	7.6 (3.4)	0.429**	0.196***
Intelligence quotient	95.3 (14.6)	101.7 (13.7)	0.058**	0.607***
Tower of Hanoi				
Time (with 3 pieces)	38 (33.2)*	21.3 (10.6)*	0.007**	0.666***
Moves (with 3 pieces)	13.0 (6.6)	8.9 (2.1)	0.019**	0.823***
Errors (with 3 pieces)	2.5 (3.3)	1.5 (2.0)	0.112**	0.363***
Time (with 4 pieces)	83.4 (35.8)*	57.4 (24.0)*	< 0.001**	0.846***
Moves (with 4 pieces)	31.6 (9.4)	24.9 (8.9)	0.051**	0.731***
Errors (with 4 pieces)	5.4 (5.5)	2.0 (2.4)	< 0.001**	0.790***

* time measured in seconds/.
** generalized linear model /.
*** Cohen's d.

References

Ambrosini, P.J., 2000. Historical development and present status of the schedule for affective disorders and schizophrenia for school-age children (K-SADS). J. Am. Acad. Child Adolesc. Psychiatry 39, 49–58. https://doi.org/10.1097/00004583-200001000-00016.

Barkley, R.A., 1997. ADHD and the Nature of Self-Control [WWW Document]. Guilford Press URL. https://www.guilford.com/books/ADHD-and-the-Nature-of-Self-Control/Russell-Barkley/9781593852313/reviews accessed 12.07.18.

Boldrini, M., Del Pace, L., Placidi, G.P.A., Keilp, J., Ellis, S.P., Signori, S., Placidi, G.F., Cappa, S.F., 2005. Selective cognitive deficits in obsessive-compulsive disorder compared to panic disorder with agoraphobia. Acta Psychiatry Scand. 111, 150–158. https://doi.org/10.1111/j.1600-0447.2004.00247.x.

Borys, S.V., Spitz, H.H., Dorans, B.A., 1982. Tower of Hanoi performance of retarded young adults and nonretarded children as a function of solution length and goal state. J. Exp. Child Psychol. 33, 87–110. https://doi.org/10.1016/0022-0965(82)90008-X.

Cavallaro, R., Cavedini, P., Mistretta, P., Bassi, T., Angelone, S.M., Ubbiali, A., Bellodi, L., 2003. Basal-corticofrontal circuits in schizophrenia and obsessive-compulsive disorder: a controlled, double dissociation study. Biol. Psychiatry 54, 437–443.

Cavedini, P., Cisima, M., Riboldi, G., D'Annucci, A., Bellodi, L., 2001. A neuropsychological study of dissociation in cortical and subcortical functioning in obsessive-compulsive disorder by Tower of Hanoi task. Brain Cognit. 46, 357–363. https://doi.org/10.1006/brcg.2001.1293.

Christopher, G., MacDonald, J., 2005. The impact of clinical depression on working memory. Cognit. Neuropsychiatry 10, 379–399. https://doi.org/10.1080/13546800444000128.

da Costa, C.Z.G., de Morais, R.M.C.B., Zanetta, D.M.T., Turkiewicz, G., Lotufo Neto, F., Morikawa, M., Rodrigues, C.L., Labbadia, E.M., Asbahr, F.R., 2013. Comparison among clomipramine, fluoxetine, and placebo for the treatment of anxiety disorders in children and adolescents. J. Child Adolesc. Psychopharmacol. 23, 687–692. https://doi.org/10.1089/cap.2012.0110.

Eysenck, M.W., Calvo, M.G., 1992. Anxiety and performance: the processing efficiency theory. Cognit. Emotion 6, 409–434. https://doi.org/10.1080/02699939208409696.

Eysenck, M.W., Derakshan, N., Santos, R., Calvo, M.G., 2007. Anxiety and cognitive performance: attentional control theory. Emotion 7, 336–353. https://doi.org/10.1037/1528-3542.7.2.336.

Friedman, S.L., Scholnick, E.K., Cocking, R.R., 1987. Blueprints for thinking: the role of planning in cognitive development. Blueprints For Thinking: The Role of Planning in Cognitive Development. Cambridge University Press, New York, NY, US.

Günther, T., Holtkamp, K., Jolles, J., Herpertz-Dahlmann, B., Konrad, K., 2004. Verbal memory and aspects of attentional control in children and adolescents with anxiety disorders or depressive disorders. J. Affect Disord. 82, 265–269. https://doi.org/10.1016/j.jad.2003.11.004.

Hadwin, J.A., Brogan, J., Stevenson, J., 2005. State anxiety and working memory in children: a test of processing efficiency theory. Educ. Psychol. 25 (4) WWW Document]. URL. https://doi.org/10.1080/01443410500041607 accessed 12.7.18.

Iorfino, F., Hickie, I.B., Lee, R.S., Lagopoulos, J., Hermens, D.F., 2016. The underlying neurobiology of key functional domains in young people with mood and anxiety disorders: a systematic review. BioMed Central Psychiatry 16 (1), 156. https://doi.org/10.1186/s12888-016-0852-3.

Klahr, D., 1994. Discovering the present by predicting the future, in: the Development of Future-Oriented Processes. The John D. and Catherine T. MacArthur Foundation Series on Mental Health and Development. University of Chicago Press, Chicago, IL, US, pp. 177–218.

Kreitler, S., Kreitler, H., 1987. Conceptions and processes of planning: the developmental perspective. Blueprints for Thinking: the Role of Planning in Cognitive Development. Cambridge University Press, New York, NY, US, pp. 205–272.

Lee, S.S., Falk, A.E., Aguirre, V.P., 2012. Association of comorbid anxiety with social functioning in school-age children with and without attention-deficit/hyperactivity disorder (ADHD). Psychiatry Res. 197, 90–96. https://doi.org/10.1016/j.psychres.2012.01.018.

Lezak, M.D., Howiesson, D.B, Bigler, E.D., Tranel, D., 2012. Neuropsychological Assessment, fifth ed. Oxford University Press, New York.

Mazzone, L., Ducci, F., Scoto, M.C., Passaniti, E., D'Arrigo, V.G., Vitiello, B., 2007. The role of anxiety symptoms in school performance in a community sample of children and adolescents. BMC Public Health 7, 347. https://doi.org/10.1186/1471-2458-7-347.

Mogg, K., Salum, G.A., Bradley, B.P., Gadelha, A., Pan, P., Alvarenga, P., Rohde, L.A., Pine, D.S., Manfro, G.G., 2015. Attention network functioning in children with anxiety disorders, attention-deficit/hyperactivity disorder and non-clinical anxiety. Psychol. Med. 45 (12), 2633–2646. https://doi.org/10.1017/S0033291715000586.

Nelder, J., Wedderburn, R.W.M., 1972. Generalized Linear Models. https://doi.org/10.1007/978-1-4612-4380-9_39.

Ng, E., Lee, K., 2010. Children's task performance under stress and non-stress conditions: a test of the processing efficiency theory. Cognit. Emotion 24, 1229–1238. https://doi.org/10.1080/02699930903172328.

Ornstein, T.J., Arnold, P., Manassis, K., Mendlowitz, S., Schachar, R., 2010. Neuropsychological performance in childhood OCD: a preliminary study. Depress Anxiety 27, 372–380. https://doi.org/10.1002/da.20638.

Owens, M., Stevenson, J., Hadwin, J.A., Norgate, R., 2012. Anxiety and depression in academic performance: an exploration of the mediating factors of worry and working memory. School Psychol. Int. 33, 433–449. https://doi.org/10.1177/0143034311427433.

Owens, M., Stevenson, J., Norgate, R., Hadwin, J.A., 2008. Processing efficiency theory in children: working memory as a mediator between trait anxiety and academic performance. Anxiety Stress Coping 21, 417–430. https://doi.org/10.1080/10615800701847823.

Robinson, O.J., Vytal, K., Cornwell, B.R., Grillon, C., 2013. The impact of anxiety upon cognition: perspectives from human threat of shock studies. Front Hum. Neurosci. 7, 203. https://doi.org/10.3389/fnhum.2013.00203.

Simon, H.A., 1975. The functional equivalence of problem solving skills. Cognit. Psychol. 7, 268–288. https://doi.org/10.1016/0010-0285(75)90012-2.

Snyder, H.R., Hutchison, N., Nyhus, E., Curran, T., Banich, M.T., O'Reilly, R.C., Munakata, Y., 2010. Neural inhibition enables selection during language processing. Proc. Natl. Acad. Sci. USA. 107, 16483–16488. https://doi.org/10.1073/pnas.1002291107.

Snyder, H.R., Kaiser, R.H., Whisman, M.A., Turner, A.E.J., Guild, R.M., Munakata, Y., 2014. Opposite effects of anxiety and depressive symptoms on executive function: the case of selecting among competing options. Cognit. Emotion 28, 893–902. https://doi.org/10.1080/02699931.2013.859568.

Snyder, H.R., Miyake, A., Hankin, B.L., 2015. Advancing understanding of executive function impairments and psychopathology: bridging the gap between clinical and cognitive approaches. Front Psychol. 6. https://doi.org/10.3389/fpsyg.2015.00328.

Spitz, H.H., Minsky, S.K., Bessellieu, C.L., 1985. Influence of planning time and first-move strategy on Tower of Hanoi problem-solving performance of mentally retarded young adults and nonretarded children. Am. J. Ment. Deficiency 90, 46–56.

Unterrainer, J.M., Domschke, K., Rahm, B., Wiltink, J., Schulz, A., Pfeiffer, N., Lackner, K.J., Münzel, T., Wild, P.S., Beutel, M., 2018. Subclinical levels of anxiety but not depression are associated with planning performance in a large population-based sample. Psychol. Med. 48, 168–174. https://doi.org/10.1017/S0033291717002562.

Vloet, T.D., Konrad, K., Herpertz-Dahlmann, B., Polier, G.G., Günther, T., 2010. Impact of anxiety disorders on attentional functions in children with ADHD. J. Affect Disord. 124, 283–290. https://doi.org/10.1016/j.jad.2009.11.017.

Wechsler, D., 1999. Wechsler abbreviated scale of intelligence™ [WWW Document]. URL. https://www.pearsonclinical.com/education/products/100000593/wechsler-abbreviated-scale-of-intelligence-wasi.html accessed 12.07.18.

Weems, C.F., Costa, N.M., Watts, S.E., Taylor, L.K., Cannon, M.F., 2007. Cognitive errors, anxiety sensitivity, and anxiety control beliefs: their unique and specific associations with childhood anxiety symptoms. Behav. Modif. 31, 174–201. https://doi.org/10.1177/0145445506297016.

White, L.K., Moore, T.M., Calkins, M.E., Wolf, D.H., Satterthwaite, T.D., Leibenluft, E., Pine, D.S., Gur, R.C., Gur, R.E., 2017. An evaluation of the specificity of executive function impairment in developmental psychopathology. J. Am. Acad. Child Adolesc. Psychiatry 56, 975–982. e3. https://doi.org/10.1016/j.jaac.2017.08.016.