

Between Chaos and Creation: The relation between ADHD symptoms, Creativity and Empathy

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Abstract

The current study focuses on the relationship between the symptomatology of Attention Deficit/Hyperactivity Disorder (ADHD) and creative performance, which explicitly considers empathy as a moderating variable. Although ADHD has been linked to cognitive deficits and augmented creative ideation, the available literature has mostly overlooked the potential role of empathy in the connection. Using the empathizing-systemizing model and relying on the known models of divergent and convergent thinking, the paper sought to determine the possibility of empathy as a means of promoting more adaptive types of creativity in people with higher rates of ADHD symptoms. 145 participants were administered validated self-report measures of symptoms of ADHD (Adult ADHD Self-report Scale [ASRS]), empathy (EQ-10), creative self-concept (Self-Assessment of Self-Concept Scale of the Brain [SSCSB]) and participated in creativity tasks of divergent thinking (Alternative Uses Task [AUT]) and convergent thinking (Remote Associates Test [RAT]). Main effects and interactions between symptom severity in ADHD and empathy were evaluated by performing hierarchical linear regression analyses to assess creative outcomes. The results showed that ADHD symptom severity had a positive effect on both divergent and convergent-thinking scores. Notably, empathy moderates the relationship between ADHD symptoms and creative outputs; high levels of empathy dampened the magnitude of the ADHD-creativity relationship of both divergent and convergent tasks, indicating a regulatory or structuring role of empathy on ideational output. These findings help to form a subtle picture of creativity among people exhibiting ADHD characteristics and emphasize the role of empathy as a possible cognitive and affective resource that can regulate creative processes. The implications in the discussion include the need to embrace cognitive diversity and to design strength-based interventions in educational and psychological support contexts.

Keywords: ADHD traits, divergent creative thinking, convergent creative thinking, empathy

Introduction

Creativity is a core cognitive capacity which fosters innovation, adaptation and cultural development. In the course of history, creative breakthroughs were born in art, science, and technology and have influenced the development of different societies. Creativity is a critical topic, although the cognitive and neural processes that take place during the creative process are still controversial. This issue is further complicated when creativity is considered in terms of neurodevelopmental disorders like Attention Deficit/Hyperactivity Disorder (ADHD). ADHD is generally described as inattention, impulsiveness and hyperactivity, and not the focus, planning and cognitive control that is often thought to be the domain of creative work. However, there is now increasing evidence that some ADHD-related qualities can benefit various dimensions of creative potential, notably in divergent thinking, which is the capacity to make numerous novel ideas out of one stimulus (White and Shah, 2006; Boot et al., 2017).

Rather than viewing ADHD and creativity as mutually exclusive, researchers have begun to work towards more integrative models that contemplate common neural processes, overlapping personality traits and compensatory mechanisms (Healey and Rucklidge, 2006; Boot et al., 2020). The results are however inconsistent, pointing to the fact that there may be other factors that condition this correlation. One of such factors is empathy which should be examined closer. It is a complex phenomenon that includes emotional attunement, self-regulation, and perspective-taking as the elements that contribute to the way in which ideas are created, developed, and shared. Empathy may affect the ways in which individuals perceive and react to social and emotional messages, which might determine the nature and the significance of their creative work. New theories suggest that empathy can be a moderator between ADHD-related characteristics and creativity, either amplifying or moderating the cognitive mechanisms through which impulsive idea generation is transformed into creatively productive outputs, which are original and socially adaptive (Greenberg et al., 2018).

This thesis is built on that integrative perspective. It examines the role of empathy in the relationship between ADHD symptoms and creativity, that is divergent thinking, as its indicator (Guilford, 1967). The present study will employ a moderated model to explain how some cognitive and emotional traits interact to influence the performance of creativity in adults and what this interaction can say about the structure of creativity itself.

Creativity

In order to make creativity measurable in psychological research, the researchers tend to distinguish between divergent and convergent thinking. Divergent thinking is the ability to generate numerous novel ideas out of one stimulus (White and Shah, 2006; Boot et al., 2017). The most used measure of divergent thinking is the Alternate Uses Task (AUT) in which one is asked to list as many uses as possible of a common object such as a brick or a paperclip (Guilford, 1967; Silvia et al., 2008). The scoring of the AUT involves fluency (the number of ideas), flexibility (the range of the categories of ideas), originality (the novelty of responses) and elaboration (the level of detail in the explanation).

On the other hand, convergent thinking is the process of narrowing down a number of options to a single correct answer and such exercise is usually measured through assessments like the Remote Associates Test (RAT) (Mednick, 1962).

The majority of the work dedicated to the investigation of the ADHD-creativity relationship emphasizes the importance of divergent thinking, which is relevant since it is more similar to the rapid, spontaneous generation of ideas, and reduced inhibition. Importantly, divergent and convergent thinking do not exclude one another but are different cognitive demands and styles (Cropley, 2006; Kaufman and Beghetto, 2009). The current study focuses on divergent thinking, as the primary outcome variable, whereas the convergent thinking aspect of creativity is secondary, more exploratory.

An added dimension to the study of creativity is that of domain specificity. There are researchers who believe that creativity is a general trait that can be applied in any context and there are those who suggest that creativity is field-, task-, or expertise-specific (Baer, 2012). This has implications for the research design since tasks like the AUT may affect general creative potential but not domain specific competencies.

ADHD and Creativity

ADHD is a neurodevelopmental disorder and is manifested by chronic and impaired patterns of inattention, hyperactivity, and impulsivity (American Psychiatric Association, 2013). Even though ADHD is typically linked to the issues of executive functions, emotional control, and the inability to remain consistent in tasks, in recent years it has also been associated with some cognitive strengths, namely ideational fluency and flexibility. These relationships are especially evident in individuals who have subclinical manifestations of ADHD, where one will have symptoms but not a full set of them. This allows cognitive

inclinations to be found independent of confounding factors of medication or impairment (Boot et al., 2017; White and Shah, 2011).

A series of studies have pointed out that individuals with high symptoms of ADHD perform better on tasks that require divergent thinking. In particular, they tend to produce more ideas when they are given open ended prompts, implying that they are more fluent (Healey and Rucklidge, 2006; Boot et al., 2020). This has been explained by cognitive characteristics, including lower latent inhibition, greater associative richness, and less filtering of irrelevant stimuli, which may enhance the rapid production of atypical ideas (Carson et al., 2003; Abraham, 2014).

However, the relation between ADHD and creativity is not that straightforward. Meta-analytic reviews and empirical studies have been mixed and, in some cases, negative, particularly when creativity is measured through convergent thinking or through real-life creative achievement (Furnham et al., 2011). The first explanation for the occurrence of these inconsistencies is the heterogeneity of ADHD itself. The multiple symptom groups, for example inattentive versus hyperactive impulsive may possess different cognitive correlates and cognitive effects on creativity (Sowerby et al., 2011). Moreover, situational and personal conditions, including task demands, knowledge of a particular domain, and emotionality, can also be the factors leading to the development of ADHD traits as either an advantage or a disadvantage.

ADHD and creativity also have an intermediary relationship that is mediated by executive functioning and emotional regulation. Although ADHD patients are capable of cognitive flexibility in order to engage in divergent ideation, they tend to have problems in organizing, developing, and implementing their ideas into concrete creative products (Barkley, 1997; Castellanos and Proal, 2012). These regulatory deficits may be the source of associating ADHD with more ideation but not necessarily more quality or utility of production.

This has led researchers to seek the possibility of other personality or cognitive factors that could be used in determining the degree to which ADHD related factors contribute to creativity. One of the most promising ones is empathy, which is a multidimensional concept which can enhance self-awareness, social sensitivity, and reflection. In this case, empathy may be deployed to lead ADHD patients to steer their ideational fluency toward more focused, socially relevant and adaptive creativity.

Empathy as a Moderator

The overall meaning of empathy is the ability to understand and feel the emotional condition of other individuals. It is generally considered to be made of two components: cognitive empathy, or perspective taking and affective empathy, or emotional resonance (Decety and Jackson, 2004). Although traditionally investigated in the framework of prosocial behavior and interpersonal functioning, empathy has recently been explored in terms of its general cognitive and regulatory roles, such as its possible links to creativity and emotional regulation (Shamay-Tsoory et al., 2009; Greenberg et al., 2018).

In this regard, empathy may serve as a control mechanism for those individuals who have a high level of ADHD traits. Emotional control and the ability to predict thoughts of others may be a protective factor against impulsivity and inhibition breakdown, and empathy may serve as a facilitating framework in which more organized and socially oriented creative expression can occur. More specifically, cognitive empathy is associated with metacognition, reflective thinking and the ability to orient within the social conventions, which can enhance both originality and suitability of creative ideas (Preckel et al., 2011). Affective empathy can increase emotional sensitivity and depth which can be useful in creation of meaningful or emotionally rich creative work. These mechanisms indicate that empathy may be a compensatory factor as well as a moderating variable in the connection between symptoms of ADHD and creative potential.

Empathizing-systemizing theory is one theoretical model that gives credence to this interactional perspective because it suggests that there are different cognitive orientations between different people (Baron-Cohen, 2002). It has been discovered that high empathizers may be more adept at adapting and contextualizing their creative expressions and low empathizers may not adapt ideas well into socially coherent or effective ways (Greenberg et al., 2018). The presence of empathy can improve the creative production of an ADHD individual, which is typically highly ideational but poorly self-regulated, into work that is meaningful and productive.

Empathy has been associated with executive functioning, including cognitive flexibility and working memory, two areas in which people with ADHD tend to be impaired (Zelazo and Carlson, 2012). Empathy may, in its turn, result in better creative performance due to the promotion of integration and refinement of ideas, which are enhanced by the support of these functions. A highly empathic person with a strong ADHD can, as an example, generate many

creative ideas and have the perspective-taking abilities needed to criticize and adjust the ideas for a particular audience or problem. On the other hand, highly ADHD with low empathy may have equally creative ideas but not the disciplinary means to organize or communicate them in an appropriate way.

Despite the relative scarcity of research that has tested the interaction between empathy and ADHD in predicting creativity, the conceptual similarity between the two constructs, specifically related to the areas of emotional regulation, executive control, and social cognition, makes empathy an interesting moderator to consider. Such interaction can provide a more complex account of how creative potential can be realized in neurodiverse humans and how some of these qualities can balance or complement each other in the determination of outcomes.

A Moderated Model

Combined, the available literature indicates that some of the ADHD-related traits, including increased novelty-seeking and high associative thinking, can encourage improved ideational fluency, defined as the quality of generating a large number of ideas within a short duration of time. This is especially true in tasks that reward spontaneity and cognitive flexibility where numerous responses are preferred. These mechanisms are inherently cognitive and can facilitate divergent thinking even without social-emotional factors such as empathy. Expected is a main effect of ADHD on divergent thinking, independent from empathy. Also expected is an interaction effect with empathy.

Consequently, it is expected that a higher number of ADHD symptoms will be associated with greater divergent thinking, (H1).

This potential, however, is not always manifested in the same way. Without the cognitive control and emotional control to shape and guide these thoughts, the creative output of people with ADHD may be fragmented, childish or inappropriate for the situation (Barkley, 1997; Castellanos and Proal, 2012). Not having the capacity to take others' perspectives or anticipate the social impact of one's ideas, functions closely associated with empathy (Decety and Jackson, 2004), creative output often lacks coherence, relevance, or appropriateness. This can further lead to ideas which can be perceived as immature or disconnected from social norms (Silvia et al., 2008). In its connection with executive functioning, emotional awareness, and perspective taking, empathy may be a key moderator between the presence of

this raw creative potential and functional creativity. In turn, it is hypothesized that *empathy will moderate the relationship between ADHD symptoms and divergent thinking, enhancing the positive correlation in subjects with higher levels of empathy (H2)*.

It is worth noting that while creativity can occur in solitary settings, many creative domains such as design, education, or communication rely heavily on social sensitivity and the ability to anticipate the responses of others. In these contexts, empathy becomes a valuable cognitive and emotional resource. ADHD provides creative impulse, and empathy, in return, the creative filter that helps people to select, refine and modify ideas in socially meaningful ways, as well as in ways cognitively consistent with their inner self. Such interaction of traits can thus lead to a unique cognitive picture where the high ADHD traits and high empathy are found to be linked with the highest levels of creative fluency. On one hand, people with strong ADHD and low empathy may express a large number of ideas without quality, coherence or relevance.

Creativity is turning into a more understandable outcome of both conscious and subconscious actions, a compromise between unedited thinking and goal-oriented evaluation (Sowden et al., 2015). In such a two-process model, ADHD and empathy may represent two extremes of this generative creative system with one, ADHD, facilitating bottom-up processing and the other, empathy, facilitating top-down processing.

In order to test this model, this thesis is primarily interested in divergent thinking which is defined as the Alternate Uses Task. One of the most applicable to analyzing the ideational generation in ADHD is divergent thinking, which has been widely used in studies of creativity in neurodiverse people (White and Shah, 2011; Boot et al., 2017). The hypothesis concerns the interaction between ADHD symptoms and empathy in relation to divergent thinking performance.

This paper will attempt to provide an explanation of the inconsistency of the ADHD/creativity research as well as provide a perspective on the role of empathy as a moderator in predicting the creative outcome. With this kind of support, the framework can offer a more balanced explanation of creative cognition in individuals possessing ADHD traits and highlight the potential of empathy as a strength that supports more adaptive and productive creativity.

Method

Participants

The present study was conducted in a partly controlled environment at different locations such as the Erasmus University Rotterdam or the home of the participant or the researcher. The participants were recruited from the general adult population by means of university and online outreach. The inclusion criteria consisted of the age of at least 18 years and adequate level of English in order to be able to complete self-report measures and creative assignments. All the participants gave consent to participate in the study.

The minimum sample size required to detect a small-to-medium effect ($f^2 = 0.05$) in a multiple linear regression with three predictors (ADHD symptoms, empathy, and their interaction), with $\alpha = .05$ and power $= .80$ was computed using G*Power (Faul et al., 2007). The results have shown that a minimum of 123 participants should be used.

Initially, 150 participants were tested, but five cases with incomplete responses or with large amounts of missing data were excluded. Therefore, in total, 145 participants were considered in the final sample.. Of these, 67 were male and 78 were female. Among the participants 35,9% had a University degree or higher, 53,1% had an HBO degree (higher professional education) and 11% had a MBO degree (intermediate vocational education). The age of the participants varied between 18-63 years ($M=29.50$, $SD=11.18$). The participants were allowed to fill the survey under supervision to guarantee focus and compliance. Participation was not compensated in any monetary way.

Materials

Creativity

Creativity was measured in two ways using a divergent thinking task and the convergent thinking task.

Divergent thinking. The ability to think divergently was assessed with the Alternate Uses Task (Guilford, 1967), wherein the participant was asked to give as many unusual uses as possible of a common object in 90 seconds. The responses were considered in four dimensions

1. Fluency – the number of valid, unique ideas.
2. Flexibility – the number of distinct conceptual categories among responses.
3. Originality – the novelty of responses, scored on a 3-point scale.

4. Elaboration – the level of detail in the explanation, also rated on a 3-point scale.

The scoring of AUT responses was conducted as per the guidelines of Wahbeh et al. (2024) and reviewed with the assistance of a GPT-based scoring assistant to make sure it was consistent. All the data was scored according to the Alternate Uses Task scoring codebook by Wahbeh et al., (2023). Fluency was scored by counting the number of acceptable answers, answers that were not useful or repeated were excluded ('building a house ' and 'building a wall ' were only counted once). Flexibility was scored by categorizing the answers into types of function (for example: 'build a house' and 'build a chimney' both are coded under 'construction', but 'doorstop' was coded under 'weight'). Elaboration was scored on a 0-2 scale depending on the level of detail in the explanation (for example: 'doorstop' received 0, 'doorstop to prevent a door from slamming in the wind' received 2). Originality was scored on a 0-2 scale by how common/uncommon ideas were compared to others in the dataset. If many participants listed the same answer this was considered common and scored as 0 (Wahbeh et al., 2024).

Convergent Thinking. The ability to think convergently was evaluated using a shortened version of the Remote Associates Test (Mednick, 1962), in which 15 triads of seemingly unrelated words (for example, “time”, “hair”, “stretch”) were used to assess the ability of the participants to identify a fourth word associated with all three (for example, “long”). The time allocated for doing this task was four minutes. The total score was the number of correct solutions with a potential range of 0-15. The analysis of the scoring was implemented with the help of the IBM SPSS Statistics 29.0.2.0.

ADHD

ADHD symptoms were measured with the full version of Adult ADHD Self-Report Scale (Kessler et al., 2005) comprising 23 items to assess the symptoms of inattention and hyperactivity/impulsivity on a 5-point scale (1 = never/rarely, 5 = very often). Examples of the questions are, “How frequently do you find it difficult to tie up the loose ends of a project, after you have completed the hard work?” Total scores were calculated by adding responses on all the items and as the score gets higher, so does the severity of ADHD traits. In the sample, the ASRS showed a very high internal consistency (Cronbach’s alpha =.88).

Empathy

Empathy was assessed with the help of a 10-item questionnaire Empathy Quotient-10 (EQ-10; Greenberg et al., 2018) that included questions rated on a 5-point scale (1 = strongly disagree, 5 = strongly agree). The scale contains items such as: “I can easily notice whether somebody wants to join a conversation or not.” The total scores were summed and as the score gets higher so does the level of empathy. Sample internal consistency of the EQ-10 was good, as measured by Cronbach’s alpha of 0.80.

Control Variables

The demographic data was included. This was the age (as a continuous variable), gender (1 = male, 2 = female), and educational level which was coded as follows:

- 1= MBO (intermediate vocational education)
- 2 = HBO (higher professional education)
- 3 = WO-bachelor (university undergraduate)
- 4 = WO-master (university graduate)
- 5 = PHD

Procedure

Data was collected in a partly controlled environment (different locations). The participants were seated alone and a research assistant monitored them throughout the session to reduce the distractions and ensure uniform testing conditions. All the participants signed informed consent before participating in the study in accordance with the ethical rules and regulations approved by the university research ethics committee.

The whole process took around 20 minutes. The participants were asked to take part in the self-report questionnaires, including demographic questions, the Adult ADHD Self-Report Scale and the Empathy Quotient-10. Upon the completion of these, the participants were directed towards the behavioral tasks, the first of which was Alternate Uses Task followed by the Remote Associates Test.

English was used in all instructions. All tasks were preceded by a short explanation and example item to make sure that they are understood. The sequence of the tasks was strict among the participants in order to provide consistency. At the end of the work, the participants were thanked and given the opportunity to be informed about the results of the study. There was no monetary or scholarly reward for participation.

Data Analysis

Statistical analysis of all the data was done using IBM SPSS Statistics (version 29). Before the main analysis was conducted, the data was filtered with regard to incomplete responses and missing values.. Although the primary focus of this study is divergent thinking, convergent thinking was also assessed in a complementary manner. This allows for a broader understanding of the cognitive processes involved in creativity. Previous research has emphasized that creativity is not only about generating numerous ideas (divergent thinking), but also about refining and selecting the most appropriate ones (convergent thinking) (Cropley, 2006; Benedek and Jauk, 2018). For this reason, we are measuring both components as they provide a more comprehensive picture of creative cognition, especially in neurodiverse individuals, whose performance often varies across different types of creative tasks.

For the AUT, the four measures of divergent thinking were fluency (total count of valid responses), flexibility (count of the number of unique conceptual categories), and originality (rated on a 3-point scale based on novelty). Scoring was based on previously developed rubrics (Wahbeh et al., 2024), and early reliability testing was facilitated by AI-based validation by using GPT to ensure agreement with human scoring (Wahbeh et al., 2024). As in previous studies (Boot et al., 2017), each of the dimensions was standardized, summed, and then averaged to provide a composite score of divergent thinking, which was the principal outcome measure.

The RAT was rated with the total number of correct answers (range: 0-15), from which the convergent thinking was measured (Mednick, 1962). The ASRS was used to measure the symptoms of ADHD with higher scores measuring the severity of the symptoms (Kessler et al., 2005). Empathy was assessed by the use of the EQ-10 (Greenberg et al., 2018).

Primary analyses involved Pearson's correlation to observe a bivariate relationship between ADHD symptoms, empathy, and creativity measures. Hierarchical multiple regressions were undertaken to determine whether empathy moderates the connection between ADHD symptoms and the divergent thinking. All predictor variables that were continuous in nature were standardized before interaction terms were calculated. The test of statistical significance was set at the $p < .05$ level.

Assumption Checks

Prior to interpretation of the regression models, all standard assumptions of underlying linear regression were tested in both models, one that predicted divergent thinking based on ADHD and empathy and the other that predicted convergent thinking based on ADHD and empathy. The assumption of normality was not met in the convergent thinking model. Although the linear regression is largely resistant to such violations in large samples, this deviation must be considered when interpreting the RAT results since these are the most detailed models tested. We did not conduct separate assumption checks for the simpler models that only included ADHD as a predictor. In case that the assumptions are true in the more complex models, they are also true in the nested simpler models as well (Pedhazur, 1997).

Results

Preliminary Analysis

Before the main analysis, the data was screened for completeness, normality and outliers. A total of 145 participants were left in the final sample after data cleaning.

Bivariate Pearson correlations were performed on all the important variables, such as symptoms of ADHD, scores in empathy, and in divergent thinking. The divergent thinking as the number of unique responses in the AUT was measured in accordance with the traditional criteria (Guilford, 1967; Silvia et al., 2008). A positive correlation between ADHD symptoms and AUT Score ($r = .395$, $p < .001$), and negative correlation between empathy and convergent thinking ($r = -0.450$, $p < .001$) were indicated by preliminary correlation analyses. A negative correlation between ADHD symptoms and empathy was also found ($r = -0.403$, $p < .001$). In addition, there was a significant correlation between AUT Score and RAT Score of 0.485 ($p < 0.001$).

Table 1

Correlations between study variables (N = 145)

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Age	-										
2. Gender	.08	-									
3. Education	-.05	-.02	-								
4. AUT Score	-.06	-.12	.12	-							
5. ADHD	-.14	-.12	.02	.40***	-						
6. Empathy	.13	.40***	.05	-.24**	-.40***	-					
7. RAT Score	-.12	-.21*	.04	.49***	.39***	.45***	-				
8. AUT Fluency	-.07	-.15	.10	.96***	.39***	-.23**	.48***	-			
9. AUT Flexibility	-.15	-.10	.12	.93***	.36***	-.19*	.44***	.86***	-		
10. AUT Originality	.19*	-.14	.10	.78***	.25***	-.17	.29**	.66***	.75***	-	
11. AUT Elaboration	-.14	-.05	.07	.61***	.37***	-.33***	.46***	.49***	.53***	.50***	-

Note. $p^* < .05$; $p^{**} < .01$; $p^{***} < .001$.

Main Analysis

To perform our main analyses, a hierarchical linear regression was employed to investigate whether ADHD symptoms are statistical predictors of divergent thinking. In step 1 the control variables (age, educational level and gender) were added. In step 2, ADHD symptoms were added as a predictor. In step 3, empathy and the ADHD symptoms x Empathy interaction term was entered.

The initial model was significant, $F = 7.403$, $p < .001$, $R^2 = .175$ with a standardized beta of .385. This shows that the variance in the divergent thinking performance was explained by the ADHD symptoms to the extent of 17.5 percent explained variance. Adding empathy and the interaction term in step 3 further improved the fit over the overall model, $F = 8.714$, $p < .001$, and the R^2 value improved to .2748. Symptoms of ADHD ($\beta = 0.34$, $p < .001$) and empathy ($\beta = 0.29$, $p = .001$) were both found to be independent predictors of divergent thinking. Nevertheless, the interaction term between ADHD and empathy was negative ($\beta = -0.17$, $p = .0016$), which implies that for higher levels of empathy, there is a less positive relationship between ADHD symptoms and divergent thinking.

These results confirm the hypothesis of main effects (H1), which shows that ADHD symptoms have a positive relation with divergent ideation in which empathy also has a positive and independent contribution to divergent thinking creativity. They, however, do not confirm the moderation hypothesis (H2) in the expected direction. Rather than augmenting the relationship, increased empathy appears to weaken the positive association between ADHD symptoms and divergent thinking. One possible interpretation is that higher empathy may be associated with increased self-regulatory or executive functioning capacities, which could temper the more spontaneous ideation typically associated with ADHD (Barkley, 1997; Sowden et al., 2015). However, this remains speculative and would require further investigation.

Complementary Analysis

To perform our exploratory analysis, a hierarchical linear regression was employed to investigate whether empathy would also have value in predicting convergent thinking performance, the measure of which was the RAT. In the first step, the control variables were added. In the second step, ADHD symptoms were added as a predictor. The third step

included the addition of empathy and ADHD $\times$ Empathy interaction term to test their incremental value to the model.

The initial model was significant, $F = 7.696$, $p < .001$, $R^2 = .425$, and ADHD symptoms positively predicted RAT performance ($\beta = .357$, $p < .001$). Adding empathy and the interaction term in step 3 further improved the fit of the overall model, $R^2 = .3289$, $F = 11.27$, $p = .0000$. ADHD was a significant predictor of convergent thinking ($\beta = .17$, $p = .018$), empathy was positive but not significant ($\beta = .18$, $p = .057$). The ADHD $\times$ Empathy interaction term was, however, significant and negative ($\beta = -.23$, $p = .0002$), indicating that higher empathy weakens the positive influence of ADHD symptoms on convergent thinking performance.

These findings confirm the principal effect of ADHD on convergent thinking and indicate that empathy has a positive effect in its own right as well, but not significant. Instead of augmenting the impact of ADHD, empathy seems to have a modest suppressive effect on it, which may be the result of augmented regulatory control that limits flexible associative processing. This tendency is in line with theoretical models which separate spontaneous ideation and controlled evaluation as two discrete parts of creativity (Benedek and Jauk, 2018; Sowden et al., 2015).

Robustness Checks

A number of robustness checks were performed. All the regression models were re-run with gender and age as control variables. The results were unchanged, and the main and the interaction effects of ADHD and empathy on divergent and convergent thinking remained significant, which indicates that demographic variables did not confound the relations observed. Multicollinearity was checked with the help of VIF's, which were all less than 2.0, and thus, there was no critical overlap between predictors. Checking the residual plots showed that assumptions of linearity and homoscedasticity were true and the histograms indicated normally distributed residuals. In addition, there were possible outliers that were evaluated using standardized residuals and Cook's distance. None of the cases exceeded the standard thresholds ($|z| > 3.29$ or Cook's $D > 1$), which indicates the validity of the reported effects.

Discussion

Overview of Findings

The present study investigated the interrelationships between the symptoms of ADHD and empathy and two separate components of creativity, divergent thinking (measured by the Alternate Uses Task) and convergent thinking (measured by the Remote Associates Test). The main aim was to uncover whether empathy moderated the correlation between ADHD symptoms and creativity in a non-clinical adult population.

All in all, the findings confirm the first main hypothesis (H1): the ADHD symptoms were positively related to divergent thinking, and the effect was robust even after empathy was controlled for. Empathy also proved to be an important predictor of divergent thinking independent of other variables. Nevertheless, empathy was not found to be a positively moderating factor between ADHD symptoms and creativity (H2). The same pattern was true in both the divergent and the convergent thinking models, where the $\text{ADHD} \times \text{Empathy}$ interaction term was negative, indicating that higher empathy might decrease, rather than increase, the creative advantage that comes with ADHD. These results indicate that although both ADHD and empathy can affect performance in creativity in an independent manner, there is no evidence that empathy can strengthen the relationship between the ADHD traits and creativity for this particular sample. In contrast, there is evidence for the fact that empathy can weaken this relationship.

The results indicated that the symptoms of ADHD were positively related to convergent and divergent thinking performance. Empathy was also determined by divergent thinking and convergent thinking independently. Most importantly, the interaction effect between the ADHD symptoms and empathy in both models was negative and significant, which suggests that empathy did moderate the relationship between ADHD characteristics and creativity. Particularly, the positive association between ADHD traits and both forms of creative thinking was suppressed by more empathic levels. These results indicate that although both ADHD and empathy are important variables in relation to creativity, their contribution effects are interactive instead of additive, and that empathy limits the degree to which ADHD characteristics can translate into creative performance.

Divergent Thinking

The result that ADHD symptoms were positively related to divergent thinking is in line with the previous studies that found a relationship between ADHD characteristics and the increased ideational output (White and Shah, 2006; Boot et al., 2017). The tendency to produce more associative processing, cognitive disinhibition, and idea fluency that are common traits of ADHD may increase the number of different responses that one produces. This confirms theoretical frameworks such as the dual pathway to creativity, which asserts the importance of cognitive flexibility when it comes to the generation of creative ideas (De Dreu et al., 2008). Empathy was also found as an important independent predictor of divergent thinking. This implies that the ability to comprehend the emotions and thoughts of other people could increase creativity because it allows people to look at issues in different ways and generate a number of ideas that can be viewed in various directions (Guilera et al., 2015). Whilst empathy did show a positive main effect on divergent thinking, it simultaneously reduced the positive association between symptoms of ADHD and divergent ideation. This seemingly paradoxical pattern may reflect the fact that empathy can support creativity through mechanisms such as perspective-taking or emotional richness. However, when coupled with the spontaneity often associated with ADHD, empathy may introduce cognitive regulation (e.g., inhibition, social filtering) that reduces the free associative process. This suggests that the impact of empathy on creativity may vary depending on the individual's broader cognitive-emotional profile.

The ADHD-related tendencies are likely to have the most significant benefits in the context of the AUT, which is a time-limited and structured task and is not burdened with increased empathic regulation. This is an indication that empathy, though positive in its effects on creativity, may be a barrier to the impulsive or uninhibited style of thinking which is characteristic for individuals with high ADHD symptoms, and which leads to divergent ideation.

Convergent Thinking

The second result of the positive relationship between ADHD symptoms and convergent thinking performance on the RAT was also unexpected due to the fact that such tasks are usually associated with sustained attention and cognitive control, which is often impaired in ADHD patients (Barkley, 1997; Diamond, 2013). Nonetheless, RAT performance is highly reliant on the capacity to make distant associations of seemingly unrelated concepts which could be facilitated by the more general associative networks of ADHD (Mednick,

1962). The degree of empathy was not significantly related to convergent thinking performance, the interaction between ADHD symptoms and empathy was found to be significant and negative, which did show a moderating effect. Just like divergent thinking, this implies that a greater degree of empathy suppresses the creativity advantages of ADHD characteristics in convergent tasks. It is conceivable that socio-emotional attunement also brings with it mental filtering or inhibition that constrains the cognitive risk taking and non-linear linkages which underpin success on the RAT. Also, the more rigid and time limited structure of the RAT can keep people with ADHD symptoms focused, and those with greater empathy will tend to take more measured answers, shunning the more intuitive answers in favor of a more socially acceptable or more even-handed response, and for this reason might perform worse.

Comparison of Results

This conclusion supports the idea that ADHD symptoms positively correlate with divergent and convergent thinking, challenging the common belief that ADHD traits hinder performance on structured tasks while benefiting open-ended ones. (Fugate et al., 2013). The fact that AUT and RAT scores correlated (~ 0.48) indicates that there is a cognitive process common to the two creative domains, either broad semantic activation or associative fluency. The ways in which empathy leads to these results, however, seem to vary. Empathy was found to be a predictor of both divergent and convergent thinking and thus may be relevant to creativity via perspective-taking and emotional attunement processes. Moreover, its moderating effect in both domains is also rather interesting as the negative interaction effects are significant, which means that when accompanied by high ADHD trait levels, empathy can hinder its creative potential. Such results would suggest that socio-emotional regulation may offset the cognitive impulsiveness and associative effect of ADHD and hence limit the associated advantages of divergent and convergent creativity.

Theoretical Implications

The current results help to expand the body of literature that refutes the idea that ADHD is a uniform cognitive impairment. Despite the fact that earlier studies have stressed the existence of deficits in attention, inhibition, and working memory in individuals with ADHD (Barkley, 1997; Willcutt et al., 2005), our findings indicate that some of the cognitive styles associated with ADHD, namely a tendency to exhibit reduced latent inhibition and a

wider range of associative processing, might actually enable creative thinking when placed in a certain context.

This is in line with dual pathway theories of creativity, which suggest that both divergent and convergent thinking may be improved by facilitating associative activation in the presence of sufficient cognitive control (Nijstad et al., 2010). The correlations between symptoms of ADHD and both divergent (AUT) and convergent (RAT) thinking indicate that the positive relationships observed here support the associative theory of creativity developed by Mednick (1962), according to which the ability to make remote associations is central to creativity performance. Moreover, the relatively high correlation (~ 0.48) between divergent and convergent thinking indicates that there are some common underlying processes involved, e.g., associative flexibility, that are not considered in the domain-specific theories of creativity (Baer, 2012).

These results suggest that ADHD-related characteristics can promote a broader creative ability as opposed to task-specific. Empathy also emerged as an important independent predictor of divergent thinking and convergent thinking. More to the point, it mediates the connection between ADHD symptoms and creativity in both directions: the higher is the degree of empathy, the less strong is the positive correlation between ADHD traits and creativity.

This indicates that empathy could facilitate ideation by itself, but its more regulatory or inhibitory role could limit cognitive impulsiveness and associative breadth that are commonly related to ADHD-related creativity. This differentiation sharpens the present models by indicating that socio-emotional characteristics can have complicated effects, both enabling and constraining, relative to the cognitive characteristics with which they interact and the context of the task.

Practical Implications

In an applied sense, the present findings could be used in educational, occupational and clinical settings. In education, the implications are that students with high ADHD traits might do well in both the open-ended and structured creative tasks as long as the environment fits their cognitive style. The moderating effect of empathy, however, suggests that a high emotional attunement is not necessarily a benefit when combined with ADHD traits and even may interfere with the ideational benefits that result due to cognitive disinhibition. Teachers

can find it advantageous to create a kind of atmosphere that will facilitate emotional awareness and uninhibited ideation, but they need to be careful about how they interact.

Some of the ADHD symptoms such as rapid ideation and associative flexibility, can be reinterpreted as an advantage in the workplace, especially in an innovation-driven profession. Divergent thinking can be helpful in brainstorming and ideation, whereas convergent thinking can be helpful in unique problem-solving when it is reinforced to an adequate level. Nonetheless, the results indicate that the employees who have a high level of ADHD traits coupled with high levels of empathy might be more internally regulated or inhibited, and this might not enhance their creative spontaneity. Individualizing tasks to cognitive profiles, allowing emotional expression so long as it is not overregulated, may maximize both the individual and group factors.

However, the findings are clinically significant in the sense that they support the need to adopt a strengths-based view of ADHD. The difficulties with attention and inhibition are reasonably established, but attention and inhibition can be viewed as a set of capabilities rather than a set of deficits. Interventions may include creativity-based activities or spaces that would help direct ADHD characteristics in a positive direction. Meanwhile, it is important that practitioners think about the interaction of socio-emotional characteristics, for example empathy, with cognitive impulsiveness in either facilitating or suppressing creative expression. A coaching approach that has been shown to be particularly effective in striking the right balance between these two forces is one that focuses on cognitive flexibility as well as emotion regulation.

Limitations

A number of limitations should be mentioned in relation to the interpretation of these findings. First, cross-sectional study design cannot allow any causal inferences. Although the ADHD symptoms were related to higher creative performance, it is not yet clear whether ADHD traits contribute to creativity or whether this relationship is moderated by other unmeasured third variables such as intelligence or personality traits (for example openness to experience). Second, the research was based on self-report scales of ADHD symptoms and empathy that are prone to social desirability and low self-insight. Although validated scales were employed, it would be of benefit in future research to include objective behavioral measures or clinical interviews to better measure these constructs. Third, the sample consisted mostly of university-affiliated adults, and thus may not be generalized to younger

samples, clinical samples of ADHD, or more culturally diverse samples. Moreover, measures of creativity employed, the RAT and AUT, are abstract and time-limited measures of creativity and may not capture real-life creative performance or performance in a specific domain. Despite their widespread use as representative measures of divergent and convergent thinking, the AUT and the RAT are limited measures of the more complex construct of creativity. They estimate performance in terms of a limited period of time and decontextualized prompts, which cannot provide the full picture of creative behavior in the real world. In addition, test-taking motivation, experience of the task format, and verbal fluency can affect performance on these tasks, and may be confounding factors in the relationships observed. Lastly, the regression assumptions were tested and generally met, however, the assumption of normality was not met in the convergent thinking model. Although the linear regression is largely resistant to such violations in large samples, this deviation must be considered when interpreting the RAT results.

Also, the use of self-report measures of ADHD and empathy brings the risk of biases associated with self-awareness, desirability and response style. The cross-sectional design does not allow drawing conclusions about causal relationships as it is not possible to say with certainty which way the observed associations work. Also, the sample included mostly university-related participants that can limit the applicability of the results to other populations, especially those with clinically diagnosed ADHD or of different educational and cultural backgrounds.

Future Research

Future studies are needed to replicate these results in larger and more heterogeneous samples, including the clinical population of individuals with ADHD, to examine whether patterns are similar at a higher level of diagnosis. Longitudinal studies would be able to determine whether ADHD related traits are predictive of long-term creative success or the effects are more situationally specific.

It would also be worthwhile to extend the area of creativity assessments. Although the AUT and the RAT provide standard measures of divergent and convergent thinking, they measure only a small segment of the creativity continuum. Including domain-specific scales, collaborative activity, or real-life creative achievements would provide a more valid picture of how the ADHD traits affect creativity.

Since empathy moderated the association between ADHD and creativity in both tasks, other socio-emotional constructs, such as emotional intelligence, openness, or interpersonal sensitivity should be investigated in future studies. These could be useful in clarifying whether some emotional or personality characteristics promote or discourage some of the dimensions of creativity, especially in combination with cognitive diversity.

Higher levels of statistical methods like structural equation modeling may also be used to separate the direct and indirect effects of the ADHD traits, empathy and creativity. Lastly, moderate correlation between performance on AUT and RAT indicates a possible common mechanism, that might be associative processing, that needs further examination. The investigation of the ADHD traits in terms of the shared and distinctive elements of creativity could enrich the current cognitive and neuropsychological theories of creative thinking.

In future studies, these limitations should be overcome by using more heterogeneous sampling, a multi-method assessment of ADHD traits and a broader definition of creativity that encompasses collaborative, applied, and domain-specific products. Longitudinal or experimental studies could help in understanding mechanisms of causation and neuroscientific studies could help in understanding the neural correlations of the ADHD-creativity associations. Moreover, it would be interesting to look at other moderators such as openness to experience, tolerance to ambiguity or affective states, in order to better understand the circumstances under which ADHD traits benefit or harm creativity.

Conclusion

This thesis explored the relationship between ADHD symptoms, empathy, and creative cognition. The results indicate a positive main effect of ADHD symptoms and empathy on both divergent and convergent thinking, while empathy reduced the strength of the ADHD–divergent/convergent thinking link, suggesting a complex interplay between spontaneity and self-regulation in creative cognition.

The results add to the increasing amount of data indicating that cognitive styles related to ADHD may both have a facilitating and inhibiting effect on creative performance, contingent on the type of creative task and the presence of moderating characteristics. These results are consistent with previous findings of positive relationships between ADHD symptoms and performance on divergent thinking tasks and convergent thinking tasks (White & Shah, 2006). At the same time, they contradict the traditional belief that ADHD attributes are

inherently a barrier to structured problem-solving and suggest that cognitive flexibility and non-linear thinking patterns which are fundamental to ADHD can be an advantage in some task requirements.

Notably, empathy is an important moderating variable between ADHD symptoms and creative performance in both models as there is a negative interaction effect. This observation implies that although empathy can be associated with creativity in its own right, it can also inhibit some of the creative benefits of ADHD traits, perhaps because it results in greater self-regulation, reflective thinking, or social conformity. These findings encourage a more nuanced explanation of the role of empathy as an element that does not necessarily boost creativity, but rather one whose impact varies according to the cognitive situation it is applied to. It is possible that the positive effects of empathy are more significant in creative fields of interpersonal communication, emotions expression or perspective-taking in narrative, but not in abstract, decontextualized problem-solving.

In addition to theoretical value, the study has a practical value. The results are significant to educators, employers, and clinicians in that they need to understand the concept of cognitive diversity as a potential resource. People with more severe ADHD symptoms might be more successful in the settings which reward creativity in generating ideas, unusual connections, and the ability to frame problems in a fluid way. Nevertheless, the moderating effect of empathy indicates that the social-emotional characteristics may enhance or limit the manifestation of these cognitive advantages. This shows the importance of specific interventions and work designs to strike the right balance between ideational freedom and the proper degree of emotional and behavioral control.

In sum, this thesis supports the view that cognitive profiles associated with ADHD, which are problematized in school and in the workplace, can have creative benefits. These benefits are transferred into both idea generation and associative problem-solving, complicating the overly simplistic accounts of ADHD as being deficit-based. By incorporating these observations, future research and practice may become more inclusive and strength-based with the ability to acknowledge and use the varied cognitive profiles that have been identified.

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