Testing the Relation of ADHD and Hyperfocus with a Preliminary Self-report Hyperfocus Measure

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Abstract

The relationship between hyperfocus and attention-deficit hyperactivity disorder (ADHD) is explored. Hyperfocus is a state of increased focus that is more automatic, prolonged, narrow and deep than regular focus, leading to reduced awareness of the world, time and self, and impairments in stopping and initiating other tasks. ADHD is a neurodevelopmental disorder marked by inattention, hyperactivity and impulsivity. Previous research has found positive correlations between ADHD and hyperfocus experiences. The associations between 8 core hyperfocus dimensions and ADHD are measured using the Core Hyperfocus Questionnaire (CHQ) and Adult ADHD Self-Report Scale Screener (ASRS-S), with an expectation of positive correlations for all core dimensions. Additional measures for demographic characteristics (age, sex and education level) are included in the online questionnaire administered to participants ($N = 322$) from a convenience sample consisting predominantly of first-year Psychology Bachelor students from Groningen. The only positive significant correlation was identified between ADHD and 'awareness of the self' ($\tau = .092$, $p < .05$), with negative correlations found for 'automatic focus' ($\tau = -.354$, $p < .01$) and 'prolonged concentration' ($\tau = -.090$, $p < .05$), and nonsignificant correlations for the other core dimensions and for demographic characteristics. The incongruence with prior research indicates that further research is needed to explore hyperfocus based on core dimensions, as well as their relationship with ADHD and demographic characteristics. Only through further validation can reliable conclusions be drawn regarding the validity of the CHQ and the definition of hyperfocus according to the 8 proposed core dimensions.

Key words: Attention, Neurodevelopmental Disorders, Adult ADHD, Focus.

Testing the Relation of ADHD and Hyperfocus with a Preliminary Self-report Hyperfocus Measure

Hyperfocus is a phenomenon which has received increased scientific attention in recent years. According to Ashinoff & Abu-Akel (2019), hyperfocus is a relatively common cognitive/attentive experience in which an individual is so engrossed in an activity that all unrelated or environmental stimuli are automatically neglected. They explain that this phenomenon is most commonly reported when the task or activity is particularly interesting or cognitively challenging. According to Hupfeld et al. (2018), hyperfocus is most likely to occur when an individual engages in a hobby or leisurely activity which is intrinsically rewarding and enjoyable. Hyperfocus experiences have also been reported to relate to individual demographic characteristics. For example, Groen et al. (2020) found in their study that especially older individuals and those with a higher educational level tend to experience hyperfocus more frequently (but for shorter duration and in fewer situations). Furthermore, they found that women tend to experience hyperfocus less frequently than men, but in more different situations.

Various studies have also identified a relationship between hyperfocus and attention-deficit hyperactivity disorder (ADHD), a neurodevelopmental disorder which is characterized by "a persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development" (American Psychiatric Association, 2013). For example, Ozel-Kizil et al. (2016) found that participants with clinically diagnosed ADHD scored higher on a hyperfocus assessment scale. Hupfeld et al. (2018) found that participants who scored higher on a self-reported ADHD assessment scale, reported increased hyperfocus experiences in three situational settings (school, hobbies, screen time). Lastly, Groen et al. (2020) identified that participants with a clinical diagnosis for ADHD did not experience hyperfocus more frequently than a matched healthy control group, but that scores on ADHD

scales positively correlated with self-reported hyperfocus experiences in non-diagnosed individuals. These findings indicate that a connection between ADHD and hyperfocus experiences may exist.

The findings in prior research are surprising, since hyperfocus is commonly understood to be a state of increased or more intense focus, and most people associate ADHD with inattention and reduced focus (McLeod et al., 2007). However, this common view may not be entirely accurate. While inattention, hyperactivity and impulsivity are the symptom categories of ADHD receiving most clinical and practical attention (American Psychiatric Association, 2013), it could be theorized that these symptoms may be signs of a broader underlying problem. A systematic review of meta-analyses conducted by Abramovitch et al. (2021) identified that many psychiatric disorders feature significant cognitive impairment. Specifically, this review identified significant impairments in executive functioning for patients with ADHD. Unweighted mean effect sizes for individual executive functions were small to medium, ranging from $d = .39$ (planning) to $d = .57$ (fluency). These findings are supported by a literature review by Emond et al. (2009), which assessed the current neuropsychological knowledge on ADHD and various cognitive and executive functions. They identified that executive dysfunction in ADHD is frequently associated with decreased volume as well as reduced activation in the prefrontal cortex. This is consistent with the neuropsychological understanding that the prefrontal cortex corresponds with executive functions, and the ability to regulate and direct lower-order cognitive functions (Ogden, 2005, p. 11). Based on these findings, it can be theorized that hyperactivity, impulsivity and inattention originate at least partially from deficits in executive functions such as impulse control, shifting and attentional control. Therefore, a potential explanation for the previously identified correlation between ADHD and hyperfocus lies in attentional control and shifting impairments commonly found in the presentation of the disorder, rather than insufficient

attentional resources. This could result in increased experiences of hyperfocus, since the ability to consciously self-direct attention and shift away from a task or activity is impaired.

Previous studies on hyperfocus have operated under different definitions, and have therefore measured different components of hyperfocus. For example, Hupfeld et al. (2018) assessed hyperfocus depending on the specific situation in which it could occur (i.e. school, hobbies, screen time), basing their understanding of hyperfocus on the rewarding and engaging qualities of the task, rather than the inherent characteristics of the focus. Furthermore, the study by Groen et al. (2020) focused predominantly on the duration and frequency of hyperfocus, as well as in how many different situations (e.g. work, consuming media and social activities) hyperfocus occurred. Finally, the questionnaire developed and utilized by Ozel-Kizil et al. (2016) inquires about consequences of hyperfocus (e.g. item 2: 'Due to excessive focusing on a work, I often neglect myself and those around me'). While it is important and useful to understand these situational and consequential factors surrounding hyperfocus, the current study aims to study dimensions that are at the core of hyperfocus, regardless of the situation in which these experiences occur, and their consequences. The operational definition of hyperfocus utilized in this study identifies eight core dimensions. Namely, hyperfocus is defined as a state of prolonged (1), narrow (2), deep and intense (3) focus on a task, activity or mental representation, where attention is automatically directed towards relevant stimuli (4), attention towards time (5), the world (6) and the self (7) significantly diminishes, as does the ability to shift to a different activity (8). By defining hyperfocus based on these core dimensions, this study aims to gather information about hyperfocus that is independent of situational factors and therefore more broadly generalizable to different situations and events.

The primary research question of the current study is whether ADHD correlates significantly with the eight described core dimensions of hyperfocus. Based on previous

research, significant and positive correlations between ADHD and all core dimensions of hyperfocus are expected (Groen et al., 2020; Hupfeld et al., 2018; Ozel-Kizil et al., 2016). The secondary research question relates to the correlation between the core hyperfocus dimensions and the individual demographic characteristics age, sex and education level. Based on the research by Groen et al. (2020), it is expected that hyperfocus frequency will positively correlate with higher age and education level, and negatively with being female.

Since the phenomenon of hyperfocus is currently not well understood, it is of scientific interest to build upon previous research to better understand what it is, how it relates to other variables such as age, sex, education level and ADHD. Additionally, this study proposes a new operational definition of hyperfocus which is based on core dimensions and aims to assess hyperfocus independently from situational factors and consequences. If outcomes based on these core dimensions of hyperfocus are consistent with outcomes of previous research, it can provide support for this definition and for the potential of utilising these core dimensions in future research. This could consequently mean that hyperfocus could be assessed more reliably in the future, independently from situational factors and consequences. Lastly, hyperfocus is frequently reported to be a double-edged sword, potentially leading to positive (e.g. temporarily improved task performance) as well as negative (e.g. neglecting to eat or perform other personal care tasks) outcomes (Ashinoff & Abu-Akel, 2019). A deeper understanding of hyperfocus and the core dimensions thereof may enable individuals with and without ADHD to maximize positive outcomes of hyperfocus, while minimizing negative consequences.

Methods

Participants

Participants are obtained through convenience samples via the SONA first-year pool of the University of Groningen (*n* = 249), the paid participant pool (PPP; *n* = 84), and through social media (*n* = 35). This yields a total sample size of *N* = 368 before exclusion. Participants are excluded if they report insufficient language abilities (*n* = 1), if they report to not have answered the questions seriously (*n* = 5), if they fail one of the three validity control questions (*n* = 20), if they do not complete the questionnaire (*n* = 32) or if they do not consent to participation (*n* = 22). The final sample size is *N* = 322, with 240 female, 79 male and 3 participants who identified as 'other'. The age ranges from 18 to 54 with a mean of 21.44 (*SD* = 3.69). The level of education was coded by a bachelor thesis group and a master student separately via the International Standard Classification of Education System (ISCED; UNESCO Institute For Statistics, 2012). The Cohen's kappa is .939, which is considered as excellent inter-rater reliability. Level of education ranges from the levels 3 ("upper secondary education") to 7 ("master or equivalent"), with mode education level being 5 ("short-cycle tertiary education"). 152 participants reported Dutch as their first language (47.2%), 68 reported German (21.1%), and 22 reported English (6.8%). Additionally, various reported other languages (e.g. Frisian, Romanian, Greek, Hebrew), which are categorized as "other" (24.8%). The participants also reported if they were ever diagnosed (*n* = 98), and/or currently have a diagnosis or received treatment for psychological, mental or brain disorders by a mental health professional (*n* = 46) and/or used prescribed medication (*n* = 29). Several diagnoses are reported that were then categorized, e.g. ADHD (*n* = 16), anxiety disorder (*n* = 39) and mood disorders (n = 38). Next to this, they reported on the use of various substances, namely alcohol (*M* = 2.81, *SD* = 1.24), nicotine (*M* = 2.19, *SD* = 1.51), drugs (*M* = 1.82, *SD* = 1.10), and abuse of prescription medication (*M* = 1.23, *SD* = 0.77).

Measures

Demographic information

Via open questions in English, participants are instructed to self-report demographic data such as age, nationality, first language, highest level of education attained and in which country they attained this education. Furthermore, participants are asked to categorize their sex as either “female”, “male” or “other”. Lastly, they are instructed to categorize their current occupational status based on nine answer options, including an “other” option, where they could fill it in themselves if theirs is different from the options provided.

Core Hyperfocus questionnaire

For assessing the various dimensions of hyperfocus among participants, an experimental version of the Core Hyperfocus questionnaire is applied. Participants are instructed to indicate the frequency of specific hyperfocus experiences in the past six months, on a 6-point Likert scale (1 = never, 6 = very frequently/always). This questionnaire incorporates eight dimensions of hyperfocus: ‘reduced awareness of the world’ (6 items, α = .85), ‘reduced awareness of time’ (6 items, α = .82), ‘reduced awareness of the self’ (6 items, α = .76), ‘narrow focus’ (6 items, α = .78), ‘deep and intense focus’ (4 items, α = .75), ‘stopping and initiating other things’ (6 items, α = .34), ‘automatic focus’ (6 items, α = .86) and ‘prolonged concentration’ (6 items, α = .72), with a total of 46 items (α = .95). Examples of items are; “I can be so focused on something that I do not notice the world around me’’ (world awareness) and “There are times when I feel trapped or locked in a state of deep concentration’’ (stopping and initiating other things). Two validity control questions are included, which instruct participants to choose the answers “rarely” and “sometimes” in order to indicate attentive responding. Item order is randomized to reduce the probability of order and fatigue effects. To summarize the scores for these hyperfocus dimensions, the scores of each question are summed up, and divided by the amount of questions per dimension.

Adult ADHD self-report scale screener (ASRS-S)

To measure the risk for ADHD of the participants we use The World Health Organization ASRS-S (Kessler et al., 2005). This is a shortened version consisting of six items from the full ASRS, which contains 18 items. The ASRS assesses the prevalence of common symptoms of ADHD and therefore the potential risk for an ADHD diagnosis. The items are based on the criteria for ADHD as described in the DSM-IV (American Psychiatric Association, 2000) and input from clinical experts. The items are measured on a 6-point Likert scale (1 = never, 6 = very often). Participants are asked to self-report these symptoms over the last six months. Examples of items included are: “How often do you have difficulty getting things in order when you have to do a task that requires organization?” and “How often do you feel overly active and compelled to do things, like you were driven by a motor?”. A validity control question was included which instructed participants to choose the answer “often” to indicate that their responses were attentive. The ASRS-S summary score consists of the sum of these six individual item scores. Validity research by Kessler et al. (2007) showed Cronbach's alpha ranged from 0.63 to 0.72. This research identifies a Cronbach's alpha of 0.66.

Personal information questionnaire

The questionnaire includes items regarding personal information. Participants are instructed to self-report whether they have ever been diagnosed or received treatment for a psychological, mental or brain disorder, and whether this diagnosis was obtained in the last six months. If the response is yes, they are asked to specify which disorder(s). In addition to that, an inquiry is done regarding the use of prescribed medication, and the specific type of medication which was prescribed. Considering the sensitive nature of these questions, participants are given the option to skip any questions they did not feel comfortable answering.

The Tobacco, Alcohol, Prescription medication, and other Substance use (TAPS) tool

Furthermore, four questions of the TAPS screening tool (Adam et al, 2019) are used to examine the frequency of substance use, including tobacco/other forms of nicotine, alcohol, drugs or the abuse of prescribed medication in the last six months. An example of an item is "In the past 6 months, how often have you used tobacco or any other nicotine delivery product (i.e., e-cigarette, vaping or chewing tobacco)?" These are assessed by a 5-point Likert scale (1 = never, 5 = daily or almost daily). Considering the sensitive nature of these questions, participants were able to leave any of these questions open if they did not feel comfortable answering.

Procedure

The full survey is administered online, and takes approximately fifteen minutes to complete. Participants gain access to the online Qualtrics (https://www.qualtrics.com) questionnaire through a link and complete it unsupervised. Participants gaining access through SONA receive mandatory study credits as compensation. Participants gaining access through the PPP received €2.00 as compensation. Lastly, other participants are approached via social media (e.g. Facebook, Whatsapp), but not compensated. All relevant aspects of the study were approved by the Ethics Committee of the Faculty of Behavioral and Social Sciences of the University of Groningen.

The questionnaire starts with information of the study, after which participants give informed consent to participation and to collection of personal data (e.g. IP address). First, participants answer questions regarding demographic information. Then, the core hyperfocus questionnaire is presented. In addition to the core hyperfocus questionnaire, participants are instructed to estimate the average duration of a single hyperfocus experience in hours and minutes. Then the ASRS-S is administered, followed by additional personal information questions and the TAPS screening tool. In addition to the validity control questions, two final

quality control questions are included at the end of the questionnaire to control for attentive responding. Participants are instructed to report whether they responded seriously and if their English language skills were sufficient to reliably fill in the questionnaire. The final phase is a debriefing in which participants are informed about the research's purpose.

Data Analysis

All analyses are carried out via the Statistical Package for the Social Sciences (SPSS), version 26. Bivariate correlations are analyzed for the following variables: mean total core hyperfocus (Total HF), mean 'reduced awareness of the world' (World Awareness), mean 'reduced awareness of time' (Time Awareness), mean 'reduced awareness of the self' (Self Awareness), mean 'narrow focus' (Narrow), mean 'deep and intense focus' (Deep), mean 'stopping and initiating other things' (Stopping), mean 'automatic focus' (Automatic), mean 'prolonged concentration' (Prolonged), self-reported duration of hyperfocus in minutes (HF Duration), sum ASRS-S, Age, Sex, education level indicated by ISCED codes (Education), a coded system of ADHD diagnosis with 0 = no diagnosis or medication, 1 = clinical diagnosis but no medication, and 2 = clinical diagnosis and medication (ADHD code), and mean self-reported substance use (TAPS). Q-Q plots identified violations of the assumption of normality for HF duration, Deep, Prolonged, Age, Education and TAPS. Additionally, the assumption of homoscedasticity was violated for the variables Time Awareness, Self Awareness and sum ASRS-S. Therefore, correlation analysis of these variables is done via non-parametric Kendall's Tau (τ), whereas the variables Total HF, World Awareness, Narrow, Stopping, and Automatic are analyzed via Pearson correlations (r). The correlation between nominal variables Sex and ADHD code is assessed via the phi coefficient (φ), and point-biserial (r_{pb}) correlations were identified between Sex, ADHD code and the other variables. The cutoff for statistical significance is $p < .05$. For this significance level, to identify a small to moderate correlation ($r = .20$) with a power of .08, a sample size of

minimum $n = 150$ is needed. Therefore, it can be assumed that the current sample size ($N = 322$) is sufficient assuming that any found correlations will be small to moderate.

Results

The first analysis relates to the primary research question; whether a significant positive correlation is present between ADHD and the core hyperfocus dimensions. The second analysis relates to the secondary research question: what the correlations are between the core hyperfocus dimensions and the demographic variables age, education and sex. Table 1 and 2 summarize the descriptive statistics and frequencies of all variables included in the statistical analysis.

Table 1

Mean, Standard Deviation and Range of the Sum ASRS-S, Hyperfocus Dimensions, Demographic and Personal Information Variables.

Variable	Mean (SD)		Range
HF Total	3.42	(.604)	1.85 - 5.33
World Awareness	3.31	(.865)	1.00 - 5.83
Time Awareness**	3.54	(.811)	1.00 - 6.00
Self Awareness**	3.02	(.832)	1.00 - 5.50
Narrow	3.37	(.761)	1.33 - 5.83
Deep*	3.96	(.721)	1.50 - 5.75
Stopping	3.34	(.556)	1.67 - 4.83
Automatic	3.33	(.866)	1.00 - 5.67
Prolonged*	3.66	(.692)	1.67 - 5.33
Sum ASRS-S**	12.66	(3.916)	2.00 - 24.00

Age*	21.44 (3.689)	18 - 54
HF Duration*	218.30 (155.206)	25 - 1440
TAPS*	1.98 (.805)	1 - 4.25

Note:

* Assumption of normality is violated.

** Assumption of homoscedasticity is violated.

Table 2

Frequencies of Categorical Variables Sex, Education and ADHD Code.

Variable	Category	Frequency (percentage)
Sex**	Female	240 (74.5%)
	Male	79 (24.5%)
	Other	3 (.9%)
Education*	3	1 (.3%)
	4	7 (4.4%)
	5	241 (74.8%)
	6	55 (17.1%)
	7	18 (5.6%)
ADHD Code**	No Diagnosis	305 (94.7%)
	Diagnosis	6 (1.9%)
	Diagnosis + Medication	10 (3.1%)

Note:

* Assumption of normality is violated.

** Nominal variable.

Table 3 summarizes the correlations found between all variables included in the data analysis. Regarding the primary analysis, significant correlations were found between sum ASRS-S and Self Awareness ($\tau = .092$, $p < .05$), Automatic ($\tau = -.354$, $p < .01$) and Prolonged

(τ = -.090, p < .05). Regarding the secondary analysis, there were no significant correlations between the core hyperfocus variables and age, sex or education.

Post-hoc analysis of the correlations between variables revealed various unexpected significant findings. A positive correlation was found between ADHD code and sum ASRS-S (r_{pb}= .269, p < .01). Additionally, significant correlations were found between ADHD code and Self Awareness (r_{pb}= .111, p < .05), and ADHD code and Automatic (r_{pb}= -.161, p < .05). Correlations between core hyperfocus dimensions were also significant and positive; with correlations ranging from τ = .275 (p < .001; between Automatic and Time Awareness) and r = .599 (p < .001; between Narrow and World Awareness). Significant and positive correlations were found between HF duration and the core hyperfocus dimensions, ranging from τ = .086 (p < .05; between HF duration and Stopping) to τ = .265 (p < .01; between HF duration and Prolonged). Lastly, TAPS scores were positively correlated with sum ASRS-S (τ = .151, p < .01), and Age was negatively correlated with sum ASRS (τ = -.117).

Table 3

Pearson's Correlation (r), Kendall's Tau Correlation (τ), Point-Biserial Correlation (r_{pb}) and Phi Coefficient Between ASRS-S, Hyperfocus, Demographic and Personal Information Variables.

Variable	HF Total	1.	2.	3.	4.	5.	6.	7.	8.	HF Duration	Sum ASRS-S	Age	Sex	Education	ADHD Code	TAPS
HF Total	-	r = .862**	τ = .611**	τ = .609**	r = .770**	τ = .670**	r = .696**	r = .719**	τ = .682**	τ = .220**	r = -.035	τ = .018	r_{pb} = .053	τ = -.064	r_{pb} = .006	τ = -.025
1.		-	τ = .553**	τ = .513**	r = .599**	τ = .568**	r = .525**	r = .492**	τ = .512**	τ = .202**	r = .024	τ = -.001	r_{pb} = .107	τ = -.050	r_{pb} = .034	τ = -.013
2.			-	τ = .456**	τ = .367**	τ = .483**	τ = .397**	τ = .275**	τ = .470**	τ = .188**	τ = .072	τ = .007	r_{pb} = .008	τ = -.071	r_{pb} = .064	τ = -.014
3.				-	τ = .361**	τ = .431**	τ = .401**	τ = .312**	τ = .445**	τ = .203**	τ = .092*	τ = .057	r_{pb} = .065	τ = -.030	r_{pb} = .111*	τ = .025
4.					-	τ = .471**	r = .454**	r = .541**	τ = .485**	τ = .165**	r = -.060	τ = .014	r_{pb} = .024	τ = -.053	r_{pb} = -.031	τ = .010
5.						-	τ = .386**	τ = .429**	τ = .542**	τ = .142**	τ = -.031	τ = .038	r_{pb} = .078	τ = -.036	r_{pb} = .002	τ = -.005
6.							-	r = .410**	τ = .417**	τ = .086*	r = .089	τ = -.049	r_{pb} = -.035	τ = -.088	r_{pb} = .027	τ = -.042
7.								-	τ = .452**	τ = .143**	r = -.354**	τ = .051	r_{pb} = .072	τ = -.007	r_{pb} = -.161**	τ = -.070
8.									-	τ = .265**	τ = -.090*	τ = .052	r_{pb} = -.014	τ = -.048	r_{pb} = .007	τ = -.062

HF Duration	-	τ = -.047	τ = .065	r_{pb} = -.022	τ = .010	r_{pb} = .042	τ = -.094*
Sum ASRS-S		-	τ = -.117**	r_{pb} = -.045	τ = -.117*	r_{pb} = .269**	τ = .151**
Age			-	r_{pb} = .190**	τ = .358**	r_{pb} = .047	τ = -.080
Sex				-	r_{pb} = -.007	φ = .103	r_{pb} = -.053
Education					-	r_{pb} = .020	τ = -.071
ADHD Code						-	r_{pb} = .126*
TAPS							-

Note:

1. World Awareness; 2. Time Awareness; 3. Self Awareness; 4. Narrow; 5. Deep; 6. Stopping; 7. Automatic; 8. Prolonged.

* Significant at the .05 level (2-tailed).

** Significant at the .01 level (2-tailed).

Discussion

The primary goal of the current study was to analyze the relationship between ADHD and the core dimensions of hyperfocus, expecting significant positive correlations between ADHD and all eight core hyperfocus dimensions. The only dimension for which a positive correlation with sum ASRS-S was identified was Self Awareness. Additional to this finding, negative correlations were identified between sum ASRS-S and Automatic, as well as with Prolonged. These correlations indicate that participants scoring higher on the ASRS-S (and thus have an increased risk of obtaining an ADHD diagnosis) tend to experience higher levels of impairment in self-relevant cue awareness, but report hyperfocus to be less automatic and less prolonged. These findings were further supported by post-hoc findings of a positive correlation between ADHD code and Self Awareness, as well as a negative correlation between ADHD code and Automatic. The identified negative and non-significant correlations are not consistent with the hypothesis that ADHD would positively correlate with all core hyperfocus dimensions. Additionally, they are inconsistent with previous research which identified positive correlations between ADHD and hyperfocus (Groen et al., 2020; Hupfeld et al., 2018; Ozel-Kizil et al., 2016).

One major explanation for these divergent findings lies in the use of the core hyperfocus questionnaire. Previous studies have predominantly focused on different characteristics of hyperfocus. For example, Ozel-Kizil et al. (2016) focuses predominantly on the (mostly negative) consequences of hyperfocus (e.g. missing appointments, neglecting personal care tasks). On the other hand, Groen et al. (2020) and Hupfeld et al. (2018) inquire about situational characteristics of hyperfocus (e.g. whether hyperfocus occurs predominantly at work, during social interactions, during “screen time”). The core hyperfocus questionnaire is different, seeing as it aims to address core dimensions of hyperfocus completely independent from situations and consequences. Furthermore, the two negative correlations

can partially be explained via the defining criteria of ADHD. That is, according to the DSM-V, inattention is a core dimension of ADHD, assessed through statements such as "Often has difficulty sustaining attention in tasks or play activities" and "Is often easily distracted by extraneous stimuli" (American Psychiatric Association, 2013). It is possible that this common pattern of distractibility and lack of appropriate focus can negatively relate to the automaticity and duration of hyperfocus.

The secondary goal of the study was to assess whether correlations could be found between hyperfocus and demographic characteristics such as age, sex and education, expecting core hyperfocus to positively correlate with a higher age and education level, and negatively with being female. Contrary to the prior hypothesis, no significant correlations were identified between the core hyperfocus dimensions and age, sex and education. This is inconsistent with prior research (Groen et al., 2020).

One potential explanation for the incongruent findings is the fact that the current study used a non-representative sample with predominantly young and highly educated female participants. This relatively narrow demographic range could have negatively affected the probability of identifying a significant effect. Additionally, the study on which the expectations for demographic effects were based (Groen et al., 2020), did not measure hyperfocus based on core dimensions, but based on the situational characteristics duration, pervasiveness and frequency. It is possible that demographic characteristics significantly correlate with these situational characteristics, but not with core hyperfocus.

Post-hoc correlational analysis revealed a significant positive relationship between all core hyperfocus dimensions, as well as between the dimensions and HF duration. That is, individuals scoring high on one dimension of hyperfocus were more likely to also score higher on other hyperfocus dimensions. Furthermore, participants self-reporting a longer duration for estimated hyperfocus tended to score higher on core hyperfocus dimensions.

These findings provide construct validity for the core hyperfocus questionnaire as a valid measurement of hyperfocus. This is an important finding, since the core hyperfocus questionnaire has not been validated by research prior to this study. Furthermore, the decision to utilize the ASRS-S rather than self-reported diagnosis for ADHD is supported by a significant positive correlation between ADHD code and sum ASRS-S. This relationship indicates that individuals with a clinical diagnosis tended to score higher on the ASRS-S (with highest scores obtained by individuals who also reported medication use), supporting the accuracy of the screener in identifying the risk of ADHD.

Various limitations were identified in the current study that could potentially have affected the reliability and accuracy of the previously mentioned outcomes. For one, the sample was not demographically representative of the average population. On average, participants were more likely to be young, highly educated and female. Since previous research has found significant correlations between hyperfocus and these demographic criteria (Groen et al., 2020), a non-representative sample could potentially skew results significantly, leading to reduced generalizability of the findings. Furthermore, seeing as 228 participants (70.8 % of the total sample) were obtained via SONA, it can be assumed that they were first-year Psychology Bachelor students with above-average levels of knowledge regarding psychological testing. This increased level of knowledge compared to the average population could potentially lead to response bias in the form of demand characteristics, due to insight into the aim of the study (Orne, 2009). Prior experiences in psychological assessment could potentially lead to similar issues. In other words, higher ASRS-S scores might partially be explained by the increased knowledge of ADHD diagnostic criteria and clinical testing, as a result of the diagnosed individual's personal experiences with diagnostic assessment. It was also reported that various participants experienced significant levels of boredom and cognitive exhaustion during their participation in the study, as a result of the length and repetitiveness of

the core hyperfocus questionnaire. Even though quality control questions were included, there is no guarantee that a portion of participants did not engage in careless responding. This has a negative effect on the reliability of the current findings, seeing as there is no way to ensure that the responses correspond with genuine hyperfocus experiences. The problems of inattentive and biased responding are potentially exacerbated by the fact that the questionnaire was administered remotely and without supervision, meaning that there is no way to guarantee the reliability of participant responses through observation. Finally, even though the ASRS-S was previously found to reliably assess the risk of ADHD (Kessler, 2005) and was found to positively correlate with ADHD code in this study, an argument can be made that better forms of assessing ADHD exist. For example, Hupfeld et al. (2018) utilized the Conners' Adult ADHD Rating Scale (CAARS), a longer and more exhaustive questionnaire that has been found to reliably measure the most commonly reported symptoms of ADHD (Macey, 2003). The decision for the ASRS-S in the current study was predominantly made based on ethical and financial limitations to the length and duration of the questionnaire.

In future research, some of the mentioned limitations can be resolved with relative ease. For example, a different method of participant recruitment (rather than a convenience sample overwhelmingly consisting of participants from the same city, university and Bachelor of Psychology programme) could yield a more representative and heterogeneous sample. For example, simple or stratified random sampling are both methods of obtaining a more representative sample. The main downside is that these methods are often more expensive and time-consuming. However, this could resolve the previously mentioned problems of demographic homogeneity, as well as reduce the risk of biased responding by Psychology students with increased knowledge of clinical assessment. A proposition to minimize the probability of careless responding due to boredom is to conduct further research regarding the individual contributions of the core hyperfocus questionnaire items, and remove the items that

contribute little to the statistical power of the survey. However, this is not yet possible with the current level of knowledge and research available. A temporary alternative is to separate the core hyperfocus questionnaire into multiple sections, and alternate between sections containing core hyperfocus items and sections containing ADHD and demographic assessment items. That way, participants are less likely to become bored or fatigued with the core hyperfocus questionnaire, since regular intermissions are included where items covering different topics are presented. Lastly, an alternative method of assessing ADHD (e.g. by using the CAARS) could be utilized in a future study with more financial and ethical leniency.

Conclusion

ADHD was found to positively correlate with the hyperfocus dimension "Awareness of the self", and negatively with the dimensions "Automatic focus" and "Prolonged concentration". These findings do not support the prior hypothesis that ADHD would be positively correlated with all core hyperfocus dimensions. A potential explanation for these negative relationships relies on the inattentive characteristics frequently associated with ADHD, which can lead to increased distractibility and difficulty focusing for longer durations of time. Furthermore, the expectation of a correlation between hyperfocus dimensions and age, sex and education was not satisfied; correlations between these variables were not significant. Differences between current findings and prior research can be explained by considering the differences in defining and measuring hyperfocus. That is, as opposed to previous research, the aim of this study was to assess core dimensions of hyperfocus independently from situations or outcomes. This difference in assessment goals means that incongruent findings are not inherently problematic, even though current and prior research both assess the phenomenon of hyperfocus. The same can be said for the analysis of demographic characteristics relating to hyperfocus; since prior research focuses on situational

characteristics of hyperfocus rather than core dimensions, it is not problematic for the current study to find no significant correlations for age, sex and education level. The nonsignificant findings could also partially stem from the relatively homogeneous sample consisting of predominantly young, highly educated women, seeing as there might not have been a sufficiently broad demographic range to identify correlations significantly. Current findings did support the construct validity of the core hyperfocus questionnaire, seeing as significant positive correlations between the core dimensions were identified, as well as positive correlations between the dimensions and average estimated hyperfocus duration.

Future research should focus on further validating the core hyperfocus questionnaire, and further refining it by identifying and potentially removing items that insufficiently contribute to the construct measurement. By extension, it is of importance to further study and validate the core dimensions of hyperfocus, and whether these holistically and exhaustively describe and explain the phenomenon independently of situational and consequential factors. Additionally, alternative methods of assessing ADHD (rather than the ASRS-S) could be considered, which were too costly or time-consuming for the current study. A more representative and heterogeneous sample may also yield different and more generalizable results.

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