Abstract Procrastination is defined as the tendency to delay activities that have to be completed before a deadline.Symptoms of hyperactivity such as "being always on the go" and "often talks excessively" could compensate for procrastination behavior, because individuals scoring high hereupon may not wait to do activities and tasks. However, in the DSM-IV, symptoms of impulsivity are closely related to symptoms of hyperactivity, described as the impulsivity/hyperactivity symptom domain of ADHD. Therefore, it is also possible to predict that people scoring high on hyperactivity are likely to show procrastination behavior because of a positive association between symptoms of impulsivity and procrastination. Additionally, it could be argued that the heightened activity level of individuals scoring high on hyperactivity restrains them from beginning a task, resulting in a high level of procrastination. 7. In sum, current literature about clinical interventions indicates that procrastination is a commonly encountered problem in the ADHD population. Nevertheless, little is known about the role of procrastination in ADHD and about the association between the core symptoms of ADHD and procrastination in general and decisional, everyday, and academic procrastination in particular. Therefore, this study aims at investigating the relation between procrastination and ADHD-related symptoms of inattention, hyperactivity, and impulsivity in young adults. As a first step in this endeavor, we examined this question in undergraduate students with varying levels of ADHD related symptoms. Based on current literature, we expect to find a positive correlation in number or severity of ADHD-related behaviors and procrastination, specifically for symptoms of impulsivity and for the impulsivity/hyperactivity symptom domain of ADHD. More precisely, we predict that participants with high levels of impulsivity are more likely to procrastinate. 8. In this study, 54 undergraduate students participated with varying levels of self-reported ADHD-related behaviors. Various measures of academic procrastination, including questionnaires and direct observation of procrastination behavior while solving math problems, a questionnaire of general procrastination, and of susceptibility to temptation were used in the current study. Methods Participants 9. Four hundred and forty-seven psychology and pedagogy students of the Radboud University Nijmegen (The Netherlands) were pre-screened for self-reported ADHD related behaviors with the help of an online self-report questionnaire of attention problems and hyperactivity/impulsivity for adulthood (Kooij et al., 2005). Based on their ADHD symptoms 74 participants with either high, medium or low scores (see later) were selected for further participation. Fifty-four students (four men, 50 women) with a mean age of 19.72 [standard deviation (SD) = 2.05] agreed to participate. A portion of the participants had German nationality, but could speak, write, and understand Dutch. They were either payed for their participation (EUR10) or received course credit. The data of all participants were used for analysis. Screening 10. Participants completed a questionnaire of attention problems and hyperactivity/impulsivity for adulthood (Kooij et al., 2005). This self-report ADHD scale was earlier used in epidemiological and clinical research in adult populations (Murphy and Barkley, 1996; Kooij et al., 2004; Kooij et al., 2005) and is described as a reliable assessment for symptoms of ADHD in adults (Kooij et al., 2008). It consisted of 23 items about symptoms of impulsivity (three items), hyperactivity (nine items), and inattention (11 items). Participants were asked to rate the severity of these symptoms over the last six months on a four-point scale (ranging from 0= never or rarely to 3= very often). Of the 11 inattention items, four measured the same inattention symptoms as a pair.

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Therefore, for these two paired statements the highest score on each pair was used. 11. The same rule was applied to three paired statements on hyperactivity. The final scores for impulsivity, hyperactivity, and inattention were computed by summing the scores on respectively three impulsivity symptoms, six hyperactivity symptoms, and nine inattention symptoms. Additionally, a total score for hyperactivity/impulsivity was also calculated, because these domains are considered as one symptom domain in the DSM-IV. 12. Participants were selected based on these scores. Specifically, all participants who had scores in the highest 33% of the score range were invited, because there were relatively few participants with high scores. For the middle 33% and the lowest 33% of the score range, only a random subset was invited, because there were more students with middle and low scores as compared to high scores. As a result, the full range of scores was covered in the current sample, but there were more participants with middle and low scores than with high score [inattention: mean (M) = 10.06, SD = 4.95, range 1–25; impulsivity: M= 3.33, SD = 2.36, range 0–9; hyperactivity: M= 7.52, SD = 3.98, range 0–17; combined hyperactivity/impulsivity: M= 10.85, SD = 5.95, range 0–26]. This reflects the normal distribution of ADHD-related behaviors in the population. See Table 1 for the number and percentage of participants with high, medium, and low scores on ADHD-related symptoms. Studying procrastination Observations during math problems 13. In the first part, procrastination behavior of participants was observed while they had to solve five subtraction and five addition problems, each consisting of four numbers (ranging from a single-digit to a seven-digit number). The participants first read the instructions which stated that the goal of this study was to investigate if cognitive abilities of students (measured by solving math problems) can predict success in later life as suggested by previous research (see Ferrari and Tice, 2000). Based on pilot testing, it was determined that students could, on average, solve these math problems in 10 minutes. The participants were allowed to solve the math problems in written form, as learned in school. Participants were informed that they would need about 10 minutes for the math problems, but that in total they would be given 30 minutes. They were informed that they had the possibility to perform some other nice tasks, such as playing computer games (Sudoku, Otis, and Solitaire), playing Gameboy (e.g., Tetris and Snake), and/or reading magazines (Cosmo girl, Voetbal International, Glamour, freundin, Tina Astro) in order to reduce the stress and discomfort, which is often associated by students with solving math problems. This was told as the reason why the participants had 30 minutes time for this part of the study. Additionally, participants were told that they could decide when they would like to do the math problems: at the beginning, or after they had done other nice tasks. They were also allowed to take breaks in between solving the math problems. 14. The experimenter observed the participants via a hidden camera. The activities and the order of the activities of the participants were timed by using a stopwatch and recorded with the help of four categories: (1) solving math problems, (2) playing with computer games and Gameboy, (3) reading a magazine, and (4) "other" (e.g., brushing hair, looking around, and drinking water).This preliminary finding may stimulate more research on the possible relation between procrastination and symptoms of ADHD in individuals with a clinical diagnosis.The PPS consisted in total of 12 statements: three statements of the Decisional Procrastination Questionnaire (DPQ; Mann et al., 1997) e.g., "I delay making decisions until it's too late", five statements of the General Procrastination Scale (GPS; Lay, 1986) e.g., "I often find myself

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performing tasks that I had intended to do days before", and four statements of the Adult Inventory of Procrastination (AIP; McCown and Johnson, 1989) e.g., "I find myself running out of time". These 12 items have together a reliability of 0.92 and provide improved convergent validity with other related measures such as the Susceptibility to Temptation Scale (STS), the Satisfaction with Life Scale (SWLS), and the Irrational Procrastination Scale (IPS) compared to the convergent validity of the DPQ, AIP, and GPS alone (Steel, 2010). The subjects had to rate on a five-point Likert scale (1 = strongly agree to 5 = strongly disagree) their level of agreement with different statements related to procrastination. The PPS measures a general level of procrastination over different life domains. For purposes of data analysis a score for DPQ, GPS, AIP, and a total score for each participant was calculated. The alpha coefficient in our sample was 0.87 for the PPS, and for the subscales: 0.64 for the DPQ, 0.84 for the GPS, and 0.69 for the AIP. (4) The fourth questionnaire STS (Steel, 2002) dealt with the tendency of the participants to be focused on (short-term) pleasurable activities. The STS comprised of 11 statements and asked participants to indicate on a five-point Likert scale (1 = not true for me to 5 = true for me) the level of agreement with their own behavior (e.g., "It takes a lot for me to delay gratification", "I feel irresistible drawn to anything interesting, entertaining, or enjoyable").Procrastination has been described to be expressed in different life domains in the current literature: (i) Academic procrastination is defined as delaying to start studying for an examination or to write a paper shortly before the deadline (Solomon and Rothblum, 1984); (ii) Everyday procrastination is defined as difficulties in organizing daily activities and performing them before the deadline is reached (for example problems in answering phone messages and/or failure in paying bills on time; Milgram, 1988; Milgram et al., 1988); (iii) Decisional procrastination is defined as having chronic problems in making decisions on time (Effert and Ferrari, 1989).Other interventions such as ADHD coaching (Swartz et al., 2005), ADHD Skills and Strategies Programme (Burt et al., 1997), organizational skills intervention (Langberg et al., 2008), and meta-cognitive therapy (Solanto et al., 2010), have integrated dealing with procrastination and time management as a standard aspect of therapy for individuals with ADHD.Additionally, it may be useful to examine the unique contribution of impulsivity versus hyperactivity to procrastination in ADHD-C and ADHD-HI, instead of lumping impulsivity and hyperactivity together (possibly including additional impulsiveness measures, because the DSM-IV criteria for impulsivity in ADHD are limited to three items).Finally, an interesting focus for future research could be to examine whether procrastination as it is observed in relation to inattention may arise from deficits which have been shown to be associated with ADHD symptoms, such as executive function deficits (Barkley, 1997; Willcutt et al., 2005; Castellanos et al., 2006), a unique motivational style (Sonuga-Barke, 2005), or low arousal levels (Sergeant, 2000).Research also indicates that individuals with ADHD are often familiar with multiple negative life outcomes resulting from their long lasting neuropsychological impairments, e.g. attentional difficulties, emotional instability, disinhibition, and disorganized behavior (Newark and Stieglitz, 2010).We suggest that future research which may include ratings of ADHD-related symptoms of impulsivity as well as broader measures of impulsiveness such as the Barratt Impulsiveness Scale (BIS; Patton et al., 1995; Stanford et al., 2009) and the UUPS impulsive behavior scale (Whiteside and Lynam, 2001) can further clarify this.When these individuals are confronted with negative and/or stressful circumstances, they are

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likely to develop maladaptive coping strategies like procrastination and avoidance, which in turn can reinforce their negative beliefs, generating a vicious cycle (Newark and Stieglitz, 2010).The diagnosis ADHD is therefore divided into three subtypes: The inattention subtype is characterized by a failure to pay attention, distractibility, difficulty to sustain focused attention, lack of persistence, and disorganization (Lahey et al., 1998).The hyperactive/impulsive subtype includes behaviors such as fidgeting or restless behavior, excessive activity, engaging in activity without planning, constantly interrupting or changing the subject, impatience, and low frustration tolerance (Lahey et al., 1998).The core symptoms of ADHD are the diagnostic criteria for this disorder in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; APA, 2000), but individuals with ADHD also frequently complain about other, associated problems.An alpha coefficient of 0.75 across prevalence and anticipated problems of PASS ratings and a significant correlation between PASS scores and a behavioral measurement of procrastination behavior were reported by Howell et al. (2006).When inspecting the individual items of inattention as specified in the DSM-IV (APA, 2000), it is not hard to imagine that behaviors such as being easily distracted and having trouble remaining focused on a task may contribute to procrastination.In the assessment of ADHD-related symptoms, we used a questionnaire with three DSM-IV items reflecting impulsivity (Kooij et al., 2005): difficulty waiting turn, interrupting or intruding, and blurting out answers.Additionally, it would be helpful to study the relation between procrastination and ADHD in future research by including cognitive tasks that have been shown to demonstrate attention and/or impulsivity problems such as the Continuous Performance Task (CPT; Conners, 1992) and the Stop-Signal Task (SST; Logan and Cowan, 1984).Attention-deficit hyperactivity disorder (ADHD) is one of the most frequently diagnosed childhood disorders; approximately 3–7% of children are affected worldwide [American Psychiatric Association (APA), 2000].Further evidence for this connection is indicated by descriptions of problems associated with ADHD (APA, 2000): difficult, unpleasant, effort demanding, and uninteresting choices, tasks, daily activities, and decisions are likely to be avoided/procrastinated by children with ADHD.The majority of this research suggests a positive association: persons characterized by high impulsivity are more easily distracted by more pleasant activities while performing a task and are more likely to procrastinate (Ferrari, 1993; Schouwenburg and Lay, 1995).They indicated that procrastination and impulsivity (mainly the lack of perseverance) are closely intertwined and that their relation partially clarifies the association between the personality trait conscientiousness and procrastination.Additionally, this association was specific for the symptom domain of inattention, as the relation between procrastination and hyperactivity/impulsivity did not survive partial correlational analyses controlling for symptoms of inattention.In previous studies in which a relation between impulsivity and procrastination was reported, a different and larger set of items relating to impulsiveness has been used, such as impulsiveness items of the Revised NEO Personality Inventory.Cognitive behavioral therapy (CBT) identifies and modifies negative cognitions, which are related to the facilitation of maladaptive coping strategies (such as procrastination).Persons with inattentive problems tend to have a shortened attention span, are easily distractible, shift their attention from one uncompleted task to another, and often misplace or lose objects important for the completion of a task (Barkley, 1997).We may speculate that students at a university may have found a way to succeed

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academically, independent of their level of inattention, while inter-individual differences in inattention may be associated with procrastination in other domains of their lives, outside academia.We investigated the relation between procrastination and ADHD-related symptoms of inattention, hyperactivity, and impulsivity in 54 students with varying levels of self-reported ADHD-related behaviors.However, partial correlations (corrected for the other symptom domain of ADHD) indicated that only inattention was correlated with general procrastination.This module is frequently chosen by adults with ADHD, indicating that procrastination is a commonly faced deficit and function problem by this adult population (Safren et al., 2005; Safren, 2006).Third, as there were significant correlations between the symptoms of ADHD (inattention and hyperactivity: r = 0.62, p

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