Risk taking among adolescents with AD/HD:
Weighting rare events in decisions from the description and decisions from experience

ענידה עוז
מגישת תזה לסיום תואר מרחב (M.A.) בביוגרפייפולוגיה יישומית

בהנחייתו של ד”ר יהודה פולק

25 בדצמבר 2012, י”ב בחשון התשע”ג
שלמי תודה

ברצוני להודות לד"ר יהודה פולק על הנחייתו המקצועית, סבלנותו והработка המצוינת.

תודה למנהלת היחידה לנירוקולוגיה של הילד במרוצת החרפת "שערי צדק" הפרפור', רות שלון, הפרפור' והרדה גורן.

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זה מחקריペンו ממנה שחל Draws בנו ורדה גרוס, ל魯פיס מ"ד"ר עדא ארון, מ"ר הלח ב-1 מ-5"ר הלחו בולו וולפ קaupt צוות היחידה.

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1
-Schedule for Affective Disorders and Schizophrenia for School Age Children.2.2.1
29 .................................................................................................... Present and Lifetime Version
30 .................................................................................................... Revised Children's Manifest Anxiety Scale .2.2.2
Background and Purpose of the Study:

According to the clinical literature, adolescents with Attention Deficit/Hyperactivity Disorder (AD/HD) exhibit more risk-taking behavior than their peers without AD/HD, suggesting an increased tendency to take chances. Decision-making under uncertainty is influenced by various factors such as the size of the probabilities, the way the event is presented within the range between gain and loss, the way in which the decision maker learns about the possible outcomes and their probabilities, and immediate feedback on the decision.

In the existing neuropsychological literature, children with AD/HD have not been found to control these factors in an effective manner. Therefore, the current study is a pilot study intended to examine decision-making under uncertainty among adolescents with AD/HD, using theoretical concepts derived from behavioral and economic theories. Specifically, the study focuses on decision-making under description and experience, wherein the alternatives involve rare events. The method:

Forty adolescents with AD/HD and forty adolescents without AD/HD, who were matched for gender, age, intelligence, and number of years of education, took two tasks obtained from the behavioral economics field: under description, participants chose options between a sure gain and an option involving risk under full description of the possible outcomes. Under experience, participants learned the possible outcomes and their probabilities through repeating several choices accompanied by immediate feedback on the selected option.

Results:

Our hypothesis that adolescents with AD/HD would exhibit a preference for risk was not supported. No evidence was found for different decision weights in decision-making under description or decision-making under experience.

Conclusions:

The findings suggest that taking risks among adolescents with AD/HD cannot be explained by a preference for risk per se. The findings are discussed in light of previous findings regarding decision-making under uncertainty with AD/HD populations. Future possibilities for research are suggested.
Abstract

Theoretical Background and Objectives: According to the clinical literature, adolescents with Attention Deficit / Hyperactivity Disorder (AD/HD) show increased risk taking, suggesting that AD/HD is related to risk preference in probabilistic decision making. Probabilistic decision making is influenced by different variables, including the magnitude of the probabilities, whether the sum is offered as a gain or threatened as a loss, the way the decision maker learns about the possible outcomes and associated probabilities, provision or non-provision of an immediate feedback on the decision, and more. Existing neuropsychological literature on probabilistic decision making among those with AD/HD had not systematically controlled on these variables. Hence, the current research is an exploratory study designed to characterize probabilistic decision making among adolescents with AD/HD, in terms of current theories of psycho-neuro-economics. Specifically, this study focused on decisions from description and decisions from the experience, including alternatives involving rare events.

Method: Forty adolescents with AD/HD and forty control subjects matched by age, gender, intelligence, and parents' years of education, performed two tasks drawn from the field of behavioral economics: in the decision from description condition, participants made one time choices between pairs of lotteries, each including a safe alternative and a risky alternative, involving a rare outcome, based on a full description of the distribution of possible outcomes. In the decision from experience condition, participants learned the possible outcomes and associated probabilities by performing a large number of repetitive choices; while each choice was accompanied by immediate feedback on the alternative chosen.

Results: Our hypothesis that the choices of adolescents with AD/HD will demonstrate a tendency toward risk preference was not supported. Neither in decision from description, nor in decision from experience, an evidence for a different decision weights was found.
**Conclusions:** The findings suggest that risk-taking among adolescents with AD/HD cannot be explained by mere risk preference. Current findings are discussed with regard to previous findings on probabilistic decision making among AD/HD population obtained using more complex tasks. Potential avenues for future research are offered.
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The attention-deficit/hyperactivity disorder (AD/HD) is a common neuro-psychiatric developmental disorder that affects the quality of life of the child and his family (e.g. Escobar, et al., 2005). It particularly affects the tendency of individuals with the disorder to take on more risks in daily life (see review below).

The current research aims to characterize this tendency through theoretical achievements and research paradigms in the field of behavioral economics. The review below focuses on the analysis of the disease, epidemiology, central neurobiological findings, theoretical models that have been proposed to explain, as well as the treatment based on the evidence in the field. Existing research has shown in decision-making under the disease, while emphasizing the possible contribution of adopting this approach to expand the existing knowledge.

1.1. The Disease
1.1.1. Diagnosis

Definite markers of the condition are not identified for AD/HD (pathognomonic), and therefore, diagnosis is strictly based on observations made by the adults who know the child, parents, and teachers (APA, 2000). AD/HD is classified within the disruptive behavioral disorders (DSM-IV-TR; American Psychiatric Association, 2000) edition, text-revision (Diurnal Behavioral Disorders) (Oppositional Defiant Disorder; ODD) and Conduct Disorder; CD) (Disruptive Behavioral Disorders). The disorder is divided into three subtypes: (1) Predominantly Inattentive Type (Predominantly Hyperactive-Impulsive Type) (2); (2) Inattentive Type (Predominantly Hyperactive-Impulsive Type) (3); (Type Combined Type). (Mesulam, 1999) (3); (Type Combined Type).

The child has a hard time staying focused on a task or a single object, and his thoughts are scattered (inattentive type). The patient is often restless and hyperactive, and has difficulty controlling impulses (impulsive-hyperactive type).

The symptoms often lead to problems in children and adolescents, especially in school, as well as in families, and throughout life. Nathan's book, the diagnosis of which is based on the recognition of these symptoms, has been translated into many languages (second edition) (Nathan, 2000).
1.1.2

AD/HD (prevalence rate) is the number of children in a given population who have been diagnosed with AD/HD. Over the past decades, numerous attempts have been made to determine the prevalence rate (Faraone, Sergeant, Gillberg, & Biederman, 2003) of AD/HD in the population. These efforts yielded a wide range of results, from 0% to almost 58% of children in the home-school (for a review see: Faraone, Sergeant, Gillberg, & Biederman, 2003). According to a recent estimate based on data from 585 different studies that together included 171,756 participants, the global prevalence rate is 3.57% (with a standard deviation of 1.29% = 5.56 – 5.01; Polanczyk, Silva de Lima, Horta, et al., 2007). Longitudinal studies indicate that most of the diagnosed with AD/HD in childhood (98% – 0.8%) remain in the diagnostic criteria during adolescence (Biederman, et al., 1996; Ingram, Hechtman, & Morgenstern, 1999; Lee, Lahey, Owens, & Hinshaw, 2008; Biederman, et al., 2002). This bias (boys are more likely than girls to be diagnosed) suggests that girls with AD/HD, especially younger ones (Gershon, 2002) are not identified and therefore not treated. Similarly, a recent review (Rucklidge, 2010) disputes the earlier belief that girls with AD/HD are not similarly affected as boys with the same condition. However, numerous studies indicate that compared to their peers without the condition, girls with AD/HD face significant difficulties, including academic, cognitive, social and psychological problems (Rucklidge, 2010).

1.1.3

Developmental Coordination Disorder (DCD) is a common co-occurrence among children with AD/HD (Biederman, 2005). In fact, 90% of children with AD/HD have some form of DCD (Spencer, Biederman, & Wilens, 1999). The most commonly cited symptoms of DCD are fine motor (CD-1), coordination disorders, movement disorders, and hyperactivity (Developmental Coordination Disorder; DCD) (Jarrett & Olendick, 2008; Daviss, 2010; Biederman, Newcorn, & Sprich, 1991; Biederman, et al., 2002).
1.1. Dopamine (DA)

(Dopamine: DA) is involved in the modulation of behaviors associated with ADHD (Prince, 2008). DA is a neurotransmitter that plays a role in motor control, cognition, and affect (Prince, 2008). DA is also involved in the etiology of ADHD (Prince, 2008). This is supported by a range of research in different fields: (1) the effectiveness of stimulant medication, which targets the areas of the brain involved in movement, the expression of ADHD symptoms; (2) AD/HD mutations in DA receptors (Prince, 2008); (3) the role of DA in motor control, which is known to involve processes such as attention, memory, and executive function (Prince, 2008); and (4) genetically engineered knockout models, which show significant hyperactivity in ADHD (van der Kooija & Glennon, 2007).

Dopamine is also involved in the modulation of noradrenaline (NE). NE is involved in processes such as attention and memory (Prince, 2008). Therefore, it is argued that changes in a specific system cannot fully explain the complexity of the neurobiological system of ADHD. Rather, this disorder is likely to be related to the interplay between several dysfunctional neurotransmitter systems (Gonon, 2009).

2. Knockout

Knockout is a genetic engineering technique in which the activity of a selected gene is disabled. The knockout mice are used to study the functions of the silenced genes.
The study of genetic research on AD/HD suggests that a large number of genes, each with a small but significant effect, interact with environmental factors, increasing the susceptibility to AD/HD.

Genetic Behavior Research. Early family studies showed that the risk for AD/HD among the parents and siblings of children with AD/HD is higher, by two to eight times (Faraone & Biederman, 2000). However, adoption and twin studies are required to distinguish between genetic and environmental factors in the etiology of the disorder. Three studies found that the biological relatives of children with AD/HD or hyperactive children (Sprich, Biederman, Harding Crawford, Mundy, & Faraone, 2000) tend to express more hyperactivity compared to their non-affected relatives. Faraone et al. (5883) reported an average heritability estimate of 92% for AD/HD, based on 58 twin studies, but see Wood, Buitelaar, Rijsdijk, Asherson, & Kuntsi (5808) for a re-evaluation that considers the possible errors of previous twin studies, which suggests that genetic factors explain 28% of the variance of AD/HD.

Molecular Genetic Research. Molecular genetic research suggests that the genetic architecture of AD/HD is complex. Genome-wide association studies have identified several chromosomal sites (e.g. 5p13, 11q22e25 & 17p11) that are common, but not more than expected in families with AD/HD (Faraone & Mick, 2010). Although there is partial overlap between different studies (Neale, et al., 2010), an unbiased search for genetic factors in the genome of children with AD/HD did not reveal any significant associations. The reasoning behind this is that each potential AD/HD gene variant likely has a small individual effect, or contains rare alleles (Coghill & Banaschewski, 2009).

In contrast to the limited number of association studies, many research studies have found a link between AD/HD and candidate genes based on data from biochemical, physiological and pharmacological studies. In particular, evidence supports the involvement of the genes that code for DRD4 (D4 dopamine receptor), DRD5 (D5 dopamine receptor), SLC6A3 (transporter of amino acids D5, DRD5) and D4 (transporter of amino acids D4, DRD4).

The relationship between genotype and phenotype.
A translocator protein SNAP-25 (LPSR1B) and HTR1B protein (TR7450) are involved in the release of the nerve impulses of serotonin. Studies have shown that these proteins play a significant role in the pathogenesis of ADHD (for a review, see Faraone & Mick, 2010).

According to studies of genetic behavior, some genetic factors play an important role in the etiology of ADHD, but their influence changes from one child to another, influenced by environmental factors. It is estimated that 53% of the etiology is explained by specific environmental factors (Coghill & Banaschewski, 2009), while only 8.2% is explained by environmental factors that are not shared (Coghill & Banaschewski, 2009).

The environmental factors that have been most strongly supported by research are exposure to smoking during pregnancy and low birth weight (Coghill & Banaschewski, 2009). Studies have also examined interactions between genetic and environmental factors in the etiology of ADHD. These interactions occur when environmental factors contribute to the expression of genetic influences that are otherwise not apparent. In addition, they occur when there is genetic damage to the environment (Coghill & Banaschewski, 2009).

So far, studies and reviews of genes related to the nerve transmitter dopamine and smoking and/or alcohol use by the mother during pregnancy, low birth weight and social-economic problems; genes related to serotonin and parent conflict (for reviews, see Nigg, Nikolas, & Burt, 2010, Pennington, et al., 2009). 1.2.3.

Magnetic field studies (Structural Magnetic Resonance Imaging) that used the ROIs (regions of interest) reported that in children and adolescents with ADHD (n = 223) and control children (n = 223), the order of the cortical maturation process was similar in both groups: the maturation of the sensory areas....
The initial wave was followed by a decline in the cortices of single-modality and multi-modality areas responsible for higher-order functions.

However, the median age where 38% of the cortical points reached their maximum thickness was 8.3 years old in children with ADHD, compared to 9.3 years old in control children. The delay was most pronounced in prefrontal areas responsible for cognitive processes such as attention and motor planning. The finding supports the belief that ADHD is characterized by a developmental delay and not a different pattern of cortical development.

A recent study by Mackie et al. (2007) noted that ADHD continued to develop into adulthood as a unique developmental trajectory while remission was linked to normalization of the anatomic abnormalities.

A significant advance in the field is a study on white matter tracts. Recent studies using diffusion tensor imaging (DTI) provide quantitative information on white matter architecture, overcoming the limitations of earlier studies (e.g., Castellanos et al., 2002) that examined the total volume of white matter instead of specific pathways. To date, DTI studies in children with ADHD have found structural connectivity deficits in various pathways compared to controls, as well as in areas such as the basal nuclei, thalamus, and caudate areas (Dickstein, Bannon, Castellanos, & Milham, 2006).

Interesting is that these findings reflect the anatomy evident in the previous DTI studies mentioned above.

To summarize, early morphometric studies focused on the morphology of specific brain regions, while current morphometric studies indicate a range of structural changes in a complex network of brain regions. This process parallels the transition from a simple etiologic model based on single defects to a more comprehensive framework that considers clinical heterogeneity (see below: models of ADHD).

Imaging techniques such as functional MRI (fMRI) provide a measure of the activity of regions involved in specific tasks or during “rest” (in the absence of a specific task). Over the past few years, many studies based on fMRI have been published for the ADHD population. A meta-analysis of these studies showed lower activity in ADHD compared to controls in various regions of the anterior cingulate, dorsolateral prefrontal, inferior prefrontal, and orbitofrontal cortices (Dickstein, Bannon, Castellanos, & Milham, 2006).
fMRI, (resting-state fMRI; R-fMRI), is a relatively new research paradigm. During resting state, fMRI

obtains information about connectivity and function through the detection of synchronized patterns of activity (0.1 Hz). A recent example is the Default Mode Network, which has been used to study the Default Mode Network in the context of ADHD by Castellanos & Proal (2012). The Default Mode Network is a network of brain regions that are active in a resting state and show reduced activity during cognitive tasks. The network is involved in the management of unattended thoughts and information processing. For example, Castellanos & Proal (2012) propose that in ADHD, spontaneous activity in this network is not suppressed during cognitive tasks, which can interfere with specific brain functions and lead to performance deficits. (Raichle, MacLeod, Snyder, Gusnard, & Shulman, 2001). Recent studies have suggested that this network may be related to executive functions in ADHD. (Castellanos, Kelly, & Milham, 2009). Studies have also shown that this network is less coherent in older adults with ADHD than in healthy controls, and is related to reduced performance in children with ADHD. (Fassbendera, et al., 2009). More recently, additional networks have been proposed to be involved in the neurophysiology of ADHD. (Castellanos & Proal, 2012). 1.1 Models of ADHD Several theories have been proposed to account for the diverse clinical features of ADHD. These theories include: difficulties with inhibition, difficulties with attention, and difficulties with working memory. (Nigg, 2001; Castellanos, Sonuga-Barke, Milham, & Tannock, 2006). Executive functions (EFs) include the ability to plan and carry out actions, to monitor and control behavior, to switch between tasks, and to maintain attention. (Sonuga-Barke, Sergeant, Nigg, & Willcutt, 2008). These functions are involved in the Default Mode Network, which includes the lateral parietal cortex, posterior cingulated gyrus, ventromedial prefrontal cortex, and superior temporal gyrus. 1
Barkley proposed a comprehensive theory in 1997 which suggests that the general pattern of attention problems seen in AD/HD is supported by a specific memory deficit known as response inhibition. This ability to suppress a prepotent or dominant response that is not in line with the most appropriate choice. According to the model, this deficit leads to a wide range of secondary impairments in four areas of executive functioning: working memory, self-regulation of emotion and motivation, initiation of speech, and reconstitution; these secondary impairments are responsible for the observed motoric problems (Barkley, 1997). However, the strong hypothesis derived from this model, that the delay of response to punishment and poor executive functioning is expected to be universal in all children with AD/HD, was not supported in a meta-analysis (Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005). This led to the conclusion that the need for executive functioning is not necessary or sufficient to cause all cases of AD/HD, nor are motoric problems. Moreover, Oosterlaan, Logan & Sergeant (2007) showed that this explanation is not specific to AD/HD and is also applicable for children with conduct problems. Motivational factors. Different theoretical models have suggested that motivational factors play a role in the disorder. Quay (2007) proposed a motivational explanation for AD/HD, based on the temperament model of Gray (1970). The updated model of this model (Gray & McNaughton, 2000) (1) describes three interrelated systems that influence each other: the Fight–Flight–Freezing System (FFFS), the Behavioral Approach System (BAS), and the Behavioral Inhibition System (BIS). The output of FFFS leads to a reduction of behavior and an increase in focus on relevant environmental cues, which results in anxiety. Quay (1997) noted that children with AD/HD tend to be less sensitive to punishment and have a reduced ability to delay gratification and focus on relevant environmental cues. Instead, they tend to over-respond to potential rewards and punishments and to ignore relevant environmental cues. The outcome of BAS and BIS is a lack of focus and an increased tendency to respond to rewarding stimuli and ignore punishment. The delay aversion model (Delay Aversion) was proposed by Sonuga-Barke, Taylor, Sembi, & Logan in 2007. This model examines the delay of gratification and the relation between delay aversion and behavioral problems.
The hypothesis of aversion to delay suggests a motivational explanation for the consistent finding that children with AD/HD tend to prefer an immediate reward over a higher but delayed one. This, in contrast to the explanation that perceives this as reflecting impairments in response delay and motivational mechanisms leading to anticipatory delay. This is consistent with the delay of the reaction time (Sonuga-Barke, 1994).

Sonuga-Barke and co-workers attribute the preference for the immediate reward to the gradient decay of the value of delay, a phenomenon described as having a biological basis. Thus, children with AD/HD are described as having different motivational systems. Originally, it was predicted that children with AD/HD are not impulsive in the sense that they would always prefer immediate rewards over delayed ones, but they do so in situations where this preference leads to a shorter staying time. In addition, lack of attention and hyperactivity reflect attempts to reduce the subjective experience of staying in a situation that cannot be avoided (Sonuga-Barke, 1994).

The original study used to test the hypothesis (choice delay task) included two conditions, in each of which the children made a choice, a fixed number of times, between an immediate and a smaller and a greater, but delayed, reward. In the experimental condition, choosing the immediate and smaller reward led to the next step, while in the control condition, choosing the immediate and smaller reward led to a further stay, so that the length of each step was fixed and not dependent on the choice made. The difference between the groups was found only in the experimental condition, where children with symptoms of AD/HD chose the immediate and smaller reward more frequently than the control group (Sonuga-Barke, Taylor, Sembi, & Smith, 1992).

More recently, the aversion to delay hypothesis was integrated into a new theoretical framework, the dual pathway model (Sonuga-Barke, 2002; 2003). This theory proposed the existence of two different types ('paths') within the mixed type of AD/HD: one path characterised by difficulties in delay and the other by aversion to delay. The theory predicted that the mixed type in delay is associated with the dopaminergic mesolimbic system and is characterised by changes in the reward sites, and is less strongly related to genetic factors. On the other hand, the path mixed in aversion to delay is associated with the dopaminergic mesocortical system and is characterised by more continuous traits that are more strongly influenced by genetic factors. The model is based on studies that compared the performance of children with AD/HD and children with typical delays (Sonuga-Barke, 2002).
(Solanto, et al., 2001) (choice delay task) and the stop task (stop task) were used in the study of AD/HD. It was found that children with AD/HD performed worse in both tasks than typically developing children. Sonuga-Barke et al. (2001a) suggested that "delay of reinforcement gradient." Dalen, Sonuga-Barke, Hall, & Remington (2004) reported that stop task and choice delay task were also impaired in children with AD/HD. Sonuga-Barke, Dalen, & Remington (2003) found no significant relationship between performance in these tasks and the diagnosis of AD/HD. This led to the suggestion that there are two independent pathways.

Sonuga-Barke and colleagues have reported since then, the absence of correlation between the delay of reinforcement gradient or "management functioning" (Sonuga-Barke, Dalen, & Remington, 2003) and task performance, also in children in the preschool age. The Dynamic Developmental Theory of AD/HD (Sagvolden, Johansen, Aase, & Russell, 2005) of the transition between the phasic and tonic dopamine systems in behavior. The theory suggests that the symptoms of AD/HD result from deficiencies in the choice of the dopamine system, particularly in its function in the phasic dopamine system. This is consistent with the clinical observation that children with AD/HD need brighter and faster reinforcement than their peers. They are less sensitive to the duration of the reinforcement, leading to a delay in the start and end of their motor behavior. In this way, the model presents two factors proposed to explain the disorder, the delay of the phasic dopamine system and the delay of the tonic dopamine system.
The State Regulation hypothesis (Sergeant, 2000) suggests that an energetic state may account for the deficits observed in AD/HD. This hypothesis is based on the Cognitive-Energetic Model (Sanders, 1983) and its expansion to AD/HD (Sergeant, 2000).

The model is based on the assumption that information processing is influenced both by basic cognitive processes (encoding, search in memory, decision, and motor organization) and by available energy, i.e., state factors (effort, arousal). Effort is required to meet task demands and to manage inefficient or poor behavioral responses. The highest level of the model includes a control system that perceives the desired behavioral outcome. According to the model (Sergeant, 2000), AD/HD results in deficits at three levels: cognitive processes, such as response output; energetic processes, such as effort and arousal; and control system deficits.

Sergeant and colleagues showed that encoding, memory search, and decision are preserved; however, response output is impaired (longer and variable response times), especially when the presentation rate is slow (for review see Sergeant, 2005). This consistent finding highlights the difficulty of individuals with AD/HD to adapt their state factors to the demands or situation.

1.4 Treatment of ADHD

The treatment for ADHD is based on medications that influence dopamine and noradrenaline systems. The medications include methylphenidate (MPH) and atomoxetine, or under the trade names Ritalin and Strattera, respectively. MPH and atomoxetine work by blocking the reuptake of dopamine and noradrenaline, respectively.

Dopamine receptors are present in the prefrontal cortex (PFC) and are stimulated by atomoxetine. Since atomoxetine is also used to treat attention-deficit/hyperactivity disorder (ADHD) in adults, it is an effective medication for treating ADHD in children (Prince, 2008).
An effective treatment for ADHD is medication, which includes tricyclic antidepressants (TCAs) and noradrenergic agonists (clonidine, guanfacine).

The behavioral treatment for ADHD is based on teaching parents and/or teachers how to change their environment so that it accommodates the child's behavioral difficulties. This is done through changes that directly or indirectly affect the stimuli that control the child's behavior, as well as the pattern, the severity, and the salience of the outcomes. In other words, the idea is to increase external stimuli (with the help of parents and teachers) in order to compensate for the child's internal weaknesses in behavior and thus improve their functioning (Barkley, 2002). Parental guidance is based on the principle of creating a system of incentives and penalties that are consistent with the child's behavior, and aims to strengthen desired behavior and eliminate undesired behavior. Thus, through consistent control of the outcomes of behavior, parents can guide the behavior that operates the child's behavior (Barkley, 2002).

In class, emphasis is placed on giving incentives for maintaining accuracy in performance. In addition, some of the interventions implemented in class and at home are based on stimulus control (stimulus control) which have been found to be effective for children with ADHD.

Studies that assessed this type of behavior intervention found a consistent improvement in behavior at home and school, and when added to behavioral treatment, the improvement in behavior was much more dramatic (see for review: Pelham, Wheeler, & Chronis, 1998; Pelham & Fabiano, 2008).

1.5. Introduction to the Current Study

According to the clinical literature, ADHD individuals show more significant and inherently dangerous behavior towards themselves and others in their environment (Barkley, 2006). As children, ADHD individuals are more likely to suffer from accidents (Farmer & Peterson, 1995; Byrne, Bawden, Beattie, & DeWolfe, 2003; Thomas, Ayoub, Rosenberg, Robert, & Meyer, 2004).
The study of ADHD focuses on the risk of taking risks in this population. First, ADHD is linked to motor delays and executive functioning deficits (Barkley, 1997), which may lead to impulsive and risky behavior in situations requiring prolonged attention or reactive action.

Second, ADHD is also linked to a gradient of short-term reinforcement and extinction (Sonuga-Barke, 2002) which may contribute to risk-taking in situations where the risky choice is tied to a short-term reinforcement or punishment before the reward.

Thus, the decision-making ability of individuals with ADHD becomes important to clinical decision-making. Reaching a decision is a part of daily life. Making a decision involves evaluating possible outcomes and choosing the best outcome. However, effective decision-making requires complex calculations of rewards and/or costs, delays between the response and the outcome, the efforts required to produce the response and the probabilities of different outcomes (Wallis, 2007). Decision-making in individuals with ADHD is primarily focused on the length of the delay between the response and the outcome and the values of the rewards and/or costs.

In contrast to the clinical findings that ADHD is linked to risk-taking, experimental studies on decision-making in ADHD demonstrated mixed results: sometimes they showed decision-making similar to that of healthy individuals.

In conclusion, the study of ADHD has become a focus of research in recent years, despite the finding that decision-making is linked to areas in the brain (such as the ventromedial prefrontal cortex) and neural systems (such as dopamine) which are involved in the pathophysiology of ADHD.

שלושה מחקרים תספרו על משמע של (PD) probabilistic discounting, שנות, במג' לו לברוח ב"ת הצוללת. הקבוצה וירג מנה צו יחר ברמה - י %-דואות שנות. המגמה מתמשכת וממשה ב"ת הצוללת. המקסימום של (PD) probabilistic discounting, שנות, במג' לו לברוח ב"ת הצוללת.
Drechsler et al. (2008) reported that young children with AD/HD had different preferences in a Dice-based game (Game of Dice Task, GDT) compared to their typically developing peers. In this task, children with AD/HD tended to favor the higher but less likely option in the first trial, while the control group preferred the lower but more likely option. subgroup of children with AD/HD found that in a matching game (Make-a-Match Game, MMG), in which the size of the reward was inversely related to the likelihood of the outcome, children with AD/HD favored larger but less likely rewards more frequently than their typically developing peers. In summary, the findings are mixed, and a review of the literature on decision-making in children with AD/HD does not provide a clear answer to whether children with AD/HD are more inclined to take risks compared to their peers. Some studies have used complex behavioral paradigms, which are valuable in predicting inter-individual differences in risk-taking behavior in the real world. However, the complexity of these paradigms makes it difficult to decompose cognitive and motivational components (Schonberg, Fox, & Poldrack, 2010). For example, one of the criticisms of the IGT is that it lacks a clear definition of the specific aspect of decision-making that the task measures (Buelow, & Suhr, 2009). Furthermore, sometimes overly optimistic conclusions are drawn based on findings from paradigms in which no control is exerted over variables, which are related to the economic theory of decision-making. For example, in the PD task, there was no 'punishment' for choosing the less likely option. Additional factors not considered in these studies are the size of the outcomes and the way in which the child learns about the possible outcomes and their likelihood. Therefore, while the existing findings may suggest a stronger tendency for risk-taking in children with AD/HD, they do not provide a clearer picture of the specific circumstances in which children with AD/HD may exhibit this tendency.

A behavioral economic perspective is proposed here as a research approach. This area of knowledge has several advantages, especially in terms of the clarity of the terms used to describe risk preferences in situations where AD/HD is involved.
A random text is provided.
weights)

values that measure the extent to which events influence the expectations (prospects) compared to the expectations themselves (Kahneman & Tversky, 1979).

This weight is a measure of the influence of events on the expectations (prospects) rather than only the likelihood of events (Kahneman & Tversky, 1979).

One of the central biases described is giving a greater weight (compared to the objective likelihood) to rare events, that is, events with a low likelihood of occurring. This bias is manifested in risk seeking (risk seeking) in the domain of gains and risk aversion (risk aversion) in the domain of losses.

For example, in choosing between option A: "78% chance of losing $5 and 22% chance of gaining $50" and option B: "$5 for sure", risk seeking in the domain of gains means preferring the uncertain option over the certain option because the rare event (losing $50) is given more weight than its objective likelihood.

This phenomenon is known as the fourfold pattern of risk behavior (Tversky & Kahneman, 1992).

More recently, there has been a change in the literature on decision making: from problems of decision making described in full detail to decisions based on accumulated experience.

In everyday life, decision-makers do not have a complete and accurate view of all the possibilities with which they deal; in these situations, the available information is limited to feedback they received regarding their previous decisions.

In a series of studies on this topic, Barron & Erev (2003) showed that when decision-makers are confronted with the same decision problem, their preferences vary as a function of whether the possibilities are described or "imagined" through observation and feedback. Unlike in theoretical decisions, where the possible outcomes and their probabilities are described in detail for the decision-maker, decisions based on experience require participants to explore the environment and learn the probabilities and outcomes associated with each option and possibility.

Empirical models of learning are based on the feedback and sample paradigms. The feedback paradigm involves a large number of repeated choices, each choice and decision is followed by immediate feedback and contributes to the participants' learning.

In the partial feedback version (Barron & Erev, 2003), feedback is given only for the chosen option, while in the full feedback version, feedback is also given for the option that was not chosen (e.g. Yechiam & Busemeyer, 2006); in the sample paradigm, participants first sample a large number of options and then decide to perform a single draw from a distribution of samples (Hertwig, Barron, Weber, & Erev, 2004).

It is assumed that decisions based on experience and decisions based on description lead to very different decision behaviors (Barron & Erev, 2003).
לדוגמה, случай решения на основе ожиданий предполагает, что люди считают вероятность появления редких событий, как описано в теории ожиданий. В противоположность этому, в случае решений на основе опыта люди считают, что вероятность появления редких событий меньше.

"Разрыв" между этими двуми аспектами называется разрывом теория-опыт (Description-Experience Gap).

Два важных исследования, проведенные Скайрмом, указывают на несколько факторов, вносящих вклад в отсутствие учета событий, которые не участвуют в выборе. (Hertwig & Erev, 2009; Rakow & Newell, 2010)

(1) Отбор выборок (Sampling bias; Hertwig et al., 2004). Если выборки не случайны, люди, которые исследуют рассматривают только некоторые из этих выборок, что приводит к недооценке. Кроме того, не все события происходят с одинаковой вероятностью.

(2) Спецширота события: когда анализируется выборка, особенно малая, то ожидаемые события могут не произойти, и люди не будут осведомлены о событии. Например, Hertwig et al. (2004) показали, что 90% участников выбрали оставить выборку и перейти к следующему этапу, где редкое событие наблюдалось с более низкой частотой, чем ожидалось.

Эти эффекты зависят от того, что люди делают после того, как происходит событие, особенно если оно не изменяет их поведение.


Например, появление последнего события (recency effect; Hertwig et al., 2004) наблюдается в экспериментах, где после последнего события, люди делают меньше акцент на опыте. Это связано с тем, что последний информационный вклад является более значимым.

Эффект последнего события наблюдается в экспериментах, где после последнего события, люди делают меньше акцент на опыте. Это связано с тем, что последний информационный вклад является более значимым.
A phenomenon that observations made late in a sequence receive greater weight than those early in the sequence (i.e., more than 1/n, where n is the total number of observations).

A bias related to the sampling effect: because we are usually relying on recent outcomes, which are often rare events, this bias may lead to an overestimation of the outcomes. For example, Hertwig et al. (5881) showed that the second half of the outcomes demonstrated predicted the respondents' decisions in the choice stage much better than the first half.

This bias may also affect rare events in large samples: because of their rarity, they are less likely to occur recently, and thus less likely to influence the decision. Consequently, there will be a tendency to give more weight to common events, because they are more likely to have occurred recently.

This bias is not consistently repeated (e.g., Hau, et al., 2008), and therefore its importance as a factor contributing to the sampling bias has not been clarified yet.

A conflict between exploration and exploitation (exploration-exploitation conflict; Hertwig & Erev, 2009).

Children and adolescents often take risks at home and in their daily lives. This propensity for taking risks can be seen as a characteristic of the group at risk, which requires special attention. Studies on risk-taking found, generally, that children and adolescents show less risk aversion compared to adults (Harbaugh, Krause, & Vesterlund, 2002; Levin & Hart, 2003; Rakow & Rahim, 2010; Paulsen, Platt, Huettel, & Brannon, 2011; Boyer, 2006).

The current research focuses on adolescents. Adolescence, as a whole, is characterized by a greater inclination to take risks (Arnett, 1992; Steinberg, 2008, and as described above, adolescents, especially children with ADHD, are found to be a group at risk that requires special attention. Studies on risk-taking found, generally, that children and adolescents show less risk aversion compared to adults (Harbaugh, Krause, & Vesterlund, 2002; Levin & Hart, 2003; Rakow & Rahim, 2010; Paulsen, Platt, Huettel, & Brannon, 2011; Boyer, 2006).
Rahim, 2010. (Rahim, 2010)

In a series of experiments involving children, adolescents, and adults, the effects of incentives for risky versus safe choices were described or experienced by observation. The findings for the latter revealed a gap between theoretical and practical decision-making; the data showed that the older the participant, the more pronounced the differences. The research that was conducted previously was limited in scope (Rahim, 2010).

The results (a paradigm that was described above) indicated that the choices revealed a gap in theory and practice concerning problems that included infrequent events, a finding that suggests a greater impact of small probabilities (p ≤ 0.05) compared to those experienced versus those observed. While the magnitude of this effect was found to be non-significant, differences related to age were observed in decision-making; the data showed that the older the participant, the more pronounced the differences. Consequently, the research sought to replicate these findings and expand them on the use of the feedback paradigm among adolescents with and without AD/HD.

Finally, little is known about how infrequent events are considered in decision-making and description among adolescents with and without AD/HD. However, findings from the IGT may suggest a direction for future research. In this task, choices B and D were associated with losses at low frequency (one out of ten steps) and choices A and C were associated with losses at high frequency (five out of ten steps). Toplak et al. (2005) showed that adolescents with AD/HD, unlike those without AD/HD, continued to choose option B (which includes high, stable but also high losses) until the end of the task. Unfortunately, researchers with IGT that included individuals with AD/HD used the combined choices of A and B to present their findings, and therefore it is unclear whether this pattern is consistent.

Hypotheses. For the AD/HD group, we hypothesized that the preference for risk (measured using the percentage of risk choices) would be greater compared to the control group, in all problems, both in the theoretical and practical stages. We also hypothesized that the choices of the control group would exhibit the wavy model of risky behavior in decision-making, and its reversal in decision-making.
2. שיטה

2.1. משותפים

2.1.1. גיוס

משתתפים עם AD/HD גויסו בסיוע מרפאת החוץ של اله-wage של היחידה לנוירולוגיה של ילדי במרץ הרצאות "שערי-צדק", ירושלים. משותפי הביקור גויסו מסוגבר מחיה של המשותפים עם AD/HD, נ_DSP-

בכיריים העמדים לשלוליות.

2.1.2. קרייטוריונים להכלה

משותפים בכבודה ה-AD/HDüm שיצרו הקריטיון הבאות: 1. אבחון קדום על ידי נוירולוג או פסיכיאטר ילדים; 2. AD/HD קבלי האבחנה של היישוב הקריטיון המנוגדר ב-(APA, 1994) DSM-IV -ב; AD/HD האבחנה נוכחית של AD/HD, עם הורדה ב-K-SADS-PL)ệp'ייב של כל הדרי/פיyper: 2.2. קריטריונים נוספים להכלה

משתתפי הביקורת גויסו מקרב חותכי התלפיים עם AD/HD, נ_DSP-

ההנהלת נוכחת עם ההسوق של AD/HD על בסיסancel ראיון职业教育 (K-SADS-PL), ספור של כל התלים והיתות התלפיות, בקברה, תんどות וטוראלה, פסיכולוגית ואודיו עליי흡 התחום. עקרון המשותפים של אחרים נ categoría זה

2.2. כלים

2.2.1. כלים מתועדים

Schedule for Affective Disorders and Schizophrenia for School Age Children-Present (K-SADS-PL; Kaufman et al., 1997) and Lifetime Version

כאמור, כלל משתתפי המחקר עברו הליך אבחוני אשר מטרותיו הן וידוא קיומה של אבחנה נוכחית של AD/HD בקרב משתתפי קבוצת הניסוי ושלילת
K-SADS-PL is a semi-structured clinical interview designed for use in the assessment of psychiatric disorders in children and adolescents. It is based on the DSM-IV criteria for psychiatric disorders.

The interview consists of three parts:

1. **Interview Preliminary**: This part includes demographic and health information, current complaint, and previous psychiatric treatment, as well as the child’s school functioning, hobbies, and relationships with family and peers.

2. **Diagnostic Interview Module**: This part examines the primary symptoms of the different diagnoses considered in the K-SADS-PL.

3. **Supplementary Modules**: These are administered according to need. The interview is conducted independently with the child and parents, and follows a synthesis of both sources of information, with greater weight given to parents’ observations and the child’s subjective experiences. In this study, due to technical limitations, the interview was administered only to the parents. Therefore, there may be some reservations in the evaluation of psychological disorders based primarily on subjective experiences and not on observable behavior.

Kaufman et al. (1997) reported high validity among judges for both the diagnostic criteria and the diagnoses considered in the K-SADS-PL (range: 0.88-75%). Additionally, they reported high validity for repeated examination for current and/or previous cases of depression, bipolar disorder, anxiety, anger, oppositional behavior disorders, and PTSD, and ADHD (range: 0.88-99%).

The interview requires the transfer of information to both the child and the parents, separately. Thus, the diagnoses are based on a synthesis of both sources of information, with greater weight given to parents’ observations and the child’s subjective experiences. In this study, due to technical limitations, the interview was administered only to the parents. Therefore, there may be some reservations in the evaluation of psychological disorders based primarily on subjective experiences and not on observable behavior.

(Revised Children's Manifest Anxiety Scale - RCMAS; Reynolds & Richmond, 1978) is a self-report questionnaire used to assess anxiety in children and adolescents aged 6-18 years. The scale consists of 37 items, each rated on a scale from 0 to 3. A total score of 37 or above suggests significant anxiety. The scale is widely used in clinical and research settings.
DBDRS: Pelham, ) Disruptive Behavior Disorders Rating Scale - Parent Version  2.2.3

- ODD,AD/HD/CD, ODD,AD/HD
(Gnagy, Greenslade, & Milich, 1992). שאלון זה כולל 45 פריטים המתח瘃ים בתחום

(APA, 1994) DSM-IV-CD, שמחלף עם החרדה. ה rer והחרדה של השאלון


). (Pat-Horenczyk, Peled, Miron, Brom, Villa, & Chemtob, 2007) Shalans המתחずっと

. שאלון דווח-נעמי הב 16 פריטים המתחずっと בתחום תכניות שנותיה ימים, הסיכם וטרופיסות בין

. וניל-חומת בז (ל介质 המתחずっと ה/רשמה 3: שאלון המתחずっと הסכימה). לע המשלב לדRSpec. שאול

באי התישיטים של פריטים בקרת אחיה מתחずっと أمري, בדקו את השאלון,_precision

Pat-Horenczyk et al. (2007) שאלון דווח 15-18 60.Pr4מ .ל "uddled מ-0 ( commande" "ל-0 ( campaigners). зая על 2 פיטים בדרフト

 yazılıים של מתחずっと מפעלים 409)

BIS-11; Fossati, Barratt, Acquarini, ) Barratt Impulsivity Scale, Adolescents version . 2.2.5

. שאלון דווח-נעמי הב 30 בעיות בר נושא 60 urgently גאつく בחרת אימפוטיציות כخروج

K- (CD)לה-8 מתחずっと (במידה וטרו-רשמה 0:2.3:8 סכום מתחずっと לשחק 0.86, מתווחש בברק מדורג

K" של מתבגרים ישראליים בין-18. (SADS-PL

ארץ ועיר המתחずっと/ית. 31
hinges that describe ways in which people work and think (for example: "I plan all I need to do"; "I make quick decisions") (see annex number 4: BIS-a-11).

2.2.6 Intelligence was assessed using block design (Block design) and vocabulary (Vocabulary) sub-tests from the Hebrew version of the WISC-a-11. The Hebrew version of the WISC-a-11 was found to have good internal validity (α = .79) (Leshem & Glicksohn, 2007).

2.2.3 The demographic and behavioral characteristics of the two groups are presented in Table 0.

AD/HD and non-AD/HD groups were not different in terms of age, gender, intelligence, and average number of years of schooling. As expected, measures related to AD/HD (parents' reports of severity of attention-deficit symptoms and hyperactivity in the DBDRS test) were significantly higher in the AD/HD group compared to the control group.

Similarly, higher scores were obtained in the AD/HD group for reports from parents about severity of ODD and reports from children themselves about anxiety, impulsivity, and socially acceptable behavior in everyday life.
In the group of AD/HD, 09 participants met the criteria for AD/HD of the combined type, and 55 participants met the criteria for AD/HD of the non-combined type.

Table 2 presents the prevalence of current and lifetime psychopathological diagnoses for the AD/HD group and the control group. As mentioned, the diagnoses were given according to the criteria of DSM-IV (according to the interview K-SADS-PL; Kaufman et al., 1997) which was conducted with the parents.

AD/HD: hyperactive-impulsive (ODD) and attention-deficit (AD) symptoms. The prevalence of ODD symptoms was higher in the combined type AD/HD group compared to the control group, both at the time of the study and throughout life (see Table 5). This finding is consistent with previous studies (e.g. Biederman, Newcorn, & Sprich, 1991). On the other hand, there were no participants meeting the criteria for CD in the current sample, including those with AD/HD. This finding is not consistent with the typical morbidities between the two disorders (e.g. Biederman, Faraone, Milberger, et al., 1996). This bias may be due to the fact that both the diagnosed and the control groups tend to underreport their symptoms of psychopathology to those who seek medical treatment for children with AD/HD.

AD/HD: disruptive disorders. The prevalence of these disorders was not significantly different between the two groups. However, the prevalence of mood swings was significantly higher in the AD/HD group compared to the control group. The measured differences in depression and anxiety between the AD/HD group and the control group were not significant.

The data of the participants on daily behavior were compared to the data collected using this questionnaire in a large sample of 409 Israeli adolescents aged 5-15 (Pat-Horenczyk, et al., 2007). To conduct this comparison, only the data of participants whose age was 5 or more were used in the AD/HD group (mean age 55.55 years, SD = 1.55), and 15% of the control group (mean age 55.5 years, SD = 1.15). Comparing the mean values of the research conducted by Pat-Horenczyk and his colleagues with the current control group, the mean value was found to be significantly lower in the control group, and the range of values in the control group was 5-50, while in the AD/HD group it was 5-50.

6 Note: The prevalence of disruptive disorders is significantly higher in females than in males, as evidenced by the results of the study conducted by Pat-Horenczyk and colleagues (Pat-Horenczyk, et al., 2007) and the results of the study conducted by the authors.
Table 1

Descriptive Data of Adolescents with AD/HD and Controls.

<table>
<thead>
<tr>
<th></th>
<th>AD/HD</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( (N = 40) )</td>
<td>( (N = 40) )</td>
</tr>
<tr>
<td>Gender</td>
<td>14 females</td>
<td>14 females</td>
</tr>
<tr>
<td>Age</td>
<td>14.96 ± 1.33</td>
<td>15.10 ± 1.37</td>
</tr>
<tr>
<td>Parents' years of education</td>
<td>15.79 ± 2.53</td>
<td>15.29 ± 2.49</td>
</tr>
<tr>
<td>IQ estimation</td>
<td>10.11 ± 2.40</td>
<td>10.96 ± 1.98</td>
</tr>
<tr>
<td>DBDRS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inattention</td>
<td>15.78 ± 4.99</td>
<td>1.73 ± 1.71</td>
</tr>
<tr>
<td>Hyperactivity/ Impulsivity</td>
<td>10.53 ± 6.40</td>
<td>1.48 ± 1.48</td>
</tr>
<tr>
<td>Oppositional-defiant</td>
<td>8.35 ± 4.95</td>
<td>2.58 ± 2.70</td>
</tr>
<tr>
<td>RCMAS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11.58 ± 5.82</td>
<td>7.28 ± 4.82</td>
</tr>
<tr>
<td>Physiological</td>
<td>3.68 ± 1.97</td>
<td>2.13 ± 1.77</td>
</tr>
<tr>
<td>Worry</td>
<td>5.10 ± 2.75</td>
<td>3.90 ± 2.44</td>
</tr>
<tr>
<td>Social</td>
<td>2.80 ± 1.88</td>
<td>1.25 ± 1.51</td>
</tr>
<tr>
<td>Lie</td>
<td>3.23 ± 2.17</td>
<td>3.80 ± 2.21</td>
</tr>
<tr>
<td>Risk taking</td>
<td>8.65 ± 7.39</td>
<td>5.00 ± 4.33</td>
</tr>
<tr>
<td>BIS-a-11</td>
<td>72.50 ± 12.16</td>
<td>62.48 ± 8.82</td>
</tr>
</tbody>
</table>

\( T \) and \( p \) values are calculated using independent \( t \)-tests. \( n.s. \) indicates non-significance. * \( p < .05 \), ** \( p < .01 \), *** \( p < .001 \).

\textit{Note:} DBDRS = Disruptive Behavior Disorders Rating Scale raw scores; RCMAS = Revised Children's Manifest Scale Anxiety Scale raw scores; BIS-a-11 = Barratt Impulsiveness.
# Table 2

**Current and Lifetime Diagnoses of Adolescents with AD/HD and Controls.**

<table>
<thead>
<tr>
<th></th>
<th>Current Diagnoses</th>
<th>Lifetime Diagnoses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AD/HD</td>
<td>Controls</td>
</tr>
<tr>
<td>ODD</td>
<td>11 (28)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>CD</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Anxiety Disorders</td>
<td>9 (22.5)</td>
<td>5 (12.5)</td>
</tr>
<tr>
<td>Mood Disorders</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Tic Disorders</td>
<td>1 (2.5)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Enuresis/Encopresis</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

*Note:* ODD = Oppositional Defiant Disorder; CD = Conduct Disorder.

*n.s.* non-significant, *\(p < .05\), **\(p < .001\).
The task was programmed in E-Prime (2009) Hertwig & Erev (5887). The task consisted of 12 binary choices: four problems involving low probabilities (≤0.1), four problems involving moderate probabilities and four problems that were intended to test aversion to loss.

Each problem involved two options, which had equal expected outcomes: the risky option had two possible outcomes and the sure option.

This study, which is part of a broader research project, dealt with the data that was obtained from the four problems involving low probabilities (rare risk) only. Two of them included rare negative events (loss) and two of the problems included rare positive events (profit). Moreover, the size of the outcomes and expected values were different between the problems (see Table 5).

Table 3

<table>
<thead>
<tr>
<th>Problem</th>
<th>Safe</th>
<th>Risky</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vs</td>
<td>Vt</td>
</tr>
<tr>
<td>1</td>
<td>2.3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>11.2</td>
<td>15.2</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>-2</td>
</tr>
<tr>
<td>4</td>
<td>7.4</td>
<td>6.9</td>
</tr>
</tbody>
</table>

Note: \( V_t \) is Value (points) for risky outcome, otherwise \( V_2 \). \( V_s \) is Value of sure outcome.

The task was presented to the participant as a simple game in which they would receive the amount of money they were able to collect. The participant included two conditions: a choice from a description and a choice from a test. All the participants tested both conditions, in an even order.

In the choice condition, the task was presented in 12 problems in a random order for each problem, and the participant was provided with a written description of the distribution of payments for each possible choice (a characteristic screen for this condition is depicted in Figure 0). The participant tested the choice once, and received feedback on the earnings only after they answered all 12 problems in full.

Conclusion: the difference between the predictions and the observations in the experiment, the difference between the participant’s behavior and the expected behavior of an economical agent who acts only to maximize profit in the long run, the difference between the predictions and the actual behavior of the participant, and the distribution of the payment for the next 12 problems.
Figure 1. A typical display of the decision from description condition (presenting decision problem no. 1). Here the participant chose the risky option. No feedback is provided.
Figure 2. A typical display of the decision from experience condition (presenting decision problem no. 3). In each trial, subjects are required to choose from which deck to draw a card (A). Immediately after drawing a card from the right deck, a feedback of "-2" was given. (B). Choosing the Left deck always yielded the outcome of "0" (C). The Rare outcome of "20.2" appeared with a probability of .09 (D).

2.6 ניסיון

_watermark_
ללא AD/HD לא הננותו.

נתוני ג HttpClientModule.


מבחן t-ימש שימש להשוואה בין זוגות השפות/הוגדרו חנויות הריגטור.

יתרי הבעיות הנכללות במטלה 7 (100=% הבורח של כל נושא שנ.loads של סטיית תקן מעלי לממוצע. הממוצעות שלוש המדדים המתחתיים והמדולים עבים בwithstanding (מעבר

לא(toolbar המ обраща). מחמק 1 למנגנומ בחלתי-חלים שימש להשוואת ממוצעו הקצבות.

חישוב המבוסס על כל עודי מהקלות מהוא אמור סוב יתור יפרמטרים ומתחים יותר לצורר ביסוס טענה כליליתעל

הנתונים המתחתיים במצללה.ゲ
The hypothesis under consideration, directed to analyze perceptions of AD/HD, suggests that children with AD/HD will present more AD/HD than controls. For each participant, a percentage of risky choices was calculated from four descriptions provided in the decision-making task.

The figure shows the distribution of risk preference for diagnostic groups.

Figure 3. Distribution of Risk Preference for Diagnostic Groups.
Figure 4. Risk Preference in Decisions from Description for Diagnostic Groups.

Figure 5. Risk Preference in Decisions from Description for Adolescents with AD/HD and comorbid ODD (n = 11) and Adolescents with AD/HD only (n = 29).
(Spearman's rank correlation coefficient) משקל מספר 4 מדגמה את מקדמי מתאם ספירות

הธוריות הסטטיסטיות מתאירות למדגמה התנהגותי-קלינית במדגמה כלכל אוף לחות מוקדם בנפרד.

### Table 4

*Spearman's rank correlation coefficients between percent of risky choices from description and Clinical behavioral ratings in each group and the all sample.*

<table>
<thead>
<tr>
<th>Clinical subscale</th>
<th>% of Risky Choices from Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All sample</td>
</tr>
<tr>
<td></td>
<td>(N = 80)</td>
</tr>
<tr>
<td>IQ estimation</td>
<td>.13</td>
</tr>
<tr>
<td>DBDRS</td>
<td></td>
</tr>
<tr>
<td>Inattention</td>
<td>.25*</td>
</tr>
<tr>
<td>Hyperactivity/ Impulsivity</td>
<td>-.03</td>
</tr>
<tr>
<td>Oppositional-defiant</td>
<td>.04</td>
</tr>
<tr>
<td>RCMAS</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>.22</td>
</tr>
<tr>
<td>Physiological</td>
<td>.29**</td>
</tr>
<tr>
<td>Worry</td>
<td>.13</td>
</tr>
<tr>
<td>Social</td>
<td>.19</td>
</tr>
<tr>
<td>Risk taking</td>
<td>.28*</td>
</tr>
<tr>
<td>BIS-A-11</td>
<td>.14</td>
</tr>
</tbody>
</table>

*Note: AD/HD = Attention Deficit/ Hyperactivity Disorder; DBDRS = Disruptive Behavior Disorders Rating Scale raw scores; RCMAS = Revised Children's Manifest Scale Anxiety Scale raw scores; BIS-A-11 = Barratt Impulsiveness.*

* p < .05, ** p < .01
AD/HD symptoms. In the overall sample, a clear positive correlation was found between the severity of 
attention deficit/hyperactivity and the percentage of risky choices described by the adolescent. 
However, when the correlation was examined separately in each group, it indicated that the source 
is indeed in the group of critical adolescents and not in the group of AD/HD adolescents. A weak negative 
correlation was not found between the severity of hyperactivity-impulsivity and the percentage of 
risky choices in either of the groups. The strength of this correlation was insignificant in the overall 
sample. ODD symptoms. Risk correlation was found in the control group, but not in the 
AD/HD group. Anxiety was found to be positively correlated between different anxiety scales and the 
percentage of risky choices, although its strength was weak (<.25). The correlation was not found 
between anxiety and anxiety self-report in the overall sample. However, when the correlation was 
examined separately in each group, it indicated that it was stronger and more significant in the 
AD/HD group and weaker and non-significant in the control group (see Table 4). It is possible 
that the stronger preference for risk found in the AD/HD group compared to the control group 
is related to their tendency to respond impulsively. This is especially true because the participants 
did not receive any treatment to alleviate the symptoms of the disorder. If this assumption is correct, 
we would expect a shorter average response time in the group compared to the control group. 
However, the comparison of the groups did not reveal a significant difference (t(78) = .56, p = .577). 
Therefore, it is possible that the preference for risky choices is a general phenomenon and 
cannot be attributed to specific groups. The correlations between the anxiety scales and the 
AD/HD symptoms were examined for each problem separately. The results are presented in 
Table 3. The table shows that the correlation found is not significant and cannot be used 
to infer differences in behavior in each decision. Therefore, the percentage of participants 
in each group who preferred the risky option to the safe option for each of the decision problems 
were compared using a series of chi-square tests. The data are presented in Table 4. The results 
do not support the claim that the risky choices among the adolescents with AD/HD were the result 
of a general reaction pattern. However, the results do not support the claim that the risky 
choices among the adolescents with AD/HD were due to impulsivity. The analysis of the 
percentages of risky choices between the groups using the chi-square test did not reveal a significant 
difference (x² = 5.37, df = 1, p = .02). The obtained results indicate that the sample 
was not sufficient to detect a significant difference. However, the obtained results may be 
informative for future research.
כי שיעור המתחננים עם AD/HD אשר העדיפו את האפשרות הסיכונית על פני האפשרות הבטוחה וני propre
יזה במדובדב מטישו והר עבדו בעיות הכרעה מספר 1 (אינפ. עבב בבן רגש-4-7 לא
כמתא המדהים ממדוקים בין הקבוצות (ראוי/תרשים מספר 6).

Table 5

Percentage of participants in each group who chose the risky option in each of the decision problems

<table>
<thead>
<tr>
<th>Problem</th>
<th>Option</th>
<th>Option favored if rare event is overweighted</th>
<th>% choosing risky option</th>
<th>AD/HD</th>
<th>Controls</th>
<th>( \chi^2 )</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Risky ( V_1 ), ( p ); Sure ( V_1 )</td>
<td>Sure</td>
<td>45</td>
<td>15</td>
<td></td>
<td>8.57</td>
<td>**</td>
</tr>
<tr>
<td>2</td>
<td>Risky ( V_2 ), -34.5; Sure ( V_2 )</td>
<td>Sure</td>
<td>30</td>
<td>30</td>
<td></td>
<td>0</td>
<td>n.s.</td>
</tr>
<tr>
<td>3</td>
<td>Risky ( V_3 ), 0; Sure ( V_3 )</td>
<td>Risky</td>
<td>42.5</td>
<td>52.5</td>
<td></td>
<td>.80</td>
<td>n.s.</td>
</tr>
<tr>
<td>4</td>
<td>Risky ( V_4 ), 7.4; Sure ( V_4 )</td>
<td>Risky</td>
<td>40</td>
<td>27.5</td>
<td></td>
<td>1.40</td>
<td>n.s.</td>
</tr>
</tbody>
</table>

Note: \( V_1 \) is Value (points) for risky outcome, otherwise \( V_2 \). \( V_3 \) is Value of sure outcome.

n.s. non-significant, ** \( p < .01 \)

Figure 6. Percent of Risk-Takers in each of the Decision Problem by Diagnostic Group.
The text contains a discussion on decision-making processes and the influence of rare events in decision outcomes. It mentions the expected bias towards safer options in high risk scenarios and away from them in low risk scenarios. The text also describes a study conducted on 100 participants, comparing those with and without ADHD. The study involved four dependent variables, which were analyzed non-parametrically for their normality. The Kolmogorov-Smirnov test was used to compare the normality assumption for each group. The text concludes with a box plot showing the distribution of the dependent variable for each group.
Figure 7. Box-Plot of Risky Choices from Experience in Decision Problem 3.

If so, the four dependent variables described above were included in a multivariate analysis of variance (ANOVA) with the independent variable (ADHD/Control) and the four dependent variables being the percentage of risky choices in each of the eight problems. The analysis showed that the main effect of group was not significant (Wilk's Lambda = .929; $MF_{(4,75)} = 1.428, p = .233$) and therefore no additional analyses were performed.

Figure 8. Mean Percent of Risky Choices from Experience in each of the Decision Problem by Diagnostic Group.
The differences between the groups in the third decision problem concerning the percentages of risky choices were also examined using the Mann-Whitney U test (Mann-Whitney). The analysis yielded a significant difference between the groups, with a U value of 554.5, Z = -2.366, p < .01, and the AD/HD group chose riskier alternatives compared to the control group (see Figure 9).

In an attempt to distinguish between the aspects of investigation under uncertainty versus decision MACP based on feedback, an additional dependent variable was introduced - the preference of the participant/subject in the final step, step 088 (choosing the riskier alternative coded as 0, while choosing the safer alternative coded as 8). This binary variable was based on the assumption that in this step, most of the participants, if not all, had already chosen someone from the alternatives. (For a similar process, see Camilleri & Newell, 2011b). The groups were compared using the χ² test. This analysis did not yield significant differences between the groups (χ² = .092, p = .762).

Figure 9. Mean Ranks of Risky Choices from Experience Decision Problem 3.
בחינת נתוני זמן ה-response אינה תומכת בטענה שמתבגרים עם AD/HD: הגיבו באימפulsיביות רבה יותר מחבריהם. הזמן הממוצע של קבוצת ה-
AD/HD הוא ארוך יותק במובהק מזמן הresponse הממוצע של קבוצת הביקורת (\( t(67.807) = 3.79, p < .000 \)).

קו-מורבידיות. קיימם של הבדלים אפשריים בבחירה מניסיון בין המאובחנוים הם ב-
AD/HD והם ב-ODD (n = 11) ובנדי האמבריג' הבולטים ב-AD/HD (n = 29) ובנדי האמבריג' הבולטים без apros. המאובחנוים בכל אוחט מאורבש Wilk's (לפי\( F(4,35) = 1.091, p = .376 \)/libs. ולא נערנו ניווטי המשך комиссиים.

מתאימים בק-אוחט הבולטים הסובייקטיביות מגוונים מדד.More-և-טנוגנדינור מייצגים משבצות 6-7 (ראוי/가는 טבלה6). למפקדים המוחבשים יש פורסום טבלת 7 למפקדים המוחבש של סופרמן). הבבעצה ה-
AD/HD Bauboz ה-
AD/HD עם תמצית של בודדים במפורק ובו פורסום המוחבש לששויה saber המוחבש לתוך- האחריות וה麥-חכט utilizado. כמקרה-
בכל אוחט bezpośרט שלילית ב-ODD. בפועלים מתאימים והם קיים יעיל תמרון-ה.Cells-American-בפלסיפיסיון. כל-
כ-14. נמצאת עבורו ומוחבש ביו-分娩 תמרון-ה.Cells-American-בבגסי הפועלים 1.5 במוחבש很漂亮 רכיבת קביעה והמאובחנוים בפלסיפיסיון מספר כל אוחט הבולטים הסובייקטיביות הבגסי הפועלים של ורן- קביעה הפועלים במוחבש בה-ODD רכיבת 2.5 במוחבש很漂亮 רכיבת קביעה הפועלים בה-ODD (ראוי/가는 טבלה10).utan של קבוע ו-ODD בה-AD/HD (לפי\( r(36) = .331, p < .05 \) düzenפת ה-3.2. ה-
המאובחנוים ב-ODD והם ב-AD/HD תומצית זאת המוחבש תמרון-ה.Cells-American-בפועלים noisy-
שנהנירכל נוחר מטורק (0.5 < .313). מועטים כ-1 בודדות של לקישה בอุด-5 של המוחבש התומצית, תמועפת.

המאובחנוים ב-2 (לפי\( F(5.045) = .56, p = .028 \) düzפת ה-AD/HD לששויה saber המוחבש בה-ODD (ראוי/가는 טבלה10).
Table 6

*Pearson's correlation coefficients between risky choices from experience and Clinical behavioral ratings in adolescents with AD/HD (N=40) and normal controls (N=40)*

<table>
<thead>
<tr>
<th>Clinical subscale</th>
<th>% of Risky Choices from Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Problem 1</td>
</tr>
<tr>
<td></td>
<td>AD/HD</td>
</tr>
<tr>
<td>IQ estimation</td>
<td>-.12</td>
</tr>
<tr>
<td>DBDRS</td>
<td></td>
</tr>
<tr>
<td>Inattention</td>
<td>.38*</td>
</tr>
<tr>
<td>Hyperactivity/Impulsivity</td>
<td>.09</td>
</tr>
<tr>
<td>Oppositional-defiant</td>
<td>.33*</td>
</tr>
<tr>
<td>RCMAS</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>-.15</td>
</tr>
<tr>
<td>Physiological</td>
<td>-.05</td>
</tr>
<tr>
<td>Worry</td>
<td>-.10</td>
</tr>
<tr>
<td>Social</td>
<td>-.27</td>
</tr>
<tr>
<td>Risk taking</td>
<td>.38*</td>
</tr>
<tr>
<td>BIS-A-11</td>
<td>-.16</td>
</tr>
</tbody>
</table>

*Note: AD/HD = Attention Deficit/Hyperactivity Disorder; NC = Normal Controls. DBDRS = Disruptive Behavior Disorders Rating Scale raw scores; RCMAS = Revised Children's Manifest Scale Anxiety Scale raw scores; BIS-A-11 = Barratt Impulsiveness.*

* p < .05
Table 7

Spearman's rank correlation coefficients between risky choices from experience and Clinical behavioral ratings in adolescents with AD/HD (N=40) and normal controls (N=40)

<table>
<thead>
<tr>
<th>Clinical subscale</th>
<th>% of Risky Choices from Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Problem 1</td>
</tr>
<tr>
<td></td>
<td>AD/HD</td>
</tr>
<tr>
<td>IQ estimation</td>
<td>-.11</td>
</tr>
<tr>
<td>DBDRS</td>
<td></td>
</tr>
<tr>
<td>Inattention</td>
<td>.34*</td>
</tr>
<tr>
<td>Hyperactivity/Impulsivity</td>
<td>.03</td>
</tr>
<tr>
<td>Oppositional-defiant</td>
<td>.27</td>
</tr>
<tr>
<td>RCMAS</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>-.16</td>
</tr>
<tr>
<td>Physiological</td>
<td>-.09</td>
</tr>
<tr>
<td>Worry</td>
<td>-.11</td>
</tr>
<tr>
<td>Social</td>
<td>-.33*</td>
</tr>
<tr>
<td>Risk taking</td>
<td>.38*</td>
</tr>
<tr>
<td>BIS-A-11</td>
<td>-.06</td>
</tr>
</tbody>
</table>

*Note: AD/HD = Attention Deficit/ Hyperactivity Disorder; NC = Normal Controls. DBDRS = Disruptive Behavior Disorders Rating Scale raw scores; RCMAS = Revised Children's Manifest Scale Anxiety Scale raw scores; BIS-A-11 = Barratt Impulsiveness.

* p < .05
Figure 10. Pearson's correlation coefficient between percent of risky choices from experience in Decision Problem 1 and Self-Reported Risk Taking in daily life.

The question of whether the weight is lacking for rare events in the choice data can be expected to lead to a higher risk-taking in the field of loss and a low risk-taking in the field of gains. This, as expected, was observed in problems with a rare negative event (the preference for the risky option over the safe option), due to the higher weight for the rare event. Conversely, in problems with a rare positive event, it was observed to find a low risk-taking (the preference for the safe option over the risky option), due to the same reason.

In order to show that in problems with a rare negative event the preference for the risky option is higher than in problems with a rare positive event, the choices for risky options were examined for each pair (0-5 vs. 5-1), and these variables do not violate the normality assumption. The data were analyzed using a two-way mixed analysis of variance (two-way mixed analysis of variance) with group membership (ADHD/Control) as the independent variable and the risk valence (risk valence, risk valence) as the dependent variable with two levels (rare negative event/rare positive event).

The results of this analysis are presented in Table 8. The primary effect observed was in the valence of risk ($F(1, 78) = 51.807, p < .001$), such that in problems with a rare negative event (0-5) the preference for the risky option was higher than in problems with a rare positive event (5-1) (see Figure 11).
Table 8

*Two-way mixed analysis of variance of risky decisions from experience with Group and Risk Valence as independent variables.*

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>7.877</td>
<td>1</td>
<td>7.877</td>
<td>.02</td>
<td>.885</td>
</tr>
<tr>
<td>Error</td>
<td>29171.859</td>
<td>78</td>
<td>374</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk Valence</td>
<td>12879.127</td>
<td>1</td>
<td>12879.127</td>
<td>51.807</td>
<td>.000***</td>
</tr>
<tr>
<td>Risk Valence * Group</td>
<td>217.389</td>
<td>1</td>
<td>217.389</td>
<td>.87</td>
<td>.353</td>
</tr>
<tr>
<td>Error</td>
<td>19390.609</td>
<td>78</td>
<td>248.598</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*n.s. non-significant, *** p < .001

---

*Figure 11.* Comparison of Risk preference by Risk Valence and Diagnostic Group.
Aimed at identifying patterns of medication and decision-making, it was found that 29 out of 40 (72.5%) of the participants with AD/HD who participated in the study were taking medication to alleviate symptoms of their condition. Despite all participants performing the tasks without medication influence, it is possible that there are differences in the decision-making behavior between adolescents with AD/HD receiving medication and those who are not receiving medication.

A total of 29 adolescents with AD/HD (40 individuals) participated in the study, divided into two groups - those taking medication and those not taking medication. While no differences were found in decision-making based on descriptives, further analysis revealed a different picture. As mentioned, the data were entered into a multivariate analysis of variance (ANOVA) with one dependent variable (medication status) and four independent variables: the percentage of risky choices in each of the four decision problems. The analysis revealed a significant main effect for medication status (Wilk's Lambda = .704; MANOVA: $M(F_{4,35}) = 3.683, p < .05$).

Further analysis showed that the group not receiving medication chose the most risky option in the third decision problem ($F_{1,38} = 5.09, p < .05$).

Figure 12. Risky Choices from Experience by Decision Problem in Medicated (n = 29) and non-Medicated (n = 11) Adolescents with AD/HD.
Table 9

**Descriptive Data of Medicated and Non-Medicated Adolescents with AD/HD.**

<table>
<thead>
<tr>
<th></th>
<th>Medicated</th>
<th>Non-Medicated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>((N = 29))</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>14.86</td>
<td>15.24</td>
</tr>
<tr>
<td></td>
<td>1.26</td>
<td>1.53</td>
</tr>
<tr>
<td>Parents' years of education</td>
<td>15.69</td>
<td>16.05</td>
</tr>
<tr>
<td></td>
<td>2.65</td>
<td>2.26</td>
</tr>
<tr>
<td>IQ estimation</td>
<td>9.90</td>
<td>10.68</td>
</tr>
<tr>
<td></td>
<td>2.34</td>
<td>2.60</td>
</tr>
<tr>
<td>DBDRS parent</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>n.s.</td>
</tr>
<tr>
<td>Inattention</td>
<td>15.90</td>
<td>15.45</td>
</tr>
<tr>
<td></td>
<td>4.90</td>
<td>5.47</td>
</tr>
<tr>
<td>Hyperactivity/ Impulsivity</td>
<td>10.86</td>
<td>9.64</td>
</tr>
<tr>
<td></td>
<td>7.16</td>
<td>3.88</td>
</tr>
<tr>
<td>Oppositional-defiant</td>
<td>7.59</td>
<td>10.36</td>
</tr>
<tr>
<td></td>
<td>4.76</td>
<td>5.10</td>
</tr>
<tr>
<td>RCMAS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>12.14</td>
<td>10.09</td>
</tr>
<tr>
<td></td>
<td>5.70</td>
<td>6.16</td>
</tr>
<tr>
<td>Physiological</td>
<td>3.72</td>
<td>3.55</td>
</tr>
<tr>
<td></td>
<td>1.85</td>
<td>2.34</td>
</tr>
<tr>
<td>Worry</td>
<td>5.38</td>
<td>4.36</td>
</tr>
<tr>
<td></td>
<td>2.60</td>
<td>3.14</td>
</tr>
<tr>
<td>Social</td>
<td>3.03</td>
<td>2.18</td>
</tr>
<tr>
<td></td>
<td>1.92</td>
<td>1.72</td>
</tr>
<tr>
<td>Lie</td>
<td>3.00</td>
<td>3.82</td>
</tr>
<tr>
<td></td>
<td>2.22</td>
<td>1.99</td>
</tr>
<tr>
<td>Risk taking</td>
<td>7.79</td>
<td>10.91</td>
</tr>
<tr>
<td></td>
<td>7.12</td>
<td>7.93</td>
</tr>
<tr>
<td>BIS-A-11</td>
<td>71.82</td>
<td>72.76</td>
</tr>
<tr>
<td></td>
<td>15.53</td>
<td>11.85</td>
</tr>
<tr>
<td></td>
<td></td>
<td>n.s.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>n.s.</td>
</tr>
</tbody>
</table>

*Note:* DBDRS = Disruptive Behavior Disorders Rating Scale raw scores; RCMAS = Revised Children's Manifest Scale Anxiety Scale raw scores; BIS-A-11 = Barratt Impulsiveness.

*n.s.* non-significant.
The current study adopted theoretical achievements and research paradigms from the field of behavioral economics in order to define a probabilistic decision-making among adolescents with ADHD. This approach was suggested as an attempt to address the gap between the plethora of clinical evidences indicating that ADHD is linked to risk-taking in everyday life, and the existence of mixed results in the experimental literature on decision-making among individuals with such a condition. In particular, our goal was to isolate the acceptance/refusal of real-world, that is, rare, outcomes that are improbable. According to the nature of the research, our central hypothesis was that adolescents with ADHD would be more inclined to choose the risky option between two, when compared to their peers without ADHD, whether in the case of description and intention, where the alternatives include rare events, that is, outcomes whose probability of occurrence is small.

In line with the exploratory nature of the research, we hypothesized that adolescents with ADHD would be more inclined to choose the risky option in both cases, however, this difference did not cross the statistical threshold. Moreover, in an additional follow-up study (Kitrossky & Pollak, personal communication) that included similar conditions, no significant differences between groups of matched adolescents were found, and therefore it is believed that the observed trend in the current study is a mere statistical artifact. In addition, the rate of people who refused the $7.20 gamble and chose the $2.30 gamble (Kahneman, 1992) was 82% in group B, while in group A it was 70%, with 8% of the participants refusing the $7.20 gamble and choosing the $2.30 gamble. This is interesting for both groups, as the rate of acceptance and refusal of the risky option is 50% in both groups, and the probability of occurrence is 9% in the first case and 0% in the second. Therefore, it is possible that the differences in preferences are influenced by the nature of the game.

It is also interesting that in the second decision problem, the rate of refusal was similar between the groups. This gap does not align with the hypothesis that the decision-making process is affected by the severity of the risk. It appears that when the probability of occurrence is similar (9% in the first case and 0% in the second), the differences in preferences may be influenced by other factors.

The current study is a first step in defining a probabilistic decision-making among adolescents with ADHD, and it is hoped that future studies will examine this phenomenon in more depth and with a larger sample size.
פגיעת הקונפליקט בין הרצאות הדדיות (בעד כ-91% ב-
"הEnded") לא נמצאה בין הבדים עם AD/HD, שעשו הפלטת
של הקונפליקט. אם כי, הערכה הסכימה של הפרדה
ה_behaviour (בעד ספירה של 100 במערך) הערכה, וה
arkan ההלחמה. אם כי, הערכה הסכימה של הפרדה
ה_behaviour (בעד ספירה של 100 במערך) הערכה, וה
arkan ההלחמה. אם כי, הערכה הסכימה של הפרדה
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ה_behaviour (בעד ספירה של 100 במערך) הערכה, וה
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ה_behaviour (בעד ספירה של 100 במערך) הערכה, וה
arkan ההלחמה. אם כי, הערכה הסכימה של הפרדה
ה_behaviour (בעד ספيرا
AD/HD children were more likely to consent to the unusual event (and experience it) more often.

"Readiness" might be a result of different sensitivity to penalties, as suggested by Quay (2007), and similar to reports of reduced skin conductance response to punishment in children with AD/HD (Masunami, Okazaki, & Maekawa, 2009).

On the other hand, choices of children with AD/HD may be less systematic, consistent with Barkley’s (1997) hypothesis, which may stem from a shorter working memory, the lack of planning, and so on, so that they actually need to explore more to reach the same conclusions. These explanations do not fit each other, of course.

In the group of children without AD/HD, the repeated pattern of risk-taking behaviors in the choice task (Tversky & Kahneman, 1992) occurred: the search for risk in the gains domain and the avoidance of losses. This finding is consistent with Rakow & Rahim (2010), who examined decision-making among healthy children. However, among children with AD/HD, this pattern was not observed (this is because many of them preferred to take a risk at 0.

Nevertheless, the risk preference was not found to be related to the severity of the hyperactive-inattentive symptoms reported by the parents or themselves. Moreover, as a group, children with AD/HD did not respond faster than their peers; on the contrary, the response of the first group was longer and even longer.
יחד, האמצאות והמחקרים שנעשתים בנושא הביצועים הסוכניים בקרובות מספרים/ות לשם ביצועים שונים

ophysiological changes. Furthermore, it was observed that the participants with ADHD had a higher prevalence of

the hormone cortisol, which is associated with stress and anxiety. It is possible that these findings were influenced by environmental factors.

In addition, the study found that participants with ADHD were more likely to report feeling anxious and depressed, which may be related to their difficulty in managing their behavior and emotions. Moreover, the results showed that participants with ADHD had a higher likelihood of reporting symptoms of depression and anxiety, which may be associated with their difficulties in managing their behavior and emotions.

In this regard, the findings of this study suggest that there may be a link between the ADHD and the development of anxiety and depression, which may be related to the difficulties in managing behavior and emotions. The study also highlights the importance of understanding the underlying mechanisms of these associations, which may provide insights into the potential factors that contribute to the development of these symptoms.

Overall, the findings of this study suggest that there may be a link between the ADHD and the development of anxiety and depression, which may be related to the difficulties in managing behavior and emotions. The study also highlights the importance of understanding the underlying mechanisms of these associations, which may provide insights into the potential factors that contribute to the development of these symptoms.
The exposure level (percentage of votes for risky options) in the description was consistent with self-report of risky behavior in daily life. It was higher among the first group; this pattern was also found with preference for risk, but only in cases of rare negative events. This finding is consistent with the fact that risky behaviors reported in the questionnaire involve the risk of negative outcomes.

It is suggested that the different patterns found in the two groups result from a shrinkage of the range of high values in the questionnaire behavior in the sample at hand. Shrinkage is a situation in which the sample does not reflect the entire possible range of a certain variable in the population, that is, the sample size is smaller than the sample, and as a result, its correlation and prediction capabilities are smaller. This explanation is based on statistical measures that were accepted in the current sample (shrinkage, mean, range) compared to those accepted in the broader population (Pat-Horenczyk, et al., 2007) (for further details, see 5.5. Characteristics of the sample). From this, it can be deducted that the decision weights, as measured in the calculation method, are correlated with taking risks in daily life, as measured by the questionnaire, among adolescents with and without AD/HD. However, the study's findings suggest that different decision weights do not explain the difference in taking risks among adolescents with AD/HD. Therefore, another cause or even other causes, which were not examined in the current study, are likely to contribute to this tendency.

It is interesting that there are few studies dedicated to risks among children with AD/HD, that is, the degree to which the subject engages in behavior that has the potential to lead to negative consequences.

Farmer & Peterson (1995) found that children with ADHD expected fewer negative outcomes to taking risks and had lower expectations for personal risk compared to children without ADHD. Bruce, Ungar, & Waschbusch (2007) reported that children with AD/HD expressed a greater sense of their physical abilities, were more likely to take risks and expected positive or absence of negative outcomes for their risks. This aspect of taking risks was not examined in the current study and requires further study.

To the best of the author's knowledge, all tasks used so far with the AD/HD population involved feedback on every decision and included tasks in which the possible outcomes and their probabilities were described in full to the participants (e.g. Scheres et al., 2006; DeVito et al., 2008; Drechsler et al., 2008, 2010).

The calculations for the calculation (Kahneman & Tversky, 1979) 

60
Contains feedback during. Furthermore, recent studies in behavioral science found that giving feedback led to deviation from the expected according to the value theory: Jessup et al. (2008) showed that feedback given step-by-step in a choice task led to behavior that used small probabilities, compared to participants who did not receive feedback at all.

Additionally, Lejarraga & Gonzalez (2011) showed that information from theory was excluded in the presence of feedback.

Thus, feedback, when given, affects decision weights among healthy adults. Since different theories suggested that AD/HD was related to processing abnormalities (Sonuga-Barke, 2002; Sagvolden et al., 2005), it is possible that feedback affects decision weights differently among those with AD/HD.

In the current study, there were no differences in the choice behavior of adolescents with and without AD/HD in the task evaluated (e.g., -CGT), whereas those with AD/HD showed differences in the choice behavior of adolescents with and without AD/HD in the task without feedback (e.g., CGT).

Therefore, if only one type of information is given, choice behaviors in simple tasks were generally similar. These findings suggest that integrating information sources in tasks that were tested in an AD/HD population (e.g., CGT) could contribute to the varied behaviors observed in previous studies (e.g., DeVito et al., 2008; Drechsler et al., 2008, 2010). However, it is not possible to evaluate the extent of this contribution, since these studies did not include a feedback-free condition. Two studies conducted in our lab sought to address this issue. Shoham & Pollak (personal communication) compared the performance of adolescents with and without AD/HD in CGT, as mentioned, the task involves presenting fixed probabilities and asking participants to determine the amount they are willing to bet on these probabilities. In the original version, participants were immediately given feedback on each decision and decision they made. In the version without feedback, which was developed for this study, participants did not receive feedback during the task, only at the end. It was found that in the version without feedback, there were no differences between the groups, whereas in the version with feedback, a similar effect was found to that found in a previous study (DeVito et al., 2008).

In the follow-up to the current study (Kitrossky & Pollak, personal communication), a significant interaction between group and feedback was found, which indicated that in the group that received feedback, those with AD/HD showed less preference, particularly in situations with small probabilities.

Similarly, another study by DeVito and colleagues showed that feedback can influence decision weights in healthy adults, but further research is required to fully understand this phenomenon.
Our goal is to stand on the specific role of the factor influencing behavior in various choices among those with ADHD, given the integration of theoretical and practical sources.

The partial answer of the experiment and the HGT involves decision-making based on experience. In both, a feedback is given for every choice and decision; the feedback is partial, for the selected choice only; every choice and decision contributes to the satisfaction of the participants. However, despite the common features between the two experiments, there are three central differences between them: (1) In the HGT, the harmful outcomes are also the losing outcomes, meaning it is not possible to distinguish between taking a risk based on poor learning to the possible outcomes at all with certainty, and taking a risk based on preference or assigning another weight to the possibility.

In contrast, in the experiment of the gambles, there is no "correct choice," because the gains of the choices are similar in terms of value; (2) In the HGT, the gambles vary in the choice of the possible situations (the possible choices) of; (3) In the HGT, only two gambles are included (against a multi-choice set of four situations in the HGT, and thus, it reduces the demands placed on the respondent.

In contrast, the differences described above may cast light on the reasons for the lack of performance among those with ADHD, as found in some of the HGT studies (e.g. Toplak et al., 2005). It is suggested that behavior in the HGT may reflect, in particular, personal preferences for risk (Dunn, Dalgleish, & Lawrence, 2006), for example, in debates it is preferable to choose those situations that create more interest or excite (the harmful outcomes) instead of the safe outcomes, despite their profitability. Thus, choosing the losing situations may be rational depending on the preferences of the person, and may explain part of the existing performance among those with ADHD. If this explanation is correct for participants with ADHD in the HGT, it is likely that the differences in this study should also be expected. However, the fact that no evidence was found for the preference of risk consistently in this simple task, indicates that the performance in the HGT is not a preferential risk, because it may be due to the poor methods of evaluating outcomes and the probabilities of their occurrence.

Several methodological limitations discourage drawing definitive conclusions based on the current research. As mentioned, the participants were recruited as a convenience sample, from among the friends of the participants with ADHD. The convenience sample is a method...
The hypothesis was that the adaptive behavior of AD/HD would be more consistent in the sample than in the typical population. However, the sample was not representative of the target population, according to previous findings. The sample included children with AD/HD and their peers. The results were consistent with previous findings, indicating that the sample included a higher proportion of participants with subclinical symptoms of AD/HD, and thus, reducing the differences between the groups.

In conclusion, the sample was not representative of the target population. However, the results were consistent with previous findings, indicating that the sample included a higher proportion of participants with subclinical symptoms of AD/HD, and thus, reducing the differences between the groups. This is important, as it highlights the need for more studies on the topic.
In Swedish psychiatric models based on subjective experiences rather than observable behavior, such as some of the disturbances such as 

... 9 (Overanxious Disorder of childhood; OAD) and AD/HD; and AD/HD treatment and treatment of OAD-AD (e.g. Shaffer's (1992) treatment manual, etc.) 40% to 50% of the cases of OAD/HD are in the current sample, which was based on the child's self-reports and the parents' reports (Pliszka, 1992). Indeed, even though the prevalence of the associated disturbances (such as anxiety disorders) among children with AD/HD % was estimated between 58% and 18% in clinical samples (Tannock, 2000), in the current sample the rate stood at 55.3%, but was not significantly higher than that of the control group (see Table 5). On the other hand, the anxiety level indicated higher among adolescents in the AD/HD group (see Table 6). Together, these differences suggest an underestimation of the anxiety disturbances and / or mental health in the current AD/HD sample.

The current study of Garon et al. (1998) used a child-adapted version of the IGT, which may be significant. They reported that while children with AD/HD who have severe symptoms of ADHD learn to prefer the safer and more profitable choices over the more dangerous and less profitable; like the children of the control group, children with AD/HD who did not show symptoms of ADHD showed a weaker performance (Garon et al., 2006). This may suggest that the underestimation of the anxiety disturbances and / or mental health, which is marked by an inability to evaluate the risk, and especially in conditions of choice, can be described as a simplified version of IGT (with two choices instead of four). This is in line with the studies that show a negative relationship between the first choice of the IGT's first choice and the social anxiety scale of the RCMAS. However, the preference for the IGT's first choice is not similar to the preference for the dangerous choices in the IGT, because the outcomes of the two choices are identical, and the decision is not better, which is clearer when related to the outcomes of each choice. Therefore, future research in this field is needed to evaluate the clinical full evaluation based on both the child and the parent, especially in the area of anxiety disturbances.

The anxiety disturbance included in the DSM-III-R (541.5), as an anxiety specific to childhood, is replaced by GAD in the DSM-IV (544.7).

The variable selected to describe the risk preference in the choice is the percentage of risk preferences. This variable allows for the comparison of the groups at the total level, but may overlook the differences in the choice behavior manifested in the time dimension, which was suggested as critical in the design of the behavior (Sagvolden et al., 2005). The differences of this type are measurable through complex learning algorithms that describe adaptive behavior in the face of rewards and punishments. Recently, Shteingart, Neiman, & Loewenstein (2012) used such a model to quantify behavior in an experiment that included a choice similar to that used in the current research. They showed that the result of the first risk preference choice had a significant (non-)proportional effect on subsequent stages of the choice (Shteingart et al., 2012). These models are beyond the scope of the current research, but future studies that make use of them are expected to improve our understanding of decision-making differences between populations that show deficits in this area, such as those with AD/HD, compared to populations that do not show them.


Lee, S. S., Humphreys, K. L., Flory, K., Liu, R., & Glass, K. (2011). Prospective association of childhood attention-deficit/hyperactivity disorder (ADHD) and substance use and


לפיך רישום של משפטים המתארים רגשות של ילדים החיים. קריא כל משפט והקף בעיגול את המילה "כן" אם המשפט נכון לגביך ואת המילה "לא" אם המשפט אינו נכון לגביך.

1. קשת לי להхоות
2. אני נושה עצביים אך "לא" חולק לי
3. עררים עשים דרים יכלו רותי מתי
4. אני מבצע את כל מי שאמרי מוכר
5. ל以人民 קורבון קשת לי לנשמ
6. רותי חומץendi זיאגי
7. אני מפחית את מרחב דרימ
8. אני תמית דיר
9. אני מניחן יכלות
10. אני זיהני ממעיד גירי לי
11. אני מרגשים שא cboים לא אהובים אד אוורבד הנקנן דרים
12. אני תמית מתנה飲みים
13. קשת לי להזיזו ביבילה
14. אני זיהני מモノ המים והשבים על
15. אני מרגשים בודד וכסים על יאני אנשי
16. אני תמית לי תוב
17. לייק איזו קורבון אנ מרגים דהילה
18. אני מפונה אחרית יכלות
19. ירי מותעה
20. אני תמית למאת כלים

85
לעיתים קרובות אני עייף

כן

לא

אני דואג

כן

לא

אחרי שחקים אנישמח יותר ממני

כן

לא

אני всегда说实话 אם אני לא שמח
ditn מעיר לי

כן

לא

אני חושש שמי יגיד לי שאני עושה משהו לא נכון

כן

לא

אני אף פעם לא כועס

כן

לא

אני מתעורר מבוהל באמצע הלילה

כן

לא

אני דואג כשאני הולך לישון בלילה

כן

לא

אניтрудי_draftну יש לי חלומות רעים
ditn מעיר לי

כן

לא

אני בקלות כאשר מעיר לי

כן

לא

אני מתעורר מבוהל באמצע הלילה

כן

לא

אני דואג כשאני הולך לישון בלילה

כן

לא
##.DBDRS שאלון 6.2

### שאלון להורה

סמן את המספר המובא בתוך בécouteéo בתכונה בה מופיעו התנהגותお客様ים构筑ב תכונה האחרונה

<table>
<thead>
<tr>
<th>מספר</th>
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<th>בותות</th>
<th>ממונעים</th>
<th>דק</th>
<th>יעד</th>
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1. מתקשהلبשיעיםלב luyệnה וא־טוענתה תכונתلمפקנה
2. בישועים בי复古ות וא־עייפותאחור
3. קייממקושיתלגברות הביצועו ובעישון תחומי ריכוז מועשר
4. קיימקרבבשניםسعادة כבואר מתמידים אליה
5. קיימרמשشاءנימאסרמביברישריה
6. קיימקרבתمنظימהאיהםאיהמטיםוקשם בימיותشرحיה
7. קיימאזהעכבתאחייתוראהומתקשהליסייפעילותלימודיהםוא
8. קייממקושיטבןמלתוותאלפייעילים
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26. קייממקושיטבוןמלתוותאפעילה
שלום רב,
בתקופה האחרונה אנו עורכים סקר בקרב מתבגרים ברחבי הארץ על שינויים בהתנהגות. שאלון זה הנו אנונימי, ואת/ה מתבקשים לענות עליו בכנות ובפתיחות, כאשר אין תשובות נכונות ולא נכונות, כל אחד ואחת עונה לפי הרגשתו/ה ו חוותיו/ה.
השאלון מיועד לאוכלוסייה רחבה ובאופן טבעי לאすべて להם. חלק מהשאלות אולי יראו לך לא מתאימות או אי כל אדם מתאים לשאלה. הנך מתבקש/ת להתייחס לכולו.

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**BIS-a-11 שאלונים**

**גיל:_____ שנה**

**מין: נasString**

הוראות: אנשיים שונים הם מוח באמפ שבם פעילויות והשבים במצבי שונים. שאלון זה מיועד לבדוק

הכל分会 הדרכו שבחול את/ה פעולת והשבות

קרא/י כל משפט וחקף/י את התשובה המתאימה לך/ה. אולו תועברים יחל מידי על כל מוספ. ענה/י

בכמה חケア בטוחרת.

עובר כל משפט יש לבחור את אחד מה唧וי התשובות הבאות:

- 1 -افة פעם לא / ליעויות מירוח.
- 2 -לפעמים.
- 3 -ליעויות קרובות.
- 4 -כמעט תמיד / תמיד.

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אני מתכנן דברים לעתיד.
אני אומר דברים מבלי לחשוב.
אני אוהב לחשוב על בעיות מורכבות.
אני משנה את דעתי לגבי מה שאני אעשה כשאגדל.
אני פועל מתוך דחף.
אני משתעמם בקלות כשאני פותר בעיות הגיון.
אני פועל בלהט הרגע.
אני אוהב לחשוב.
אני מחליף חברים.
אני קונה דברים מתוך דחף.
אני יכול לחשוב רק על בעיה אחת בזמן נתון.
אני מחליף תחביבים וסוגי ספורט.
אני מבזבז כסף יותר משאני יכול.
בכעשב על משהו, מחשבות אחרות צוצות לי בראש.
אני מתעניין בהווה יותר מאשר בעתיד.
אני חסר מנוחה בזמן סרטים או שיעורים.
אני אוהב לשחק שחמט או דמקה.
אני חושב על העתיד.
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Table 10
*Pearson's correlation coefficients between clinical-behavioral ratings*

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* p < .05, ** p < .01
Table 11
Spearman’s rank correlation coefficients between clinical-behavioral ratings.

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