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**How do children and adolescents with autism spectrum  
disorder (ASD) depict their future?**

**Literature review**

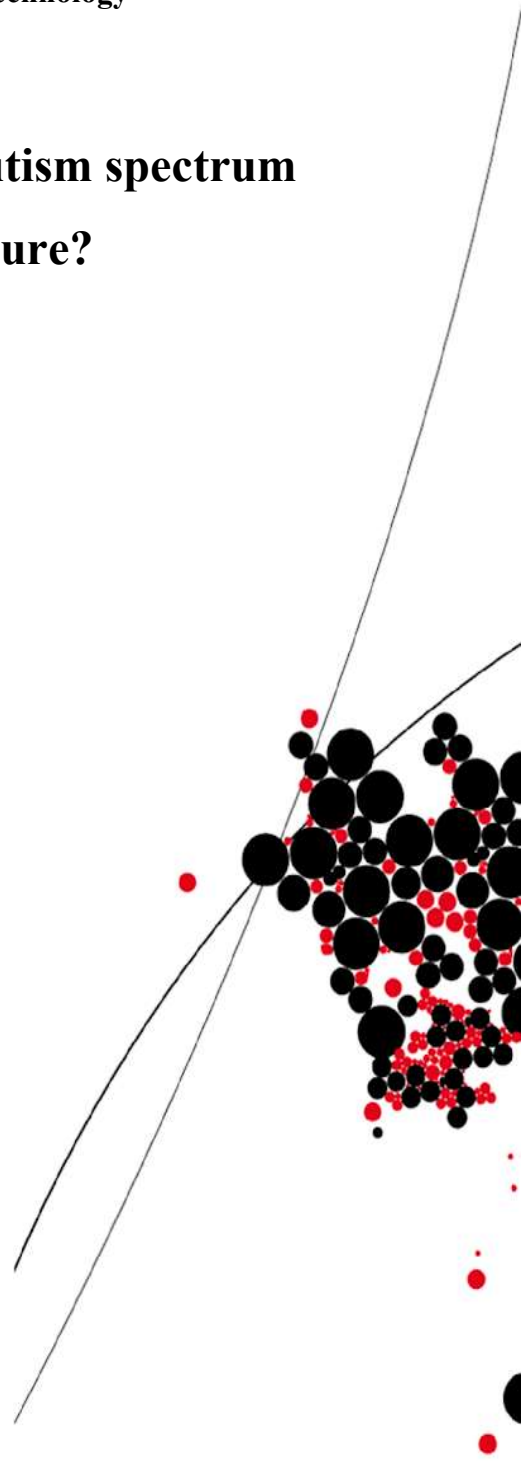
Master thesis

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## Abstract

**Background.** Future thinking is beneficial and natural to most, yet people with autism spectrum disorder (ASD) have difficulties engaging in it. In current research, a vast body of research exists examining the impact of ASD in adults on the ability of future thinking. However, little is known about children and adolescents with ASD and how they anticipate their future. Nevertheless, sufficient insight could help in establishing tailored training programs for children with ASD to improve this skill. Therefore, this review aims to understand current research's knowledge about the extent to which children and adolescents with ASD engage in future thinking.

**Method.** A systematic review was conducted using the databases Scopus, PsychNet, JSTOR, and ScienceDirect, based on selected exclusion criteria.

**Results.** In total, 14 articles were selected that fit all criteria. Most studies were conducted in Europe and had mainly male participants between the ages of 4 and 19. The majority of the reviewed articles understood future thinking as episodic future thinking and investigated it by utilizing narrative building. An additional focus was set on the four subtypes: *simulation*, *planning*, *prediction*, and *intention*, whereas in current literature, *simulation* and *planning* were assessed most frequently. Additional types of future thinking were evident as well.

**Discussion.** So far, no clear rules exist for measuring future thinking, and thus criteria could hardly be established. Further, in the reviewed articles, the diagnosis of ASD was given via different means, and thus it could not be ensured that all participants were equally diagnosed with ASD.

**Conclusion.** Among the reviewed articles, 90% of the studies found significant difficulties for participants with ASD to engage in future thinking compared to the typically developed control group. This effect is especially evident in future thinking that regards the self, compared to future thinking about neutral events or other people.

**Keywords:** Future thinking, episodic future thinking, autism spectrum disorder, ASD, children, adolescents, literature review

## Introduction

“Where do you see yourself in 5 years?” – A question that seems normal for most people and does not bear any apparent obstacles. In fact, most people think about some aspects of their future every day, whether it is about thinking about how to continue after school, mentally preparing for the next steps to get that promotion, planning upcoming holidays, or just thinking about whether or not their favorite soccer team might win the upcoming game (Schacter et al., 2017). According to the Bishof-Köhler hypothesis, thinking about their future like that is significant for humankind and distinguishes us from other species (Raby et al., 2007; Atance & O’Neill, 2001; Atance, 2008). Generally, future thinking is the ability to “anticipate, plan for, and contemplate the future” (Atance, 2008). Being able to anticipate our future is of many advantages, such as estimating risks, regulating our emotions, or making reasoned decisions (Schacter et al., 2017). Thus, thinking about the future is a valuable skill and capacity.

According to Haith (1997) and Raby and colleagues (2007), we are not born with it; instead, the base for future thinking is an innate capacity, but it can be trained in childhood, as it emerges around the age of 4 or 5. Being able to anticipate the future allows children to delay gratification, meaning to miss something positive for a greater goal, which is an essential predictor for later academic success and physical health (Atance, 2008; Michaelson, 2013). Therefore, it is imperative to reinforce this skill in children, so they can use it from early on. Recently, this exact topic has become the focus of many researchers (Gott & Lah, 2014; Atance, 2015; Atance, 2008; Russell et al., 2010). More specifically, researchers examine what factors contribute to good development and why some children have difficulties imagining their future and planning ahead (Atance, 2008). As a matter of fact, what seems perfectly normal for most people, such as thinking ahead, is reasonably problematic for others.

Literature indicates that one group that may experience difficulties anticipating their future is people with autism spectrum disorder (in the following referred to as ASD) (Terrett et al., 2013). People with ASD often have impairments in social communication, highly restricted interests, and general problems understanding the psychological world (Lord et al., 2020; Jackson & Atance, 2008). More precisely, Jackson and Atance (2008) argue that, based on their deficits in recognizing emotions, motivations, and similar constructs, people with ASD often have difficulties understanding the theory of mind. Theory of mind describes the understanding of a person that other people have inner lives as well and that everybody makes independent choices (Frith & Frith, 2005). According to Lind et al. (2014), this is

hypothesized to be crucial for future thinking, as it is required to understand motivations and expectations to anticipate the next steps.

Even though literature already indicates that adults with ASD struggle with picturing their future and hypothesized potential reasons for this, little is known about children and adolescents with ASD regarding their future thinking. In fact, Marini et al. (2019) did focus on children as their target group. However, they found evidence that children with ASD struggle with recollecting past memories and solely suggest a similar relation with future thinking. Lind and colleagues (2014) also conducted a study examining children with ASD and found them to have impairments in future thinking but not in possession of a theory of mind, as Jackson and Atance indicated in 2008. Thus, the focus on children with ASD concerning future thinking is underrepresented in current literature. Furthermore, the existing literature contradicts to what extent certain concepts are presented in children with ASD. Therefore, this literature review aims at grasping the current understanding of this topic in research, with the main research question:

*What is known about the extent to which children and adolescents with autism spectrum disorder (ASD) engage in future thinking?*

## **Future thinking**

According to Atance and O'Neill (2001), future thinking can be divided in episodic future thinking, and semantic future thinking. These two types are based on Tulving's distinction between episodic and semantic memory in 1972, which describes that semantic memory entails general data and factual information, while episodic memory encompasses personal information and memories (Renoult & Rugg; 2020). Referred to future thinking, the same explanation holds true. Semantic future thinking describes how factual information without any personal relation is used to forecast a future outcome (Blankenship, Broomell, & Bell; 2019). Episodic future thinking means to "re-experience, through auto-noetic awareness, previous experiences as such, and to project similar experiences into the future" (Atance & O'Neill, 2001). For example, being aware that at a zoo there are various animals and using this information to expect many different animals at the next zoo visits, is semantic future thinking. In this example, episodic future thinking could be remembering that in the walk-through area of another zoo, monkeys climb on the visitors, and now expecting monkeys to always climb on people. However, in literature episodic future thinking is most frequently assessed, such as in the existing literature on children with ASD by Lind et al. (2014) and Marini et al.

(2019). Semantic future thinking is rarely investigated yet and does not have enough body of literature to be in the focus of a review. Thus, in this paper the focus will be on episodic future thinking.

Schacter and colleagues (2017) distinguish between four subcategories of episodic future thinking. These are 1. *Simulation*, which is similar to imagination as it describes a mental representation of the future, 2. *Prediction*, meaning an assessment of likely an event or a certain outcome will occur, 3. *Intention*, to set a goal, and 4. *Planning*, which comprises the organization of reaching a goal. Recent literature focusses to a large extent mainly on episodic future thinking in relation to simulation (Schacter et al. 2017). Furthermore, many studies are distinguishing between a type of episodic future thinking that concerns the personal self, internal states or individual events, so self-related future thinking, and future thinking that does not regard the self, so non-self-related future thinking (Hansen and Atance, 2013). However, as the goal of this review is to get a comprehensive picture of how the target group makes use of future thinking, the focus will be held more general, so all types of episodic future thinking will be investigated.

When regarding the four subtypes of episodic future thinking as defined by Schacter et al. (2017) assumptions can be made as well. Based on the impairments that are typically present in ASD patients, such as difficulties in understanding the theory of mind, it could be hypothesized that children with ASD have obstacles in engaging in *simulation* or *prediction*. Both of these concepts require an evaluation of past events, or people's motives and anticipating of future events. However, *intention* could be of less challenge as the child solely needs to understand their own will. It is not precisely needed to understand other people's motives here as well and thus it is hypothesized that this will not be quite as impaired. Finally, *planning* requires again more skills related to evaluating the past and understand other people as well, and thus it could be impeded in children with ASD.

To conclude, future thinking describes the ability to think about, plan for, and anticipate the future. It can be distinguished between semantic future thinking, which is characterized by the focus on factual information with no connection to personal relations, and episodic future thinking, which defines one's personal future, influenced by memory or personal information. The latter named includes four sub-concepts, namely *simulation*, *prediction*, *intention*, and *planning*. The focus can either be on the self or on others or neutral protagonists. As current literature concentrates on episodic future thinking, this review will follow this notion and thus focusses on future thinking containing all subtypes to create a comprehensive picture of literatures current understanding of the topic.

## **Autism spectrum disorder**

In order to fully understand the target group, it is of help to get a profound understanding of autism spectrum disorder. ASD occurs in 0.76% – 2.5% of the world population with males being three times more likely to develop ASD than females (Hodges, et al., 2020; Lord et al., 2020). The average onset of ASD is at 19.8-month-old (Tan et al., 2021). Thus, children with ASD already experience its symptoms while developing and growing up. ASD is a neurobiological disorder, characterized by impairments in social interactions, restricted interests and repetitive behaviour. This disorder has a genetic component, as well as environmental factors that have an influence on it, when happening while the brain is still developing (Hodges, et al., 2020).

To be diagnosed with ASD the two main symptom categories from the DSM-V must be met. The first category relates to “deficits in social communication and social interaction across multiple contexts” (Hodges, et al., 2020). Here, three out of three criteria must be met. First, “deficits in social-emotional reciprocity (including abnormal social approach and failure of reciprocal conversation [...])”, second “deficits in nonverbal communicative behaviour used for social interaction (poorly integrated verbal and nonverbal communication [...])”, and third “deficits in developing, maintaining, and understanding relationships ([...] difficulties in sharing imaginative play or in making friends, or lack of interest in peers)”. In the second category, which entails “restricted, repetitive patterns of behaviour, interests, or activities”, at least two out of four criteria must be met. These are first, “stereotyped or repetitive motor movements, use of objects, or speech”, second “insistence on sameness, inflexible adherence to routines, or ritualized patterns of verbal or nonverbal behaviour”, third “highly restricted, fixated interests that are abnormal in intensity or focus”, and fourth “hyper- or hyporeactivity to sensory input or unusual interest in sensory aspects of the environment” (Hodges, et al., 2020).

Moreover, current research indicates that the prevalence of ASD has more than doubled within the last 20 years (Hodges, et al., 2020; Lord et al., 2020). This emphasizes again the need for more research about people with ASD and corresponding topics. The target group in this review will therefore be children officially diagnosed with ASD.

## **Contribution to research and practical relevance**

So far, a solid body of research exists about autism and future thinking as by Lind and Bowler (2010) and Crane and colleagues (2013), but solely few studies have been conducted

on children with autism and their ability to engage in future thinking. The existing literature is constituted out of empirical research, but no systematic literature review is existing on this topic. Therefore, the current study is adding to the scientific and psychological field with practical implications. Understanding what is known about this topic in literature offers the base to develop further research and potentially incorporate findings into practice. Being able to engage in future thinking can bear multiple advantages and children with ASD eventually have severe limitations in that matter. Thus, understanding to what extent they do envision their future can aid in developing potential interventions to support and enhance their future thinking. In order to understand how children and adolescents are able to engage in future thinking, following sub-questions are posed:

1. *How are studies designed that aim at examining future thinking in children and adolescents with ASD?*

In answering the sub-question, it can better be understood how autism in children and adolescents is measured, as well as how future thinking is assessed. Further, the answer sheds light on what type of participants are included and where the study is conducted.

2. *What type of future thinking of children and adolescents with ASD is assessed in current literature?*

The answer to this question aids in gaining a first understanding in the subtypes of future thinking and whether there might be a difference.

3. *What is known about the impact of ASD on future thinking in children and adolescents?*

Analysing the impact that ASD has on children regarding their future thinking provides a more coherent picture about the current understanding of this topic in literature and where potential further implications lie.

## **Method**

The design of this study is a systematic literature review. Therefore, the data bases *Scopus*, *PsychNet*, *JSTOR* and *ScienceDirect* have been used to scan for suitable literature. The search started using 'future thinking' and variations thereof as a base, and subsequently scanning the body of literature for other keywords. The search was sharpened by specifically finding literature within the articles that relate to future thinking, that focus on children and adolescents. Finally, the results were further refined by solely including articles with the term



‘autism spectrum disorder’ or ‘ASD’. For an overview of the search terms and strings, see table 1. On the remaining 105 articles the exclusion criteria were used, which can be seen below. The final pool of literature consists out of 14 articles. For an overview of the search terms and strings, see table 1. The full overview of the search process can be seen in Figure 1.

The analysis of these 14 articles continued as the outcome of each study was used, meaning in this research their methods, results and conclusions were compared. Whether or not the articles found significant results was decided based on the given data and the conclusion made by the researchers. Further, in this literature review the subtypes of episodic future thinking were investigated as well. The decision upon which type was analysed in which study was again based on the statement of the researchers as they oftentimes stated them clearly. In cases where the distinction was not made by the researchers themselves, following scheme was used. The methods of each study were analysed by means of their study set-up and their methods of testing. Specifically, it was looked for cues such as statements that the participants had to predict potential outcomes, or simulate stories, which was often done in narrative building. The analysed methods were then used for further comparison.

**Table 1**

*Search terms and search strings*

Search terms	Search strings
Autism OR Autism spectrum disorder OR ASD	Autism OR Autism spectrum disorder AND future thinking OR episodic future thinking OR possible selves OR prospection OR anticipation AND Children OR child OR adolescents OR Teenagers OR Teen AND Children OR child OR adolescents OR adolescent OR Teenagers OR Teen AND Autism OR Autism spectrum disorder OR ASD AND Future thinking OR episodic future thinking OR possible selves OR prospection OR anticipation
Children OR child OR adolescent OR adolescents OR Teenagers OR Teen	

Future thinking OR episodic future thinking  
OR possible selves OR prospection OR  
anticipation

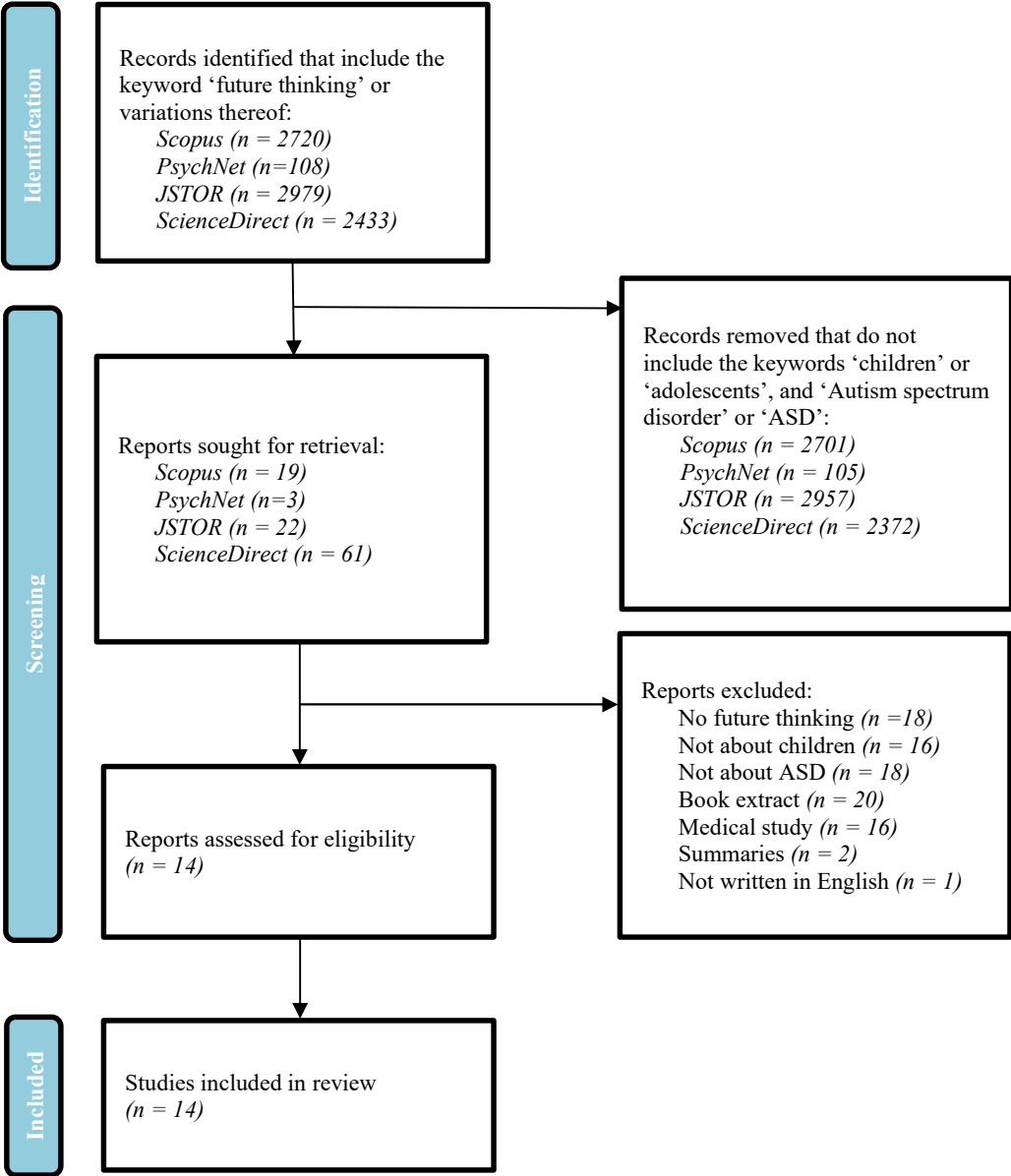
Future thinking OR episodic future thinking  
OR possible selves OR prospection OR  
anticipation AND Children OR child OR  
adolescents OR Teenagers OR Teen AND  
Autism OR Autism spectrum disorder OR  
ASD

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### Exclusion Criteria

In this analysis seven exclusion criteria have been applied. These are not focussing on future thinking, not having children and/or adolescents as the target group, not having a target group with ASD, book extracts, medical studies, summaries, and not written in English. Due to the first criterion four articles had to be excluded that stemmed from the database *Scopus*, seven from *JSTOR*, and the remaining seven from *ScienceDirect*. The second exclusion criterion is that articles cannot be used, if the focus is not on children or adolescents. Caused by this, two from *Scopus*, three from *JSTOR*, and eleven from *ScienceDirect* had to be erased. The third criterion was that the research must include the focus on ASD or be excluded. Here, three articles from *JSTOR* were erased and 13 from *ScienceDirect*. The fourth exclusion criterion was that the article may not be a book or encyclopaedia extract. Caused by this, 21 articles had to be excluded, which were constituted out of three articles from *JSTOR* and 17 articles from *ScienceDirect*. The next criterion focussed on medical studies, as they were excluded as well. Due to this restriction, two articles from *Scopus* were segregated, one from *PsychNet*, three from *JSTOR* and 10 from *ScienceDirect*. The sixth and seventh criterion were that no summaries of suitable articles were used and only articles in English were included. Therefore, two summaries from *Scopus* had to be excluded and one article from *ScienceDirect*, which was not written in English.

Figure 1. Literature review chart



Results

Research design and operationalization

This review revealed 14 studies. Most of these studies (57%) were conducted in Europe. The remaining studies were administered in America (n=3), in Asia (n=2) and in Australia (n=1). The majority of the participants is male (71%) and mainly around ten years old (46%). The remaining studies focus on adolescents (27%) as their target group or on

younger children (27%). All studies used a cross-sectional design. See Table 2 for an overview.

All studies concentrated around children and adolescents with ASD and how they engage in some sort of future thinking. Yet, the main focal point shifts slightly among them. The research done by Anger et al. (2019), Ciaramelli et al. (2018), Ferretti et al. (2018), Jackson and Atance (2008), Marini et al. (2016), Marini et al. (2019), Naito et al. (2020), and Terret et al. (2013) had their aim at investigating future thinking, with the target group and the disorder of autism as side variables. Quinn and colleagues (2019) had well-being of adolescents and young adults as main goal of their study and thus investigated future thinking as means to the goal, based on theories about purpose in life. Studies by Lind et al. (2014) and Hansen and Atance (2013) put ASD as their independent variable and researched about related concepts such as future thinking, theory of mind and spatial navigation. Furthermore, Feller and colleagues (2021) analysed ASD as well, yet had another medical condition in their attention and examined relations between them, as well as related constructs, similar to Lind et al. (2014) and Hansen and Atance (2013). Finally, Ganglmeyer et al. (2019) had future thinking in the main focus, but learning abilities were added, and the study operated more technically, as eye-tracking was used compared to many narrative-based studies, such as done by Ferretti et al. (2018) or Terret et al. (2013).

To conclude, the studies that examine future thinking in children and adolescents with ASD are design as cross-sectional. The participants are mainly male and from Europe. Additionally, the majority of studies focussed on future thinking as independent variable. Still, other conceptualizations exist as well, such as investigating multiple disorders or medical conditions simultaneously and inserting future thinking as the dependent variable among others, such as spatial navigation or theory of mind.

**Table 2**

*Study demographics*

Article	Sample size (n)	Age in years ( <i>mean</i> )	Nationality
1. Anger et al. (2019)	32 (32 male)	10-18 ( <i>13.4</i> )	France
2. Ciaramelli et al. (2018)	29 (27 male)	7-15 ( <i>11</i> )	Italy
3. Feller et al. (2021)	53 (34 male)	12-25 ( <i>17.4</i> )	Swiss
4. Ferretti et al. (2018)	132 (97 male)	6-12	Italy

5. Ganglmeyer et al. (2019)	97 (gender distribution unknown)	Children mean age 9 years; Adolescents mean age 15 years	German
6. Hansen & Atance (2013)	50 (44 male)	3-8	Canada
7. Jackson & Atance (2008)	24 (22 male)	4-13 (7)	Canada
8. Kimhi et al. (2014)	59 (51 male)	4-5	Israel
9. Lind et al. (2014)	40 (gender distribution unknown)	6-12	England
10. Marini et al. (2016)	154 (gender distribution unknown)	6-11 (8.1)	Italy
11. Marini et al. (2019)	154 (gender distribution unknown)	6-11	Italy
12. Naito et al. (2020)	188 (100 male)	4-6	Japan
13. Terret et al. (2013)	60 (44 male)	8-12 (9.5)	Australia
14. Quinn et al. (2019)	8 (gender distribution unknown)	13-18	USA

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### Assessment of ASD

Most studies have sampled their participants via institutions and clinics for patients with ASD, through advertisement, or through centres for parents with autistic children (see Anger et al., 2019; Feller et al., 2021). Whether the participants are in fact experiencing ASD was mainly tested by the Diagnostic Interview-Revised (ADI-R; Lord et al. 1994), and the Autism Diagnostic Observation Schedule-2nd edition (ADOS-2; Lord et al. 2012), administered by the researchers. The ADI-R was utilized by 42% of the studies and the ADOS-2 by 50%. Both or one of these diagnostic tests was used in 57% of the used literature, meaning four studies used both measurements to obtain greater validity. These studies are done by Lind et al. (2014), Feller et al. (2021), Ciaramelli et al. (2018), and Anger et al. (2019). Hansen and Atance (2013) used the Childhood Autism Rating Scale, Second Edition (CARS-II; Schopler et al. 2010). Naito and colleagues (2020) indicate to have assessed the ASD by psychologists trained in ASD but do not further elaborate on this. Ganglmeyer and colleagues (2019), Jackson and Atance (2008) and Quinn et al. (2019) did not conduct the assessment of ASD themselves but relied on proof given by parents of prior diagnosis. See table 3 for an overview.

**Table 3***Assessment of future thinking (FT) and ASD*

Article	Assessment of FT	Assessment of ASD
1. Anger et al. (2019)	EFT; simulation	ADI-R, ADOS-2, conducted by psychologists
2. Ciaramelli et al. (2018)	EFT; simulation, intention, planning	ADI-R, ADOS-2, conducted by psychologists
3. Feller et al. (2021)	EFT; simulation	ADI-R, conducted by psychologists; ADOS-2, SCQ, conducted by caregivers
4. Ferretti et al. (2018)	EFT; simulation, planning	ADOS-2 conducted by psychologists
5. Ganglmeyer et al. (2019)	Anticipating	Participants had to provide a medical certificate to proof the ASD diagnosis done by a psychologist according to the Diseases-10th Revision criteria (World Health Organization 1993)
6. Hansen & Atance (2013)	EFT; simulation, prediction, intention, planning	History questionnaire about the child, conducted by parents; Participants had to provide a medical certificate to proof the ASD diagnosis consistent with the criteria outlined in the DSM-IV; Childhood Autism Rating Scale, Second Edition (CARS-II; Schopler et al. 2010), conducted by psychologists
7. Jackson & Atance (2008)	EFT; intention, planning	Parents reported that the children are officially diagnosed with ASD, which was done by different independent clinics. Exact procedure is unknown
8. Kimhi et al. (2014)	EFT; planning	ADI-R, conducted by psychologists

9. Lind et al. (2014)	EFT; simulation	Participants had to provide proof of an ASD diagnosis according to the DSM-IV criteria. Controlled with the ADI-R and ADOS-G, conducted by psychologists
10. Marini et al. (2016)	EFT; intention, planning	ADOS-2, conducted by psychologists
11. Marini et al. (2019)	EFT; simulation	ADOS-2, conducted by psychologists
12. Naito et al. (2020)	EFT; prediction, planning	Diagnosed by child psychiatrists based on DSM-5 criteria
13. Terret et al. (2013)	EFT, simulation	Participants had to provide proof of an ASD diagnosis according to the DSM-IV criteria. Controlled with the ADI-R and SCQ, conducted by psychologists
14. Quinn et al. (2019)	Purpose in life	Participants needs to show proof of official ASD diagnosis, which was done by different independent clinics. Exact procedure is unknown

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*Note: EFT = episodic future thinking; ADI-R = Diagnostic Interview-Revised; ADOS-2 = Autism Diagnostic Observation Schedule-2nd edition*

### **Assessment of future thinking**

As different types of future thinking are investigated, so are the means to analyse them. However, the majority of studies assess future thinking by asking the participants to build a narrative. The children are asked to tell a past event and subsequently describe an upcoming event in short-term future and long-term future, such as lunch tomorrow, or high-school graduation. By this, the children's ability to engage in *simulation* is assessed, which is a subtype of episodic future thinking. The exact set-up and timeframe of future thinking varies, yet most studies make use of this broad set-up. Further, the narratives partly focus on the participants future personally, and partly on non-personal related content. An exception to this is the research done by Ganglmeyer et al. (2019), to used eye-tracking while watching partly-hidden videos to understand whether the participant foresees where the protagonist will

go. Jackson and Atance (2008), Kimhi and colleagues (2014) and Marini and colleagues (2016) investigated future thinking by prompting puzzles to the children, such as the famous “Tower of London task”, which requires planning skills and anticipation of the next moves.

In the reviewed articles all four subcategories of episodic future thinking as defined by Schacter and colleagues (2018) as well as two additional subcategories were found. The most common type of future thinking which is assessed is the first subcategory of episodic future thinking, called *simulation*, which was tested in eight studies. This is similar to imagination and commonly used in forms of narratives to assess future thinking. Further, *simulation* only was measured in five out of these eight studies. In the remaining three studies narratives were combined with other tasks, such as problem-solving tasks (Hansen & Atance, 2013). The type of future thinking that was assessed second most is *planning*, which was found in seven studies. In six of these seven studies *planning* was jointly assessed with *intention* or *simulation*. The exception constitutes Kimhi and colleagues (2014) who investigated future thinking by means of a logistical puzzle that requires solely planning abilities. *Intention* was measured in four studies, which were conducted by Ciaramelli et al. (2018), Hansen and Atance (2013), Jackson and Atance (2008), and Marini et al. (2016). Hereby, the participants had to set justified goal. In all four studies *intention* was measured in combination with *planning*. The participants were asked to name a goal or were given a goal and then had to plan the way to achieve it. The fourth subtype, *prediction*, could be found in two studies, conducted by Hansen and Atance in 2013, and by Naito and colleagues in 2013. The only study that includes all four subcategories is Hansen and Atance (2013), and Ciaramelli and colleagues (2018) as only study including three subtypes, missing *prediction*.

Exceptions to the four subcategories introduced by Schacter and colleagues in 2018 are the research done by Ganglmeyer and colleagues (2019) and the study done by Quinn et al. (2019). Ganglmeyer et al. (2019) referred to future thinking as anticipation, which is similar to *simulation*. Quinn and colleagues (2019) evolved their study around the concept of purpose in life, which primarily resembles the subcategory *intention*, but entails elements of *simulation* and *planning* as well. See Table 3 for an overview of the different types of conceptualizations.

To conclude, in the majority of the investigated literature future thinking was assessed as *simulation*, as it appears in 57% of the studies. Further, *planning* was measured in 50% of the literature, with a great overlap of *planning* and other subcategories. *Intention* was analysed in 29% of the studies and *prediction* is found in 5 % of the literature. One study entails all four category and one study includes three types, whereas the remaining studies focus on two



or one type of future thinking. Additionally, future thinking in forms of anticipation and purpose in life was found, with one study each.

### **Impact of ASD on future thinking in children and adolescents**

In the vast majority of reviewed articles was a distinction between self-related future thinking, where the participants had to imagine scenarios regarding themselves, and non-self-related future thinking, concentrating around general facts, events and solving strategies. As most studies regard them separately, so it needs to be done in this paper. However, besides the studies by Quinn et al. (2019) and Anger et al. (2019), all studies report difficulties in future thinking among the participants with ASD, that typical developed children and adolescents did not show. This indicates that ASD might in fact have a negative impact on future thinking. See table 4 for an overview of the reviewed articles regarding whether they found participants with ASD showing difficulties in self-related, non-self-related future thinking, or both. When considering the distinction between self-related and non-self-related future thinking, it is found that participants with ASD show difficulties in self-related future thinking in 90% of the studies that measured this distinction. Further, literature indicates problems for participants with ASD in non-self-related future thinking in 35% of the studies. However, additional 3 studies found partial proof for difficulties in non-self-related future thinking and are thus not included in the 35%. To conclude, the reviewed articles indicate that ASD has a negative effect on future thinking, since most studies found difficulties in future thinking for the participants with ASD in comparison to a normally developed control group.

**Table 4**

*Difficulties in self-related and non-self-related future thinking for patients with ASD*

Article	Difficulties in self-related future thinking for participants with ASD	Difficulties in non-self-related future thinking for participants with ASD
1. Anger et al. (2019)	Not measured	no
2. Ciaramelli et al. (2018)	yes	no
3. Feller et al. (2021)	yes	no
4. Ferretti et al. (2018)	Not measured	partly
5. Ganglmeyer et al. (2019)	Not measured	yes
6. Hansen & Atance (2013)	yes	no

7. Jackson & Atance (2008)	yes	no
8. Kimhi et al. (2014)	Not measured	yes
9. Lind et al. (2014)	yes	yes
10. Marini et al. (2016)	yes	partly
11. Marini et al. (2019)	yes	yes
12. Naito et al. (2020)	yes	yes
13. Terret et al. (2013)	yes	partly
14. Quinn et al. (2019)	no	Not measured

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## Discussion

A systematic literature review was conducted to investigate current research's knowledge about the extent to which children and adolescents with ASD engage in future thinking. Generally, it was found that future thinking is primarily understood as *simulation* or *planning*, which are subcategories of episodic future thinking. This is according to literature as from Schacter and colleagues (2017), who found that in current research future thinking is mainly understood as simulating a future situation. The other two subtypes, *intention* and *prediction*, were found to a smaller extent. Even though the goal of this review is to understand what is currently known and utilized, it is striking that respectively few studies included multiple types of future thinking. Whereby including them, the results could bear a more valid picture and perhaps detect differences among the subtypes. Furthermore, it was found that there appears to be a differentiation between future thinking regarding themselves and future thinking regarding others or neutral events. Multiple studies reported participants with ASD to show stronger difficulties in self-related future thinking than in non-self-related future thinking.

Besides the type of future thinking assessed, it was found that in the vast majority of the studies, participants with ASD show difficulties to make use of future thinking to some extent. Additionally, the majority of studies distinguishes between self-related future thinking and non-self-related future thinking. Concerning self-related future thinking, which means situations that regard the participant personally, or describe internal states, it is found that children with ASD show difficulties to engage in future thinking in 90% of the studies. The only studies that did not find significant difficulties for participants with ASD to engage in future thinking used a respectively small sample size, which might distort and thus question the validity. Besides these studies, the other researchers found that compared to typically

developed children and adolescents, children with ASD have difficulties thinking about themselves in the future, especially about their internal states.

Interestingly, problems in non-self-related future thinking are not as present. Among the ten articles that found difficulties in self-related future thinking, in four of them the participants did not show any problems in non-self-related future thinking. None of the studies found the opposite, which means that ASD participants show difficulties in using self-related future thinking, but not in non-self-related future thinking. Hansen and Atance (2013) already point out the finding about the discrepancy between self- and non-self-related future thinking.

So far, little research exists about explanations for this outcome. When considering that it is known that people with ASD, they oftentimes experience difficulties in engaging with the theory of mind, that describes the understanding of the psychological world and the existence of separate minds in other people (Jackson & Atance, 2008; Frith & Frith, 2005). Based on that line of reasoning, it should be more troublesome for ASD patients to understand the motives of other people and thus show difficulties in predicting and anticipating non-self-related future thinking. However, the exact opposite is found. Instead of not being able to predict other people's behaviour, people with ASD appear to have difficulties in thinking about themselves in the future. A potential explanation might be that people with ASD frequently show difficulties in remembering personal information as well, meaning they engage to lower levels in episodic memory (Crane et al., 2013). The experience of difficulties in extracting personal memories could in turn result in obstacles for understanding the development of events so far and thus hinder the anticipation of future events.

An additional point to ponder is the concept of non-self-related episodic future thinking in general. According to Atance and O'Neill (2001) future thinking can be divided into episodic and semantic future thinking, whereas episodic concentrates on personal experiences and expectations and semantic future thinking regards factual information without personal reference. Semantic future thinking has not been yet used in studies so there is a lack of literature existing about it officially. However, the non-self-related future thinking that is measured in 92% of the analysed studies as well, is respectively reminiscent of just that. Szpunar (2010) already pointed out this line of reasoning and concluded that episodic future thinking inevitably includes semantic knowledge as well as episodic knowledge and thus cannot just be separated completely.

## Limitations and strengths

A limitation of this research is that it could not be controlled for that all participants are in fact suffering from ASD. The majority of studies used valid measurement tools, such as the ADI-R and the ADOS-2. Yet, literature has contradicting standings about the used measurement tools. On the one hand, Mazefsky and Oswald (2006) state that the ADI-R and the ADOS-2 have about 75% accordance with the professionals' team diagnosis, which is respectively high but still leaving 25% differences to the professionals' opinion. On the other hand, Bishop found in 2011 that the two tools not suitable for research due to multiple reasons. Besides the two tools, other studies in this review relied solely on spoken or shown proof by the participants parents, which must be seen as a limitation since the accuracy and validity of the diagnosis cannot be controlled for. Furthermore, across the studies the sampling strategies vary as well and thereby increase the risk for a bias. Most studies recruited participants from institutions and clinics specifically for ASD, but some relied on advertisements only, which is a weaker indication for the correctness of the diagnosis than the clinics. The recruitment strategy as well as the assessment of ASD both bear risks to the validity of the diagnosis due to potential biases.

Same holds true for future thinking. The aim of this research is to understand the facets of future thinking and how it is assessed, yet so far, no clear statement can be made about the most sufficient and suitable way to measure future thinking. This distinction is necessary to understand which measurements should be included in such a review but as it is not yet defined what the best way is, this is rather difficult. Also, it ensures the assessment criteria are applied correctly and thus the results are not distorted. Moreover, since no clear measurement tools exist, the ways of assessments varied to a great extent in the reviewed studies. Especially striking is the fact that some studies found partial difficulties. Whether this is caused by biased test procedures or tools, cannot be stated. However, the tests should be replicated to investigate this further.

Another limitation is the homogeneity concerning the origin of the study as well as the gender, which can be a source of distortion across the studies. The target group consisted mainly out of Europeans and the vast majority is male. This could also be explained by the fact, that ASD is more common among boys (Hodges, et al., 2020). Nevertheless, it cannot exclude that cultural or biological components influence the results as few other cultures or females in general are not frequently included in current studies. An inclusion of a more diverse target group would heighten the reliability of the results.

Regarding the validity of the measured studies, in order to ensure this in cross-sectional designed research, a broad number of participants is required that describe the whole population of the target group (Boddy, 2016). Some studies have sample sizes above 100, whereas other studies have respectively small sample sizes and are thus to be interpreted with caution. This is especially interesting as Anger et al. (2019) and Quinn et al. (2019) used small sample sizes for their research and they are the only studies analysed that did not find difficulties in future thinking by participants with ASD. Whether or not the findings would differ with a larger sample needs to be explored in future research.

Moreover, Quinn et al. (2019) measured purpose in life, which is a different concept than episodic future thinking. To develop personal purpose in life it is necessary to have an *intention*, to be able to imagine it (*simulation*), and eventually putting it in *planning*. Hence, resemblances to episodic future thinking are given. Nevertheless, Quinn et al. (2019) also had a respectively small sample size which might bias the results. Therefore, taking the fact that this study did not precisely measure future thinking, and used a small-scaled sample size, it must be said that it is to be excluded retrospectively.

Strength of this review is that to current knowledge it is the first systematic literature review about the current stand of research about how children and adolescents with ASD engage in future thinking and what type of future thinking is assessed. In this research a grounded systematic review has been conducted using multiple data bases based on their fit to the psychological topic and scientific accuracy and professionalism. All selected data bases were scanned according to the same criteria and thus enabling good validity as well as reliability when collecting the articles, which improves the quality of this study. Thus, it can be said that the application and selection of the method in this research is a strength.

Moreover, the focus of the multiple subtypes of episodic future thinking in respect also to self-related and non-self-related future thinking is unique as well. Hereby this gap in literature could be filled. Finally, the focus on children and adolescent in this niche of research has been underrepresented and this paper aids in equalizing this discrepancy. Finally, this paper detected further literature gaps and thus bear ground for various follow-up studies and further research.

### **Implications for practice and recommendations**

In order to get an understanding of what is the most sufficient way to assess future thinking, a comparative study should be conducted. Here, the same sample should be assessed by various means, such as *simulation*, *planning*, *intention*, *prediction*, anticipation and

purpose finding, to identify possible differences and similarities. By this, a more valid statement can be made about which measurements bear the most reliable and valid results.

Besides the assessment of future thinking, also the assessment of ASD can be improved. The investigated studies used different approaches to diagnose ASD and thus it could not be controlled for that all participants are equally diagnosed with ASD. It is recommended to compare the same requirements for recruiting ASD participants to eliminate potential bias and distortion.

Additionally, it is found that children with ASD have difficulties in anticipating their own future but are able to engage in future thinking when it does not regard themselves. This is a topic to be looked into further, so programs and classes for ASD children can adapt their curriculum. A recommendation could be that while the typically developed primary school class gets the task of writing a letter to their future self, an autistic child should get the additional information to focus in this letter about their personal development and achievements instead of general events. By this, they get further encouragement to practice future thinking.

Furthermore, tailored training programs should be developed for children with ASD to train their self-related future thinking. As described in the beginning of this paper, being able to engage in future thinking properly is of multiple benefits, which children with ASD might be missing. Thus, a recommendation is to develop a program or training in which participants with ASD learn to adapt methods and tricks to improve their future thinking. Potential studies or trainings could include the following elements: adapted explanation of theory of mind, future thinking and the benefits, tailored to the understanding of children with ASD, tasks, such as the letter writing or thought experiments. Further, such a program could be implemented in clinics or institutions for ASD patients, since future thinking develops over time and accompanying the child for a longer period of time could be of greater help. By this, each step in the development of future thinking could potentially be supported and trained.

Furthermore, besides the study done by Naito and colleagues in 2020, all studies are conducted in European and North-American countries, so individualistic cultures, while collectivistic cultures are rarely investigated. As collectivistic cultures hold different key values it is likely that they also regard future differently and thus engage differently in future thinking (Trendis, 2001). Besides the ethnicity, the gender is of question as well. Even though ASD has a higher prevalence in male, it could be of interest to investigate females with ASD as well. Females are often overlooked in ASD research, but understanding better how it manifests in boys and girls, and whether there might be a difference can be of help. Especially

with regard to schools, who should enhance future thinking in children, it is also necessary to understand how future thinking looks in females with ASD.

## **Conclusion**

To answer the main research question, “*What is known about the extent to which children and adolescents with autism spectrum disorder (ASD) engage in future thinking?*”, it can be said that, in the vast majority of literature, it is known that children and adolescents with ASD show difficulties in future thinking. However, children and adolescents with ASD appear to engage more sufficiently in future thinking that is not self-related, than in self-related future thinking. Still, literature still bears multiple gaps regarding this topic and thus displays the need to engage further into it.

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