Communication Trajectory in Children with Autism Spectrum Disorder

A Systematic Literature Review

Shima Chloe Foster

One Year Master Thesis 15 credits
Interventions in Childhood
Disability Research
Spring Semester 2019

Supervisor: Mats Granlund
Examiner: Eva Björck-Åkesson
ABSTRACT

Author: Shima Chloe Foster

Main Title: Communication Trajectory in Children with Autism Spectrum Disorder
Subtitle: A Systematic Literature Review
Pages: 30

Stability of diagnosis, symptoms and functioning across the life span is central to understanding any disorder and yet remains a relatively unexplored area in the study of autism (Sigman & McGovern, 2005). This is particularly apparent in the development of communication, including social interaction and language development in children with autism spectrum disorder (ASD), as there is little research on longitudinal development of children with ASD in general. The outlook on ASD has changed throughout the years, and although the emphasis on speech delay and communication problems have been separated from ASD, it is still one of the most common causes of initial referral in autism diagnoses (Pickles, Risi & Lord, 2004). Understanding the trajectory of communication for a child with ASD is fundamental in providing support and intervention in early years development. As communication is also a primary indicator on later development, it can gage outcomes into adaptive skills, school achievement and adult independence in later adult life. Eleven articles were identified in order to systematically review longitudinal studies based on communication development in ASD, or lack thereof, and why it is important to further carry out research in this area.

This review seeks to explore: 1. How the development of different communicative functions in children with ASD is related to change over time. And, 2. What aspects of the child’s proximal processes and/or the child’s characteristics are discussed during measurement periods. Communicative functions were the most common form of communication observed in the studies at assessment periods and as for time points; two assessment periods were most common showing a linear trajectory of progress or decline from time point 1 and 2. All studies discussed aspects of child characteristics, most predominantly being gender and I.Q., however lacked insight into the significance of these and factors of proximal process during measurement periods in the studies reviewed. Ultimately, results display a need for more studies with at least three time points. With two time points only comes a “before” and “after” perspective, whereas, three or more time points enables collection of waves of data, showing key predictors of change in communication in children with a form of ASD.

Keywords: social interaction, communication development, autism spectrum disorder, longitudinal, trajectory, measures
# Table of Content

1 Background ............................................................................................................................................ 1

1.2 Autism Spectrum Disorders & its measuring tools ........................................................................ 2

2 Theoretical Framework: Bronfenbrenner ....................................................................................... 3

  2.1 Proximal Processes ....................................................................................................................... 3
      2.1.1 Proximal Processes in context .............................................................................................. 4

  2.2 Child characteristics .................................................................................................................... 5

  2.3 Child environmental context ....................................................................................................... 5

  2.4 What is Communication .............................................................................................................. 6
      2.4.1 Form .................................................................................................................................. 6
      2.4.2 Content ............................................................................................................................... 7
      2.4.3 Function .............................................................................................................................. 7

  2.5 Longitudinal Studies .................................................................................................................... 8

  2.6 Rationale .................................................................................................................................... 8

3 Aim & research questions .................................................................................................................. 9

4 Method ............................................................................................................................................. 10

  4.1 Design: Systematic Literature Review ....................................................................................... 10

  4.2 Search strategy ............................................................................................................................ 10

  4.3 Selection process ........................................................................................................................ 12

  4.4 Quality Assessment ................................................................................................................... 13
      4.4.1 Second and third reviewer ................................................................................................. 13

  4.7 Data Analysis ............................................................................................................................. 13

  4.8 Ethical considerations ................................................................................................................ 14

5 Results ............................................................................................................................................. 14

  5.1 Overview of results ..................................................................................................................... 14

  5.2 Results corresponding to Question 1 .......................................................................................... 17

      5.2.1 Form, communicative functions and content ...................................................................... 21

      5.2.2 Time points ........................................................................................................................ 21

      5.2.3 Time between time points ................................................................................................ 21

      5.2.4 Changes & stability .......................................................................................................... 21

  5.3 Overview of results for question 2 .............................................................................................. 22
I Background

Diagnosis of ASD is on the rise, effecting around 700,000 people in the UK, (National Autistic Society, 2018). However there is limited research on the trajectory of the development of communication for children with autism spectrum disorder (ASD). That this lack is acknowledged now is partly due to the change of belief in epidemiology of ASD. In the early 1960's, there were many discrepancies in the origin and causation of ASD and speculation on ASD being exacerbated by cold parenting, referred to as "refrigerator mothers". By the 1980s ASD was seen more as a deficit having physiological reasons and a new legislation was passed in the U.S. to allow more resources to support individuals with ASD (Miller et al, 2011). Language development was also seen as a core feature of ASD, but was later deferred to a secondary feature, noting that it was dependent on the course of the ASD in the individual (Barahona-Correia & Filipe, 2016). This proves the importance of how communication is formed within the developmental trajectory of children with ASD and its course over time, taking into account the environmental surroundings of the child and measurement periods through time. Importance of the two concepts of stability and change in life; "issues of continuity versus change through the life course" (Bronfenbrenner, 1999 P. 3) necessitates a deeper look into contributing factors hindering or promoting communicative development. A child with ASD may not only have a delay in language development, but difficulties in all communicative functions, therefore it is essential to identify measurement tools which assess the trajectory of the child’s communication considering the environment, typical behaviours or symptoms of ASD and the unique characteristics of the child.

The selected eleven articles describing longitudinal studies of communication will be analysed in reference with the devised protocol (See appendix A). The study aims to answer two main research questions. Bronfenbrenner’s Biocological model (1994) will be used in conjunction with this paper to serve as a backbone assessing the communication trajectory and contextual background of the child. Following the procedure of a systematic literature review (SLR), firstly the study will look into ASD, its measuring tools and the significance of longitudinal studies, to get a firm grasp on the variation across the studies. Then, exploration into Bronfenbrenner’s biocological model (1994) will be discussed as a reference to the theoretical framework used in this paper. Thirdly, the concept of communication will be broken down into 3 main forms: form, content and function. And, finally the results and discussion will be presented in response to the two research questions and theoretical framework. This review aims to contribute to understanding how communication trajectories have been measured longitudinally in children with ASD, the change or stability of such trajectories, as well as uncover the importance of contextual and child characteristics in these scenarios.
As mentioned, this review draws from Bronfenbrenner’s (1994) bioecological model, which will be discussed in more detail later on in this section. Briefly, Bronfenbrenner’s (1994) model supports the need to better identify child characteristics as well as contextual information to understand how to measure communication development and obtain a more successful outcome. Because of the shift in belief and diagnosis related to the medical and psychological understanding of ASD, it is important to critically review longitudinal studies on communication in ASD when attempting to assess natural trajectories of communication and language over an extended period of time with reasonably spaced intervals of measurement (Willet, Singer & Martin, 1998). Children with Autism display a range of critical difficulties in the development of communication and language. Not only does the child’s heredity have an influence on their development, but also their environment (Rutter, 1978). Therefore, as our understanding of what constitutes a successful measurement for ASD is still developing, it is useful to look at the trajectory of communication development across a variety of individuals in a variety of time points.

1.2 Autism Spectrum Disorder & Its Measuring Tools
The emergence of Autism is one that is dynamic and has been in considerable change in diagnostics and awareness. The most current state of diagnosis according to the DSM-V (American Psychiatric Association, 2013); is within a spectrum, which composes of three different forms. These are: autism; asperger’s syndrome, also known as high functioning autism and; Pervasive Developmental Disorder- Not Otherwise Specified (PDD-NOS). Children with ASD are usually formally diagnosed around the age of 3, onset of symptoms, however, may be aroused or detected by parents or guardians from as early as 14 months, (Paul, 2017).

ASD is categorised as F 84 Pervasive Developmental Disorder of Psychological Development. Restrictions in functions of reciprocal social interactions and communication are characteristic for children with ASD according to the World Health Organisation (WHO, 2016, F84). WHO, (2016, f84) also states that further stereotyped and repetitive actions and interest may occur. This is said to affect a child’s ability to relate emotionally and socially with others, significantly impairing their emotional and cognitive learning and development (American Psychiatric Association, 2013). Technically speaking, the amygdala is a function of the limbic system, which is central to emotional behaviour and motivation. ASD is considered to impair the amygdala, preventing incoming sensory stimuli such as environmental cues or facial expressions to be recognised or contextually relevant. It is essential to understand a child’s social impairments and barriers in order to address specific measures related to the development of communication in children with ASD (Lord et al, 2000).

There are various tools used to measure these diagnoses that might have an impact on what treatment and approach will be provided for the child. Within these tools are also a number of different measures in assessing language and communication skills for those diagnosed with ASD. These include some of the following most common diagnostic measures: Autism Diagnostic Interview- Revised (ADI-R; Lord, Rutter, Le Couteur, 1994), Diagnostic and Statistical Manual of Mental Disorders (DSM-V, American Psychiatric Association, 2013), Autism Diagnostic Observation Schedule, ADOS (Lord, et al. 2000), ICD-10 (WHO, 2010).
2004), and The Childhood Autism Rating Scale (CARS). Most commonly ASD will be diagnosed by ADI-R or ADOS, however in the cases of autism, this will be classified as a mental health disability and will therefore be diagnosed by DSM –V, 2013 or by an experienced or accredited psychiatrist (WHO, 2004). Developmental Quotient (DQ) is an alternative form of intellectual assessment more applicable for those with cognitive impairments. The DQ is sometimes found in studies of those with ASD to detect their estimation of I.Q. with a more ASD specific measurement.

These measures are pivotal in gaining an understanding of the severity of the ASD, but has been criticised in lacking insight into the external and internal influences of language and communication acquisition. Bronfenbrenner’s (1994) bioecological model with the concept of proximal processes helps provide a framework in which a transactional process between genotypes and external factors are taken into consideration when assessing a child’s needs and support systems.


Bronfenbrenner’s (1994) bioecological model is developed from his previous model ‘the ecological model’ (1979), as a more defined separation of the two concepts of processes and environments. The processes are highlighted as a central function not only in child’s characteristics, but also to the contextual environment (Friedman & Wachs, 1999). With this notion, different systems within the model can be assessed as a transactional process, with each level having an influence and outcome within a hierarchical paradigm. It is beneficial to use Bronfenbrenner's (1994) model as a framework to conceptualise the trajectory of development in communication in a child with ASD. It incorporates an ecological overview on the child, and what may be of hindrance or support for further growth and development. For example, a child with ASD may typically have delayed language acquisition, however depending on the child's ecological systems, and severity of the disorder, this may change the outcome of the child's progression. It is important
to evaluate all necessary components of the child's environment; the more levels assessed, the more instrumental the intervention becomes.

2.1 Proximal Processes

Proximal processes are the mechanisms “…through which genetic potentials for effective psychological functioning are actualized” (Bronfenbrenner & Ceci, 1994 p. 568). The proximal processes are described as a process that is central to human development. This is a process whereby the developing child interacts with people, objects and activities in their most immediate environment. The effectiveness of these proximal processes are reliant on the frequency and complexity of the tasks also (Bronfenbrenner, 1999). Process-person-context-time- model (PPCT) incorporates four aspects of an interdependent model whereby proximal processes can be actualised. The child’s characteristics are central to this model, influencing the direction and form of the four elements, as well as the outcome, as the characteristics grow and develop over time. Therefore, the characteristics of the child are seen as both a producer and product of development: A further five components are necessary for effective proximal processes to be functional;

- Engagement (importance within proximal processes);
- Time (must occur over an extended period of time);
- Complexity (increases over time);
- Initiation and response, and;
- Inviting, engaging (objects)

This theoretical basis is invaluable to assessing longitudinal data concerning the trajectory of communication development in children with ASD and for operationalising processes within the studies to fit with developmentally sound theory.

2.1.1 Proximal Processes in context: Communication development & proximal processes

The importance of proximal processes in language acquisition and communication skills is vital to the child’s development. Fundamental milestones in human development are heightened when the child is engaged and motivated in the specific task or activity. Therefore, the opportunity for growth and learning to take place will be more attainable under these circumstances. A fundamental process in communication and social development is the child’s interactions with peers and objects in their immediate environment. However, as mentioned above, with impairment to the amygdala, motivational cues can be affected, meaning it is considerably more important for reliable measurements to be executed for the child to achieve optimal proximal processes for increased chances of communication development (Dapretto, et al, 2006).

For example, more intense interventions are suggested for those with ASD than for other disability groups, and they typically involve the parent in a multidisciplinary approach (Miesels & Shonkoff, 2000). The positive or negative outcomes for a child’s proximal processes also rely on the influence of the differ-
ent levels such as the community the child lives in or a family’s socioeconomic status. A child displaying ASD behavioural characteristics may require the parents to be more knowledgeable or educated and may also require more resources. For example, this could include experts like speech and language therapists, and/or support within the community and outside the family’s domain (Bronfenbrenner, 1999). Equally, typically developing children learn from their everyday environments, however those with ASD may not to the same degree and may necessitate different approaches and more support. Therefore, it is necessary for an adapted and individualised training environment to be implemented (Sameroff & Fiese, 2000).

2.2 Child characteristics
As discussed earlier, the unique characteristics of a child hold key information that is central when understanding the child’s development. This could include the following: age; ethnicity; gender; I.Q.; family; comorbidity. These then can be assessed against the child’s ecosystem, including the cultural context, social economic status of their family, the time in which the child is born (chronosystem) and family rituals (Sameroff & Fiese, 2000).

Children of typical functioning start to develop communicative functions from a very early age, and should show signs of social interaction including babbling, eye gaze and intonation in vocalization depending on interests and happiness/unhappiness (Humber.NHS.UK, 2018). This may differ in children with ASD showing signs of speech and communication delay from 2 months of life, with a failure to articulate sounds and syllables or difficulties in adapting to their surroundings which may be of hindrance to their proximal processes and as a consequence, their communication development (Ornitz, Guthrie & Farley, 1977).

Many key developmental stages take place during early human development. This is important to take into consideration when measuring communication, especially in children with a diagnosis such as ASD and between the ages of 6-36 months, which is a common age to be measured for language development. Depending on the child, and the severity of the disorder, this may cause impact on the trajectory of communication, hence why it is necessary to gain as much information on characteristics of the child as well as the disorder at as many time points as possible.

2.3 Child Environmental Contexts
The macro level (Bronfenbrenner, 1994) is described as ‘the attitudes and ideologies of the culture.’ This incorporates ideologies of those in a child’s community, school, family, and cultural environment. Furthermore, Coulton, Korbin, and Su, (2002), discuss social causation and how certain factors can influence the trajectory of child development and their outcomes. Social normative roles can be described as what some people believe to be typical or formalities in said group. This could mean a typical action or appropriate action (Paluck & Ball 2010). Within the progression of behavioural and social sciences, advancements and intervention necessitates. This is dependent on key aspects of child development and the construct of the society in which the child is positioned. With regard to the child’s external environmental influences, further understanding can be gained in processes of child rearing, and affects of the child on
the environment (Brim, 1975). Social normative roles could include any of the following aspects in a child’s environment: educational roles, community roles, developmental role (transitional periods) and family roles. When assessing the child’s developmental progress, it is important to measure against key developmental milestones in typically functioning children and those with ASD. When discussing child characteristics, it is useful to gain insight into the child’s environmental context as well as the child’s genetic information. Bronfenbrenner’s (1994) bioecological model provides a concept of how transactions between the child’s characteristics and their social and physical environment can either have a negative or positive effect on the child’s development. This is dependent on a number of determining factors from the child’s ecology including the following: education; financial status, and; their housing situation.

2.4 What is communication?
Communication is considered a fundamental human right that every child should be entitled to whether they are in need of special support or of typical functioning. According to the United Nations Conventions of the Rights of the Child (UNCRC), Article 12 & 13, and in particular article 23 in regards to a child with a disability, states that the child is entitled to express their own wishes depending on whether they have the capacity to do so or not (United Nations General Assembly, 1989). However, this vital right is heavily reliant on the communicative abilities of the child and whether the environment around the child permits this or not. Communication is described as a transactional process between the transmitter and recipient. It can be broken down into 3 main types of communication; form, content and function (Silverman, 2008). This is displayed below in Figure 2.

![Diagram of Communication](image)

Figure 2. Conceptualising communication.

2.4.1 Form
Language can be defined as a concept built up on an individual’s preconceived understanding of a repertoire of mutual verbal and nonverbal cues (Silverman, 2008). Mature language development should act as a process whereby intent to communicate between persons and cognitive processes are expressed (Papeliou & Trevarthen, 2006). Research suggests that this developmental function should take affect between 8-13 months of age within typically developing children (Bakeman & Adamson; 1984). Pre-linguistic behaviours include joint attention; turn taking, imitation; request and response and; anticipation to social situa-
Those diagnosed on the lower end of autism spectrum, tend to acquire several different methods of communication. This includes non-verbal communication; gestures, gaze and behavioural indicators as well as spoken language. The use of Picture Exchange Communication System (PECS), or even Augmentative Communication Devices (AAC) which may as a result augment these natural methods. Because of the array of ASD symptoms it is difficult for even an experienced professional to determine the course of language development for a child with ASD. Although, current research has allowed insight into early indicators of language growth, these, heavily rely on a child's pre-linguistic behaviours and parent-child interactions (Brady, Marquis & Fleming, 2004). Standardised testing for language acquisition in children with a disability has also been criticised, as they often need a form of speech. Some forms of ASD include those that are non-verbal as well as limited ability in speech, making the standardised testing trivial in ASD. Research also suggests that the rate of language acquisition is highly related to pre-linguistic communication, and thus defines the complexity of their language development in later life also. Therefore, it is beneficial to find an appropriate measuring tool to assess the pre-linguistic behaviours of children with ASD, in order to suit a method of intervention or support.

2.4.2 Content

Content is that of which involves aspects regarding the subject matter behind communication, for example, Theory of Mind (ToM). This is very dependent on age and developmental milestones within a child. It can also be explained as the cognitive process behind human behaviour such as intention, desire and belief (Baron-Cohen & Bolton, 1993). Implicit understanding of some of these concepts originates during infancy, yet development during the ages 3-6 is when these concepts start to take shape and become fully pronounced (Carpendale & Lewis, 2004). Research suggests that it is difficult for children with ASD to grasp certain concepts of ToM including false belief tasks before the age of 13, and may continue thereafter (Carpendale & Lewis, 2004). It is beneficial to gain insight into the trajectory of children with ASD and their capabilities of forming content and theory of mind in relation to their communication development.

2.4.3 Function

Communicative functions essential to a developing child involve the following; Social interaction, joint attention, and behaviour regulation; which is described as the monitoring and regulation of attention of another person (Charman, 2003). As a child acquires new skills and functioning, repeated social interactions will take place between the caregivers and child. Within typically developing children, research suggests that the ability to direct the care-giver’s interest in an activity or an external object typically forms between the ages of 9 and 15.
months. This is more commonly termed as ‘joint attention’ (Siller & Sigman, 2008). Important transformations are usually surfaced during the latter part of the first year of the child’s life, which include joint attention skills. Through object permanence, joint engagement skills can be actualised, which forms the basis of human interaction and social communication (Adamson, Bakeman, Deckner & Nelson, 2012). Subsequently, when a child starts to acquire new language and formulate new vocabulary, the objects evolve into symbolic measures, producing the fundamentals for eventual human communication and expression.

A common error/ misconception in recent research on joint attention and children with ASD is that research predominantly focuses on child only measurements, and their engagement with an inanimate object, often within an unnatural environment such as a laboratory (McCrimmon & Rostad, 2012). This can be misleading as based on our pre-understanding of social interaction skills, shared engagement and motivation is what drives a child to maintain or gain eye gaze or attention in an object or subject matter (Adamson & Bakeman, 1991). Another definition of social is “Socially acceptable learned behaviours that enable a person to interact with others in ways that elicit positive responses and assist the person in avoiding negative responses” (Elliot, Racine & Busse, 1995. P1005). Basic social skills that typically functioning children acquire encompass turn-taking, initiating conversations, through modelling of experiential behaviours and trial and error (Bellini, 2006). However children with ASD may need more explicit teaching in order to gain these key social skills. Bellini, (2006), also devices three categories as key components for social interaction to take place in children with ASD. These are: "thinking", "feeling" and "doing".

2.5 Longitudinal Studies
Longitudinal studies are designed to observe development in characteristics of the same individuals in at least two time points but preferably more. This study design enables insight into specific internal traits of individuals, syndromes or characteristics, but also environmental change that may influence the individual and vise-versa. The time frame in which longitudinal studies are presented in is also of great importance. For example, correlations between long periods of assessment (years, decades) between variables will significantly differ to correlations between short intervals (hours, weeks, months). Measurements used at time points are also of significance, as change in measurements may alter the outcome of the study drastically, and therefore may not provide a reliable view of the course analysis (Hofer & Piccinin, 2007).

2.6 Rationale
Children with ASD are often marginalised or excluded from mainstream education, or find it hard to be placed into special needs education with a curriculum that best suits their communicative needs (autism-alliance.org, 2018). This can continue directly into their adult lives, which also impacts other domains of their lives including mental health, general wellbeing and assisted care. This then also means that prolonged interventions and support systems are needed, requiring more time and putting financial strain on the macro/governmental level (Early Intervention Foundation.org, 2018).

Most studies show a linear trajectory of their communication development only measuring two time points as a “before” and “after” perspective. In order to accurately assess the natural trajectory of a child
with ASD’s communication development, it is necessary to measure their development several times, distributed at sensible intervals and using different forms of measurement in order to gain as much information from the child and their surroundings as possible (Willet, Singer & Martin, 1998). From this, appropriate interventions and assisting tools can be implemented to support the child's development and growth to their full capacities.

3 Aim & Research Questions

Aim: To evaluate what studies report about the trajectory of communication in children with ASD over time.

Research Questions:
1. How is the development of different communicative functions in children with ASD related to change over time?
2. What aspects of the child’s proximal processes and/or child characteristics are discussed during measurement periods in the studies?
4 Method

4.1 Design: Systematic Literature Review
A systematic review requires a thorough search process formulated around the author’s research subject, aim and questions. It necessitates various steps to undertake in order to reach an outcome of carefully selected literature to review and form a non-biased account on the subject. Based on White and Schmidt’s, (2005) example, the steps the author undertook were as follows:

1. To frame question and formulate the two research questions related to the topic: From this, the protocol was then devised which in essence is an expansion of the research questions in the form of a “measurement tool”.

2. Identification of relevant work: this was performed through searching appropriate databases relating to the research questions and the use of search words and specifications. From this, a title and abstract screening was performed from related articles. It was important at this point to maintain cross-reference to the devised protocol spreadsheet throughout the process. Subsequently, two authors here confirmed whether the articles coincide with the inclusion criteria and which articles to select or not.

3. To extract data: this was done by use of an extraction sheet, with specific criteria significant to the topic and research question’s demands. This then enabled exact data to be extracted from the selected articles, and to be checked by the second and third reviewer independently to eliminate any possibility to form biased results. Using a standardised means of quality assessment that was adapted to the applied criteria performed this.

4. Summarised evidence and;

5. Interpreted the evidence given.

“A systematic review is therefore a piece of research in its own right and, by its nature, is able to address much broader questions than single empirical studies ever can (Baumeister, 1997). This review will aim to satisfy both White and Schmidt’s (2005) criteria as well as that of Baumeister (1997).

4.2 Search Strategy
Thus, with the above steps in mind, the search process for this study was initiated in early Spring, 2018. Firstly, relevant databases were selected in accordance with the topic for this paper. Psychological, neurological and health-related databases as 'PsycINFO, ScienceDirect, CINAHL, Taylor and Francis and Wiley' were used. Within each of these databases, the advanced search option and thesaurus were operated. This enabled key words such as (autism spectrum disorder OR autism), (Major), AND (communication) OR (social interaction) OR (language development) AND (trajectory) AND (longitudinal studies) to be searched. Additional search criteria were publications published in peer-reviewed articles, between the dates of 1985-present, as there were limited results of studies with a methodology of longitudinal data analysis.
As a result, an initial 93 articles were established for screening based on title and abstract level. Cochrane’s *Covidence* (Elliott, et al., 2014), programme was used to perform each level of the inclusion and exclusion process to systematically select relevant studies for this paper. The inclusion and exclusion table is presented below in table 1.

**Table 1: Selection Criteria (Inclusion and Exclusion Criteria).**

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Publication</strong></td>
<td></td>
</tr>
<tr>
<td>- Peer Reviewed Articles</td>
<td>- Book</td>
</tr>
<tr>
<td>- Published in English</td>
<td>- Chapters</td>
</tr>
<tr>
<td>- Full text</td>
<td>- Abstracts</td>
</tr>
<tr>
<td>- Year: 1985 – March 2018</td>
<td>- Study protocols</td>
</tr>
<tr>
<td>- Empirical studies</td>
<td>- Literature reviews</td>
</tr>
<tr>
<td><strong>Method</strong></td>
<td></td>
</tr>
<tr>
<td>- Longitudinal (2 or more time points)</td>
<td></td>
</tr>
<tr>
<td>- At least 1 measure of communication</td>
<td></td>
</tr>
<tr>
<td><strong>Measures</strong></td>
<td></td>
</tr>
<tr>
<td>- Social interaction</td>
<td>- Only Autism Specific Measures</td>
</tr>
<tr>
<td>- Language acquisition</td>
<td></td>
</tr>
<tr>
<td>- Joint attention</td>
<td></td>
</tr>
<tr>
<td><strong>Sample</strong></td>
<td></td>
</tr>
<tr>
<td>- (Majority) 0-18 years of age with ASD</td>
<td>- Comorbidity no more than one diagnosis at same time.</td>
</tr>
<tr>
<td>- All forms of ASD</td>
<td></td>
</tr>
<tr>
<td>- Formal autism diagnosis at time point 1</td>
<td></td>
</tr>
<tr>
<td>- Focus sample group with ASD only</td>
<td></td>
</tr>
<tr>
<td>- Comparison group</td>
<td></td>
</tr>
<tr>
<td></td>
<td>with differing diagnosis</td>
</tr>
<tr>
<td><strong>Design</strong></td>
<td></td>
</tr>
<tr>
<td>- Quantitative</td>
<td>- Case study</td>
</tr>
<tr>
<td>- Qualitative</td>
<td>- Systematic literature review</td>
</tr>
</tbody>
</table>
4.3 Selection Process

An extensive checklist to screen the articles on each level was performed via the specially devised data extraction protocol. (Headings of which can be found in appendix A)

Based upon the two research questions, categories were devised for data extraction to take place. Firstly, title and abstract screening was conducted. This again, was completed through the use of Covidence (Elliot, et al, 2014) by importing all relevant references into the programme, enabling easier and more organised access to begin the screening process alongside the inclusion and exclusion criteria of the protocol. 63 articles were excluded on the basis of not meeting the inclusion criterion of longitudinal methodology, the sample ages being over 18 years of age, and 6 duplicates were found. Therefore, the final number of articles to review on full text level was 30.

From the 30 articles, the most fitting of these in the inclusion criteria on title and abstract basis, were then compiled into a new list on Covidence, ready for full text screening. This was a more thorough reading of each article, in search for responses to inclusion criteria corresponding to research questions. The data
extraction sheet was then used as a skeleton for information to be cross-referenced and checked for relevance and quality. If an article did not fit with the mandatory inclusion criteria, or was of too low quality, this was then excluded on this basis. A further 19 articles were excluded, leaving 11 articles for the final systematic literature review. This was also performed with the help of a second and third reviewer. (See chapter 4.4, quality assessment & 4.4.1 second and third reviewers).

4.4 Quality assessment
The quality assessment was adapted from the 'Critical review form-quantitative studies' (Law, Stewart, Pollock & Letts, 2003) and Westmoreland, (1998), and PRISMA checklist (Moher, Liberati, Tetzlaff & Altman, 2009). Therefore, the criterion for the risk assessment is as follows: 1. Study purpose- does it apply to the research questions in this study; 2. Title, abstract, introduction; 3. Literature.; 4. Theoretical perspective.; 5. Method.; 6. Sampling.; 7. Risk of bias.; 8. Limitations.; 9. Overall rigour. And; 10. Conclusions & implications. Each article was rated accordingly. (See Appendix for full category listings of said Quality Assessment). The rating of the quality assessment was from low, medium to high. 3 of the 11 articles were of high quality (>70% of the quality assessment criteria fulfilled), 6 of the 11 articles were of medium quality (>50% and <70% of the quality assessment criteria fulfilled), and 2 of the 11 articles were of low quality (<50% of the quality assessment criteria fulfilled).

4.4.1 Second & third reviewer
The Covidence programme (Elliott, et al, 2014) was also utilised by adding a second and third reviewer (two colleagues from Jönköping University) to assess the final full text articles selected with the provided extraction protocol and quality assessment criteria. From this, the peer reviewers and author co-excluded a further article due to low quality, leaving 11 articles as the final article selection number.

4.5 Data Analysis
This study carried out a qualitative, deductive content analysis with prerequisite questions and aims, resulting in categories and sub-categories around the concept of communication (function, form and content), child characteristics, ASD information and environmental factors. All of which have been discussed in the background. A thorough data extraction process was performed. This was critically executed with the use of the data extraction protocol and combined quality assessment. Extraction criteria included relevant information of full text articles: authors, title, year; then moved onto a more thorough dissection of each article. The categories were as follows: whether the sample had a formal ASD diagnosis or not, and what assessment tool was used. This was then a further point of exclusion criteria from full text if there was no formal diagnosis at Time Point 1 for each article. Furthermore, the following categories continued are: aim, hypothesis and research questions; key words; whether the main focal point of communication discussion was on language acquisition or social interaction; time points (varying from two or less, or three or more); Measuring tools. Participant information (number, mean, range), and independent variables, which aim to form the child characteristics bias: gender, ethnicity, family, comorbidity, socioeconomic. Throughout the selection and post selection procedure, a thorough data analysis was performed. This was sculptured around the basis of the research questions.
4.6 Ethical considerations
All selected articles were peer reviewed. As the author of the paper, a non-biased approach is taken and attempted not to let pre-understanding and knowledge of working with children with ASD influence the paper. Most studies in this review also include ethical considerations.

5 Results

5.1 Overview of Results
All eleven articles discuss change or lack thereof of communication in children with ASD with a longitudinal methodology. From the content analysis key categories and sub categories were formed in response to each research question. The key categories and sub categories for research question 1 are: the types of communicative function (form, content and function), the time points of assessments taken (2 or 3+ and time in between time points), and the trajectory of communication (change or stability in the communicative functions). And, the key categories and sub categories for research question 2 are: proximal processes (parent-child interactions and child-object interactions), child characteristics (gender, age, I.Q., diagnosis, ethnicity, family, transition periods and developmental milestones) and where the data was collected (home, lab, school). These are presented in tables in accordance with each research question.

Below are the chosen eleven articles displayed in table 2, showing the main information, including title, year, author, country, type of communicative function, time points and time in between time points. More information on these articles can be found in Appendix A: Protocol Headings.
<table>
<thead>
<tr>
<th>#IN</th>
<th>Title</th>
<th>Author, (Year)</th>
<th>Country</th>
<th>Communicative Function</th>
<th>TP</th>
<th>TITTP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Self-regulation and social interaction skills among children with autism across time</td>
<td>Barnard-Brak et al., (2014)</td>
<td>USA</td>
<td>Social Communication</td>
<td>3</td>
<td>2yrs</td>
</tr>
<tr>
<td>3</td>
<td>The contribution of two categories of parent verbal responsiveness to later language for toddlers and preschoolers on the autism spectrum</td>
<td>Hachig, McDuffie &amp; Weismer, USA (2013)</td>
<td>Language Development</td>
<td>2</td>
<td>1yr</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Patterns of change in children with Autism Spectrum Disorders who received community based comprehensive interventions in their pre-school years: A seven year follow-up study</td>
<td>Magiati et al., (2011)</td>
<td>UK</td>
<td>Language Development</td>
<td>3</td>
<td>2yrs, 4-5mnths</td>
</tr>
<tr>
<td>7</td>
<td>Imitation (rather than core language) predicts pragmatic development in young children with ASD: A preliminary longitudinal study using CDI parental reports</td>
<td>Miniscalo et al., (2014)</td>
<td>SWEDEN</td>
<td>Language Development</td>
<td>2</td>
<td>13mnths</td>
</tr>
<tr>
<td>8</td>
<td>A longitudinal study of joint attention and language development in autistic children</td>
<td>Mundy, Sigman &amp; Kassari (1990)</td>
<td>USA</td>
<td>Social skills &amp; Language Dev</td>
<td>2</td>
<td>1yr</td>
</tr>
<tr>
<td>10</td>
<td>Interaction and imitation deficits from infancy to 4 years of age in children with autism: A pilot study based on videotapes</td>
<td>Receanu, (2005)</td>
<td>FRANCE</td>
<td>Social Interaction</td>
<td>4</td>
<td>4mnths, 6mnths, 3yrs</td>
</tr>
<tr>
<td>11</td>
<td>Relations Among Joint Attention,</td>
<td>Bono, Daley &amp; Sigman</td>
<td>USA</td>
<td>Social Interaction</td>
<td>2</td>
<td>12.37mnths</td>
</tr>
<tr>
<td>----------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>IN</em> = Identification Number in Study</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>TP</em> = Time Points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>TITP</em> = Time in between time points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.2 Overview of results corresponding to Question 1: How is the development of different communicative functions in children with ASD related to change over time?

The studies proved to show complexities in how different communicative functions are related to change over time. This could be due to a variety of factors. One being the concept of ‘time’, and how this is perceived according to each author. In some cases this meant developmental progression (developmental milestones/cognitive development), and to others it meant progression in age (biological progression). These two definitions alone have their own complexities, especially in regard to children with ASD. All eleven articles discuss communication development or stagnation in children with ASD to some extent, yet most results prove to be dependant on the type of ASD and severity of diagnosis. This is either explored with a sample group of children with ASD alone (comparing groups within the spectrum; autism, high functioning autism and PDD-NOS), or with a comparison group with a differing disorder- most commonly being intellectual disability (ID). The articles proved to display different focal points of communication depending on their stated aim and purpose. The articles most commonly discuss communication in the means of communicative function, predominantly joint attention, social interaction and behaviour regulation as opposed to language acquisition (form) or theory of mind (content). This emphasises the most frequently observed tool of measurement in children with ASD being based around communicative functions rather than form or content, reflecting their developmental age and typically observed characteristics of ASD.
<table>
<thead>
<tr>
<th>Article (IN)</th>
<th>Categories &amp; Sub-Categories</th>
<th>Time Points</th>
<th>Time Between Measurements</th>
<th>Change or stability in communication development</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Form, Communicative functions &amp; Content</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Language Acquisition</td>
<td>Joint Attention (JA), Social Interaction (SI) &amp; Behaviour Regulation (BR)</td>
<td>Theory of mind</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>X(SI, BR)</td>
<td>X(SI, BR)</td>
<td>X</td>
<td>2 years</td>
</tr>
<tr>
<td>2</td>
<td>X</td>
<td>X(JA)</td>
<td>X</td>
<td>20 mths</td>
</tr>
<tr>
<td>3</td>
<td>X</td>
<td>X(JA)</td>
<td>X</td>
<td>1 year</td>
</tr>
<tr>
<td>4</td>
<td>X</td>
<td>X(SI)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>5</td>
<td>X</td>
<td>X(SI,BR)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>X</td>
<td>X(BR)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>X</td>
<td>X(SI, JA)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>X</td>
<td>X(JA)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>X</td>
<td>X(SI)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>11</td>
<td>X(SI, JA)</td>
<td>X</td>
<td>12.37mths</td>
<td>Dependent of child characteristics and severity of diagnosis</td>
</tr>
</tbody>
</table>
The table shows a general overview of the type of communication observed during time of assessment taken from the content analysis procedure. These are the sub categories, which are: language acquisition, joint attention, social interaction and behaviour regulation. Time points are categorised into two time points of measurement and three or more time points of measurement and time in between measurements are also recorded.

5.2.1 Form, communicative functions and Content
Communicative functions are the most commonly used forms of communication to be observed at assessment periods (9 of the 11 articles). As all 11 articles looked at sample groups of a young age, predominantly between 0-12 months and those with ASD; meaning that these communicative functions are most likely to be observed rather than the other forms of communication such as form or content (language acquisition, theory of mind). The next most frequently observed form of communication was form in language acquisition with 8 of the 11 articles discussing this. This involved early language acquisition such as pragmatics and the British Vocabulary Scales (BPVS) and Expressive One Word Picture Vocabulary Tests (EOWPVT) to measure this. These, naturally, were performed with the older sample groups, as individuals with ASD tend to develop “useful speech” by age 5, being a strong predictor of later adaptive functioning and communication (article 9).

5.2.2 Time Points
Two time points of measurement were the most commonly applied measurement periods, essentially showing a before and after perspective on communication development rather than a trajectory of development. Article 10 is significant in that it shows 4 time points of measurements. This article is of particular importance as it not only has more time points of measurement, but also at sensibly spaced intervals (6 months, 8 months & 2 years). With the sample group’s starting age at 10-12 months, observation of an important developmental period for the children was possible. Also with the use of home video analysis producing more natural and reliable sources of data. This illustrates the potential value of family and session videos for measurements of early signs of autism and it’s trajectory over time.

5.2.3 Time between time points
Most articles show a period of 1-2 years in between measurements (articles 1, 2, 3, 4, 5, 7, 8, 9, 10, 11). This time frame is neither too short nor too long of intervals to collect reliable waves of data. Yet, considering that most articles only had two time points of measurement; it lacks insight into the relationship between communicative functions over time, but just a preview, if you will, of the state of communicative functions in the child at that specific time period. This is also heavily influenced by the age of the sample group and additional factors such as transitional periods, child characteristics or external influences such as cultural or economic factors at that given time.
5.2.4 Changes and stability

Only 4 of the 11 articles had 3 or more periods of assessment. Article 11 being the only article with 4 time points of assessment.

Those articles with 2 time points showed linear progress or decline with their communication development. These articles also tended to record the measurements in unnatural or unfamiliar settings such as laboratories or clinical setting (articles 2, 3, 4, 5, 7, 11). This will be discussed further in results to question 2.

The articles with 3 or more time points were able to show more movement in the trajectory of communication development in the children with ASD (articles 1, 6, 9 and 11). For example, article 10 shows increase in impairments of communicative functions between time point 1 and 2, then stabilised development from time point 2 through to time point 4. Article 10 also showed regular intervals of measurement over a sustained period of time (from 10-12 months to post 4 years of age) displaying observations for the most crucial time of communication development in the stages of human development.

Whereas in articles 1 and 9 they show an increase in impairments from time point 1 through to time point 3 relative to their comparison group. Contrasting to article 6, which shows an increase in impairments between time point 1 and 2, however a decrease in impairment at time point 3. Heightening the importance for more than 2 time points and an evaluation of contributing factors in the child’s environment.

5.3 Overview of results for Question. 2

2. What aspects of the child’s proximal processes and/or information on the child’s characteristics are discussed during measurement periods in the studies?

The studies rarely make use of the child’s proximal processes during measurement periods, and if they do, it is usually in an unnatural or unfamiliar setting such as a laboratory making the use of proximal processes less effective or realistic. More information is provided on child characteristics in the studies, yet mostly just common characteristics such as age, and I.Q. Less information is provided on important contributing information such as family context, cultural background and social economic standing of the child’s family.

As research suggests, children often “perform” better under the right circumstances. If they are in unfamiliar territory, or have difficulties gaining motivation in the specific task at hand they may be less inclined to engage in the activity, referring to engagement in Bronfenbrenner’s (1994) model on proximal processes. Therefore, if the child’s assessment period is taken in an unnatural setting such as a laboratory (articles 2, 4, 7, 8, 11) or without someone familiar present or involved, most commonly, their parent or teacher, results of the assessment period may be inaccurate or unreliable, meaning that a suitable intervention may be difficult to attain. Little information was discovered in terms of the child’s contextual background, and the impact of life roles and experiences during the periods of assessment. And zero studies presented results
in transition periods and developmental milestones in the domain of child characteristics in relation to the measurement periods.

**Table 4. Results on proximal processes, child characteristics and child environmental settings**

<table>
<thead>
<tr>
<th>Proximal processes</th>
<th>Article IN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent-child interactions</td>
<td>3, 4, 5, 10</td>
</tr>
<tr>
<td>Child-object interactions</td>
<td>2, 3, 4, 5, 8, 9, 11</td>
</tr>
</tbody>
</table>

**Child characteristics:**

<table>
<thead>
<tr>
<th>Child characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender, age</td>
<td>all</td>
</tr>
<tr>
<td>I.Q</td>
<td>2, 4, 8, 10, 11</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>5, 8, 10</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>1, 3, 5, 6</td>
</tr>
<tr>
<td>Family</td>
<td>7</td>
</tr>
<tr>
<td>Developmental milestones</td>
<td>0</td>
</tr>
<tr>
<td>Transition periods</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data Collected</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab</td>
<td>2, 4, 7, 8, 11</td>
</tr>
<tr>
<td>Home</td>
<td>1, 3, 5</td>
</tr>
<tr>
<td>School</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 4 aims to explore the types of proximal processes and child characteristics are discussed in the articles. These are broken down into:

*Parent-child interactions:* 4 of 11 studies highlight parent-child interactions. This is typically shown in the method section of their study design, either by collecting data from parent-child interactions, or involvement of the parent in child observations and responsiveness. It is also noted that within these 4 studies, most of them discuss the involvement of the mother-child interactions, as there is little information on the father-child interactions. There is use of home videos as a source of data collection, noting parent-child
interactions more frequently and in an unrestricted manner compared to more conventional methods of measurement involving the parent.

*Child-object interactions:* 7 of the 11 studies indicate child-object interactions during measurement tasks. This was most typically in the form of observations led by examiners on verbal or communicative cues from object stimuli and object manipulation. These measurements were most commonly from standardised testings such as: the Early Social-Communication Scales (ESCS; Seibert, Hogan, & Mundy, 1982), (articles 5,8,11), and the Mullen Scales of Early Learning (MSEL; Mullen, 1995), (article 3).

*Child characteristics:* all of the 11 studies highlighted minor details of characteristics of the children in the sample, such as age and gender and I.Q. However limited information was provided on additional characteristics such as siblings, severity of diagnosis, and ethnicity. Most frequently discussed in the studies was the child’s I.Q, which appeared in 5 of the 11 studies. Following, was the ethnicity, which appeared in 4 of the 11 studies. Further details surrounding the diagnosis, for example verbal and non-verbal abilities was found in 3 of the 11 studies. And, finally, family context of the sample was merely found in just 1 of the 11 studies, in study 10, discussing the child’s number of siblings impacting the intervention provided in the study. Neither developmental milestones nor transitional periods were considered within the eleven studies.

*Data Collected:* the data collected was either in a natural setting such as the child’s home, or school, or in an unnatural setting such as a laboratory. 5 of the 11 studies’ data were collected in a laboratory. 3 were collected in a home setting. And, 1 of the 11 studies data was collected in school, through teachers and examiners observations.

In summary, in response to question 2, broadly speaking, the studies discuss aspects of the child characteristics and proximal processes. However, more critically speaking, they do not utilise them, especially in reference to the categories formulated within the proximal processes and child characteristics.

## 4 Discussion

### 6.1 General overview:
The study aimed to look at communication trajectory in children with ASD over time, and whether the development is stable or not considering different contextual factors. Results regularly showed an outcome of decline in development or of minor change in communication development, dependent on the severity of diagnosis and varied from child to child with ASD. Most studies including a comparison group resulted with the ASD sample group losing communication skills compared with their peer group with a different disorder. However, when assessed alone as an ASD sample group, results in variance were shown due to diagnosis severity and child characteristics. The sample age of studies were typically quite young (on average between 1-4 years of age), making it difficult to discuss contributing factors such as
transitional periods or symptoms of ASD, as most studies suggest that ASD symptoms are more defined after 3 years of age according to current assessment criteria.

The results of studies display a lack of information on the child’s contextual background as well as child characteristics in relation to communication development over time. This proves difficulty in assessing the reliability of whether an intervention or assessment meet the criteria in which is most applicable for the child in question.

6.2 Relationship between communication and change and over time

Most studies support existing research in core language (vocabulary and grammar) being related to pragmatic language (Adamson, Bakeman, Deckner & Nelson, 2012), and also joint attention and communicative functions being a core predictor of form and language development in children with ASD (article 8), though not necessarily supporting the idea that core language is a predictor of pragmatic growth over time (article 7).

The general consensus of the studies suggests that it is dependent on the severity of the ASD diagnosis having the most prominent influence on the trajectory. Even though this is stated in the majority of studies as a limitation, there still remains to be lack of research on child centred interventions and measurements, taking into account their characteristics and assessments that fit the severity of diagnosis.

As stated previously, the more points of measurement, at suitably spread intervals, the more reliable the intervention is (Willet, Singer & Martin, 1998). Because of the complexity of ASD, and the rapid speed of development of children, many influences around the child’s ecosystem and internal developmental processes can impact their communication development. The results of articles with more than 3 time points of measurement show evidence in that the developmental level of children with ASD remain relatively stable (Lord & Schopler, 1989) although, with variables depending on the form of ASD and the measures performed.

For outcomes reflecting developmental aptitude (mental ability, academic achievement, and social skills), proximal processes are suggested as having greater impact in more advantaged and stable environments (Bronfenbrenner, 1999). The developmental effects on children will depend on the quality of the environment. For example, the manifestations of dysfunction in children are likely to be more severe with an environment with disorganisation and deprivation. This is particularly important, as there is still a lack of research on symptoms of ASD especially at an early age (before 3 years of age, being that of a typical age of diagnosis). With more studies of environmental factors and child characteristics, identification and further knowledge of specific symptoms of ASD can be determined. The complexity of ASD symptoms and diagnosis also adds to the need for more longitudinal methods of research into the field, especially in terms of communication development.
6.3 Environmental Context and changes over time
The relationship between parent linguistic input and later language gains differ according to child’s stage of language development (article 3) reinforcing the significance of proximal processes, most specifically parent-child interactions. Sameroff and Fiese (2000) describe a transactional model whereby the child and environment exchange a series of differences, highlighting the role that the child plays as well as how it influences its environment also. This particular example results in a negative outcome of language delay, with the root cause being the child’s biological dysfunction; impacting the mother’s anxiety. This highlights the importance of observing the child’s proximal processes at measurement periods. Only 4 of the 11 articles displayed parent-child interactions at assessment periods (primarily mother-child interactions as opposed to father-child interactions) also contributing to the outcome of the assessment. This emphasises the need to assess as much as the child’s environment, especially the proximal processes as this can directly impact the development of the child’s communication, being that it is a core developmental function at an early age.

Bronfenbrenner’s (1994) Bioecological model, provides a framework to contextualise a child’s ecosystem and what interactions are most prominent to them, especially during the early stages of their lives. Results, however showed limited information in this area, and if shown lacked consistency in follow up of the studies which also led to addressing this issue in the further considerations section of the studies. 4 of the 11 studies highlighted parent-child interactions during measurement periods. However, some of these interactions took place in an unnatural setting, such as a lab, therefore could present misleading results. This was also similar to child-object interactions. As existing literature informs us, the importance of child interactions is motivation and engagement. The setting may also induce many features of ASD including behaviour problems that in turn can further interfere with the accurate assessment of the child’s abilities. It is important to implement the measurement that best suits the child and to be placed in a setting that the child feels comfortable e.g. home or school environment (Akshoomoff, 2006).

6.4 Methodology and impact of studies with more than 2 time points
This section draws from two of Bronfenbrenner’s (1994), categories of proximal processes: 1. Time (must occur over an extended period of time) and; 2. The complexity (as it increases over time) and is in response to research question one; how the development in communication is related to change over time.

The majority of studies assessed two time points in communication development in children with ASD. However, this causes limitation into in depth knowledge on a reliable trajectory, as two time points only gives a glance into intervention outcomes or communication measurements over a specific fixed period of time. With the use of an extra time frame, it enables movement into the trajectory of development, and allows insight into key information i.e. environmental factors on a micro or macro level, or genetic information more specific to the child’s syndrome, which may have hindered or promoted developmental changes. It also gives indication of individual change, and the rate of change according to that individual
or sample group being monitored.

The concept of time is one that can be precarious, and differs from person to person and context. Each individual may have different values in their individual growth parameters. The communication trajectory in some children with ASD may develop rapidly with age, whereas others may remain relatively stable as time passes or even decline as the articles have displayed in this study.

Waves of research, or frequently assessed periods of time in a child’s young life enables investigation into whether individual growth trajectory differ from person to person and if within the individuals, they are systematically related to contextual variables. These could include child characteristics, or the child’s environment. As the studies included in this SLR did provide some contextual information on the child’s variables including child characteristics (I.Q., family, ethnicity, etc.) commonalities in variables, which may hinder/promote development into a homogenous group, can start to be assessed. With the use of more time points, in a longer time frame, these variables may add to concrete factors of change within a specific group in a specific context. This is also depending on many different factors and levels such as cultural, economical and developmental. Therefore encouraging the need for more longitudinal research in this field, to explore as many of these avenues as possible, in order to gain a fuller understanding of communication trajectory in children with ASD.

Research suggests that diagnosis early on in life predicts later adult life, but with the use of longitudinal research in this area, it has been demonstrated that the majority of children who experienced such biological conditions did not have intellectual or social problems later in life (Sameroff & Fiese, 2000). Sameroff and Fiese, (2000) also discuss a transactional process whereby the child’s characteristics influences its environment meanwhile the environment also impacts the child’s development. This is similar to Bronfenbrenner's bioecological model in that it deals with the notion of nature vs nurture in the early developmental stages of the child. The more levels assessed in the child’s environment, and genetics, the more reliable the measurements can be.

As article 10 proved most reliable in terms of method (home video tapes), and time points (4 points of measurements), and matched to this study criteria, it is also interesting to note that the journal of publication is autism specific (The National Autistic Society, 2005). Most other articles included in this SLR were from journals of speech, language and communication disorders or mental health journals. This is important to acknowledge, as there should be common language across different journals, especially within disability research. This is to ensure all professionals working with ASD have a common understanding and agreement on how best to approach and intervene with communication in children with ASD.

6.5 Tools of measurement

Most common tools of measurement in the selected studies were the Early Social Communication Scales
(ESCS, Reynell developmental language scales and the ADI-R scales. Some studies also chose to use a comparison group to assess communication development. However, it is unclear as to how applicable some comparison groups were. For example, in some studies, comparison groups were matched on mental age or IQ level, without an ASD diagnosis (article 8). The focus then, did not seem to be on language but overall IQ instead. This can evoke questions of unreliability with the measurements. Participants matched on a DQ level seemed to be of best fit (article 10). From initial assessment of DQ, researchers were able to separate the participants with ASD into two groups.

The studies also show the complexity of the different forms of ASD adding to the difficulty in assessment of communication development. Those of a younger age face more issues in measuring communication, even though research suggests the earliest possible point to measure communication development, in order to intervene at an earlier stage. As discussed earlier, those on the lower end of the spectrum, or with no speech may require speech aided devices to prompt communication, yet these seldom seem to be included in any standardised testing.

6.6 Limitations of review
Being the single author for this systematic literature review causes an element of unreliability and bias. Key articles may have been excluded on this basis. A wide search was attempted via the use of 5 databases, however still creating possibility of missing key articles from other databases available. With the use of two reviewers during the selection process stage, these biases were reduced. In addition, to further this study the need for more search criteria to enhance the theoretical support for the two research questions is necessary. Upon further analysis, this could include search terms related to socio-normative roles, such as: community based interventions, social policies for children with ASD.

Included in this study was an article taken from a larger study (article 1). This could cause unreliability in results of this systematic literature review as the results from the larger study can be seen as generalisable as the sample size was that of a larger participant size (1,016) participants in total. Some studies also solely focus on loss of skills (study no. 5) resulting in biased outcomes and a low rating in the quality assessment scale taken prior to this study. However, this study is still beneficial to look into as it necessitates a better understanding in why there’s a loss of skill, and what aspects may be a contributing factor to this.

Most studies agree on the limitations of their studies being the need to consider the relationship between the child and their immediate environment when measuring their communication development. It is stressed that meaningful input for children that are of typical functioning tends to be more common as oppose to those in need of special support (Article 8). However, with support from earlier studies, it is essential for children in need of special support, especial those with ASD, as related to this study; to receive greater reinforcement from parental figures during their core language development.

6.7 Methodological Implications
It can be argued that a systematic literature review can be controversial as it provides barriers in producing any “new” material as it simply collects and regurgitates information that already exists in current litera-
ture. It does not utilise interaction with people and clients to gain new information and data surrounding the topic at hand, unfortunately missing valuable and necessary phenomena that should be at the base of research.

6.8 Discussion on Quality Assessment
As the studies found were already limited in number, some articles of low quality on the devised quality assessment scale were included in this systematic literature review. In the future, it would be advisable to only include those studies of a higher quality in order to produce more reliable findings.

6.9 Future Research
As each article in this systematic review highlighted the need for more measurement periods, further research avenues would be to look more into measurement tools used in communicative functions in children with ASD, and the use of these tools more frequently over time.

Through this study, the importance of refining both the measurement and definition of the child’s abilities, with the adoption of longitudinal design is central to understanding the fundamentals of later communication outcomes. With this, support in finding a suitable intervention or strategy to address the characteristics in ASD and to support growth and development in communication for children with ASD.

This systematic literature review attempts to review the trajectory of communication in children with ASD and how it is measured connecting with different variables such as time, environment and genetics. In research, and especially within health care and disability studies, it is always important to gain the perspective of the client or sample group. Future research should incorporate those with the clients “voice” with the use of communication aids as discussed in the background, or other means to express the child’s progress from their point of view. It would also be beneficial to look into gender differences in ASD, as through research into the background of this paper, studies and statistics show, ASD is more commonly diagnosed in males than females.

One of the biggest limitations in this type of longitudinal research is gaining and following a sample group for a long period of time. Many studies included sample groups with drop-outs due to multiple factors including families moving away, ethical issues or change in diagnosis. With these issues, more participants are needed for future research. In some cultures, there is still stigmatism surrounding neurodevelopmental disorders such as ASD, perhaps contributing to a lack of participants in current studies. With a change in societal norms and perspectives, and more awareness around the disorder, encouragement to involve more participants may be possible.
5 Conclusion

Studies show stability or slight decline/incline in communicative development in a child with ASD, being highly dependent on the child’s severity of diagnosis and child characteristics. The relationship between different communicative functions in children with ASD and change over time can be assessed on a number of different levels; the developmental age of the child, cognitive age of the child, and internal and external influences. Studies highlight change in development through comparison of different forms of ASD or with different disorders, mainly those with ID, yet there is minimal focus on changes in development in regard to a specific form or ASD, focusing on a homogeneous group only.

The outcomes of the assessments are heavily influenced by the environment, tools of measurement and proximal processes incorporated. With background and theoretical knowledge, emphasis should be put on the involvement of the child’s proximal processes during assessment periods. Most studies showed background knowledge through their implementation of measurements, yet lacking in integrating all factors. For example, some studies used parent-child interactions during measures, but in an unnatural environment such as a laboratory. Whilst others conducted assessment tasks in a familiar environment for the child such as a school or home, but with external assessors.

As results have shown, studies with a mere two time points of assessment provide only a beginning and after view with limiting perspectives on how, what and when contributing factors enhance or diminishing communication development. Given the history of ASD and the complexity of the disorder, more research in understanding the disorder from as many perspectives can shift the way ASD is considered, and even challenge societal norms, by introducing new ways of working and intervening with communication development in children with ASD that best suits individual needs.

A child with ASD may have a communication impairment, (which is a prevalent feature of ASD), yet, they are entitled to the same rights and values of a typically developing child. As statistics show, this is not being fully attained in the current state within the UK, and thus is not supporting the rights of the child (Autism.org, 2018). In order for this to be achieved, and for children with ASD to reach their full communicative development and capacities, an insight into the natural trajectory of a child’s communication development is necessary.

In conclusion, it can be argued that in order to gain a reliable source of measurement of communication in a child with ASD, it is important to include the following: as many time points of measurement over a prolonged period of time, and with rational spaced intervals; to assess as many factors in the child’s environment. As well as in an environment the child is comfortable in, and assessing proximal processes throughout measurement periods.
6 Figures & Tables

8.1 List of figures
Figure 1. Adaptation of Bronfenbrenner’s Bioecological model (1994): person, process, context, time. (Adapted by author). .........................................................................................................................3

Figure 2. Conceptualising communication..................................................................................6

Figure 3. Flow Chart of selection process................................................................................12

8.2 List of Tables
Table 1. Selection Criteria (Inclusion/Exclusion Criteria)..............................................................11

Table 2. Overview of articles........................................................................................................15

Table 3. Results on the development of communication in children with ASD in relation to change over time..........................................................................................................................18

Table 4. Results on proximal processes, child characteristics and child environmental settings........23
9 References


training. *Best practices in school psychology-III*, 1009-1020.


Retrieved from https://www.taylorfrancis.com/books/e/9781135621346 on 01.04.2018


9.1 Web-based references


### 10 Appendices

#### 10.1 Appendix. A: Protocol headings

<table>
<thead>
<tr>
<th>2nd/3rd Reviewer</th>
<th>Author(s)</th>
<th>Year</th>
<th>Journal</th>
<th>Country</th>
<th>Included (I)/ Excluded (E)</th>
<th>Reason for Exclusion</th>
<th>Title</th>
<th>Formal ASD Diagnosis Y=no.</th>
<th>Aim</th>
<th>Research Question(s)</th>
<th>Key Words</th>
<th>Form of Communication</th>
<th>Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Scale</td>
<td>Sample/Participants</td>
<td>Measurement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 TP +</td>
<td>3 Age</td>
<td>Gender</td>
<td>Types (General comments)</td>
<td>Form Communicative Function</td>
<td>Content</td>
<td>Same use of Measurement at each TP Y/N</td>
<td>I.Q.</td>
<td>Ethnicity</td>
<td>Family</td>
<td>Comorbidity</td>
<td>Social Economic Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Collection (Home, School, Lab).</td>
<td>Results</td>
<td>Conclusion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Appendix B: Quality assessment headings


<table>
<thead>
<tr>
<th>Topic</th>
<th>SIN</th>
<th>Comments</th>
<th>Rating (low, medium, high)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Study Purpose</td>
<td></td>
<td>• Clearly stated Y/N</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Does it apply to each research question in this study</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Title</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Identifies report as SLR</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provides structures summary</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Rationale, objectives (PICO)</td>
<td></td>
</tr>
<tr>
<td>3. Literature</td>
<td></td>
<td>• Relevant background literature</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Describes justification for study</td>
<td></td>
</tr>
<tr>
<td>4. Theoretical Perspective</td>
<td></td>
<td>• Describe the theoretical or philosophical perspective for this study c.g., researcher's perspective.</td>
<td></td>
</tr>
<tr>
<td>5. Method</td>
<td></td>
<td>• Are the methods congruent with the philosophical underpinnings and purpose?</td>
<td></td>
</tr>
</tbody>
</table>
| 6. Sampling                          | • Was the sampling method appropriate to the study purpose or research question?  
|                                     | • Are the participants described in adequate detail?  
|                                     | How is the sample applicable to your practice or research question? |
| 7. Risk of Bias                     | • Publication bias  
|                                     | • Selective reporting |
| 8. Limitations                      | • Discuss limitations at study & outcome level |
| 9. Overall Rigour                   | • Credibility  
|                                     | • Transferability  
|                                     | • Dependability  
|                                     | • Confirmability |
| 10. Conclusion & Implications | | • Conclusions were appropriate given the study findings? |