AN INVESTIGATION INTO EXPRESSIVE MORPHOSYNTACTIC DEVELOPMENT IN CHILDREN WITH DOWN SYNDROME

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Abstract: Combined longitudinal and cross-sectional data from 12 children with Down Syndrome were analysed. Verbal inflectional morpheme omissions were identified from spontaneous speech samples and used as an index of morphosyntactic ability. This study investigated the extent to which expressive morphosyntax develops in accordance with chronological age in children with Down Syndrome. The extent to which expressive morphosyntactic development continues after the age of 7 was also explored. Results of the longitudinal analyses showed that with increased chronological age, subjects demonstrated no consistent decrease in morpheme omission, indicating that up to age 8, expressive morphosyntactic development was limited. Results of the cross-sectional analyses showed that between ages 8 and 12, development in the production of past tense *-ed* and progressive *-ing* morphemes accelerated, demonstrating that expressive morphosyntactic development does continue after age 7.

Keywords: Down Syndrome, development, expressive language, longitudinal investigation, morphosyntax, omission, grammatical morphemes, corpus, chronological age

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1. Introduction

Down Syndrome (DS) is a condition most commonly caused when individuals are born with a third copy of the 21st chromosome. This is referred to as Trisomy 21. DS is the most common chromosomal disorder, affecting around 1 in every 1000 live births (McGrowther and Marshall 1990). There is general agreement that individuals with DS show a specific developmental profile characterised by deficits in speech and language, low IQ, and impairments in memory (Edgin 2013).

1.2 Language Profile

Language is an area of development largely affected by DS. Research into language development in children with DS is an area of considerable interest, and many previous studies have been conducted in an effort to describe and explain the linguistic variance observed. The language profile of individuals with DS is marked by deficits in expressive language- specifically in syntax, grammatical morphology and speech intelligibility- and strengths in vocabulary and comprehension (Chapman 2006:61). Notably, individuals with DS show a dissociation between mental age and chronological age (CA), yet research has found that even compared with typically developing (TD) individuals matched for mental age, individuals with DS still exhibit syntactic and morphological deficits. However, the extent to which morphological production develops consistent with CA in children with DS has not yet been determined.

1.3 The Present Study

Research in this field has valuable implications for intervention which helps to promote language development in children with DS. However, there is a notable absence of longitudinal studies which focus on the expressive morphosyntactic development of children with DS. Therefore, this study aims to address the gap in the literature by investigating the developmental course of morphosyntactic production in children with DS, and the extent to which an expressive morphosyntactic deficit remains a prominent feature of language with increased CA. The current research also aims to address competing claims of whether a plateau in morphosyntactic development occurs in children with DS. Conflicting claims over

the age such plateau may occur have also been expressed. These will be elaborated on in section 2.2. Therefore, the 2 main research questions asked in this study are as follows:

1) Does expressive morphosyntax develop in accordance with chronological age in children with Down Syndrome?
2) Does expressive morphosyntactic development continue after the age of 7 in children with Down Syndrome?

In order to answer these research questions, I will conduct analyses- assisted by CLAN [Computerised Language Analysis], of spontaneous speech produced by children with DS. This will include both longitudinal and cross-sectional data. I will use omissions of verbal inflectional morphemes as an index of morphosyntactic ability, and through identifying these omissions, I aim to establish any developmental patterns in morphological production. The hypotheses relating to the above research questions are as follows: first, given that mean length of utterance (MLU) is correlated with CA in children with DS (Rondal 1995; Tager-Flusberg 1990), and that expressive morphosyntax is correlated with CA in TD children (Brown 2013), I hypothesise that expressive morphosyntax will develop consistently with CA in children with DS. Thus, as CA increases, the percentage of verbal inflectional morphemes omitted by the subjects will decrease. Secondly, I hypothesise that expressive morphosyntax will not continue to develop after the age of 7. Thus, there will be no substantial difference in morpheme omissions between subjects at age 7 and older subjects. This hypothesis is based on the findings from 2 longitudinal investigations conducted by Fowler (1988) which suggested that a critical period for acquiring syntactic-grammatical elements of language ends as early as 7 years old in children with DS. Fowler (1990:304) claims that this is due to maturational limits to language learning at this age. Further details on these investigations are presented in section 2.2.

This dissertation will be structured in the following way: I will first review the existing research into expressive morphosyntax in children with DS. To gain insight into earlier work within the field, a range of studies with various methods will be discussed and the findings from each will be presented. In section 3, I will outline the methodology used to test the aforementioned hypotheses. The procedure used to collect and analyse data will be explained, and information on the subjects included in this study will be presented. Furthermore, the results obtained from this study will be presented in section 4. Tables and graphs are included to represent the raw tokens and percentages of omitted grammatical morphemes, and I will state any developmental patterns found in the subjects' expressive morphosyntax. Section 5

proceeds with the discussion and interpretation of the results to answer the 2 research questions. Within the discussion, I will explain how the findings from this study correspond or contrast with the findings of research mentioned in the literature review. A critical evaluation of the current study will also be given. Finally, in section 6, I will state the conclusions reached from this study, as to whether expressive morphosyntax does develop with CA in children with DS, and also whether development continues past the age of 7. The dissertation then finishes with recommendations for future research in this field.

2. Literature review

A considerable amount of research into the linguistic tendencies of children with DS has been conducted. The present section will review existing literature to provide background information on the expressive morphosyntactic development of children with DS. I will first present evidence to show that an expressive morphosyntactic deficit is characteristic of children with DS, and then that children with DS acquire grammatical morphemes later than TD children. Subsequently, to highlight specific features of expressive morphosyntax in children with DS, I will examine research focusing on the omission of grammatical words and morphemes. Given that this investigation aims to determine whether a plateau occurs in the morphological development of children with DS, I will proceed to present evidence for and against a 'syntactic ceiling'. Finally, to understand why expressive morphosyntax is jeopardised in children with DS, I will present three explanations which have been stipulated in the literature to contribute to a morphosyntactic deficit.

2.1 An Expressive Morphosyntactic Deficit

The current investigation focuses on the expressive morphosyntactic development of children with DS, as researchers (Chapman *et al.* 1998; Andreou and Katsarou 2013; Vicari *et al.* 2000; Fowler 1990; Buckley 1993) report that for children with DS, expressive language-specifically morphological production, typically displays a more pronounced deficit than non-verbal comprehension. This incongruence in expressive and receptive morphosyntax is apparent from the findings of Laws and Bishop's (2003) study, whereby subjects with DS participated in grammar reception tests and morpheme elicitation tests. Although both were relatively weak in comparison to controls, children with DS's expressive language was more severely affected than their receptive language, with the elicitation data suggesting a substantial deficit in the correct use of verb tense marking. Therefore, results confirmed a

production-comprehension gap in the grammatical abilities of children with DS. This provides a basis for further investigation into expressive morphosyntax, which is crucial for the implementation of effective strategies to aid verbal morphosyntactic development in children with DS. However, Laws and Bishop (2003) also found that in 30% of cases, subjects with DS refused to provide a response to the morpheme elicitation task, or replied with a word that did not require the target affix. This highlights a limitation of the 3rd person singular and past tense verb endings elicitation task used to measure expressive morphosyntactic abilities. Given that children do not always provide the verb expected, a small proportion of errors could be classified as the correct use of irregular verbs. Therefore, this method may overestimate the correct production of grammatical morphemes. Furthermore, Eadie *et al* (2002) investigated grammatical morphology performance in children with DS compared with TD children. They examined the expressive use of tense-bearing and non-tenserelated grammatical morphemes, finding that children in the DS group were relatively strong in using irregular past, third-person irregular and progressive *-ing* tense forms. Subjects with DS correctly produced a median of 89.2% of irregular past forms, 77.7% of third-person irregular tense forms and 89.3% of *-ing* forms. However, they found that the median percentage of correctly used past tense *-ed* morphemes was a mere 38.1, compared to 100 in TD children, and the median percentage of correctly produced 3rd person singular morphemes was 40, compared to 88.5 in TD children. This illustrates that the production of regular tense-bearing morphemes is compromised in children with DS, as the percentages of correctly produced regular forms are substantially lower than those of TD children.

2.1.1 Delayed Acquisition of Grammatical Morphemes

A potential reason for the morphosyntactic deficit in children with DS is a delay in the acquisition of grammatical morphemes. Research (Buckley 1993; Cromer 1987; Fowler 1990; Dodd 1972) suggests there is no prominent delay in the very early stage of language development between children with DS and TD children, as the prelinguistic period whereby children communicate through vocalizations and gestures appears to be similar between the two populations. Vicari *et al* (2000:634) argues that a delay occurs from a CA of around 19 months. Interestingly, expressive morphosyntax is argued to show a greater delay than areas of phonology, whilst lexical skills appear to develop most similarly to those of TD children (Fowler 1990). In particular, difficulty in the acquisition of copula *be*, 3rd person singular *-s*

and auxiliary *be* is noted by Rutter and Buckley (1994:80). Based on the order in which 14 grammatical morphemes were acquired by TD English-speaking children as suggested by Brown (2013), Rutter and Buckley's (1994) comparative research investigated the order of acquisition of these morphemes in children with DS. After analysing records of children with DS's verbal production from between 12 and 38 months, to 43 and 47 months old, Rutter and Buckley (1994) found that no child acquired all 14 of the grammatical morphemes. Moreover, copula *be*, 3rd person singular *-s* and auxiliary *be* were failed to be acquired by all 12 children with DS. Rutter and Buckley (1994:80) also present a table comparing the mean ages of acquisition of morphemes in children with DS and TD children. Although the gap between the ages is not substantial, the results clearly show that children with DS acquire morpheme rules later than TD children, supporting the idea that children with DS exhibit a delay in the acquisition of grammatical morphemes. Given that children with DS are often older than TD children matched for morphosyntactic development, the expressive vocabularies of children with DS are often larger than those of TD children at the same level of morphosyntactic development (Rondal 1995). This is due to more life experience and exposure to a greater variety of words. This dissociation found among linguistic areas seemingly increases with CA (Vicari *et al* 2000:635), suggesting that morphosyntactic development remains delayed, as lexical development continues at a rate comparable to TD children.

2.1.2 Omission of Grammatical Words and Morphemes

A typical feature of morphosyntactic production in children with DS is the omission of grammatical words and morphemes. Chapman *et al* (1998) carried out a cross-sectional study comparing the omission of function words and grammatical morphemes of children with DS and TD children. Based on transcribed audiotapes of the conversational and narrative language samples obtained, Chapman *et al* (1998) claimed that the majority of words omitted by children with DS were grammatical function words. For example, forms of the copula (*is*, *were*), auxiliary (*is*, *does*), modal auxiliary (*can*, *will*), articles (*a*, *the*), prepositions (*at*, *for*), pronouns (*I*, *she*), adverbial adjunct (*when*), conjunctions (*and*), and infinitive (*to*). These findings support the claim made by Rondal (1994 cited in Vicari *et al* 2000:635) that the spontaneous language of many individuals with DS remains mainly telegraphic with a highly reduced use of function words and grammatical morphemes. However, Chapman *et al* (1998) noted that omissions of grammatical morphemes in children with DS, particularly regular

past tense and 3rd person singular are comparable to those of TD children. This shows that individual variability is present in subjects with DS (Chapman 2003; Rondal 1988; Martin *et al* 2009; Roberts *et al* 2007), as Chapman *et al's (*1998) findings suggest that the production of certain grammatical morphemes may be more similar to that of TD children than other research (Laws and Bishop 2003; Eadie *et al* 2004; Rutter and Buckley 1994) indicates. Despite the aforementioned research, *longitudinal* investigations into DS morphological development- particularly the use of inflected forms, remain scant. Thus, through identifying developmental patterns in morpheme omission, and establishing the extent to which this reduces with chronological age, the current investigation will address the gap in existing research.

2.2 A Plateau in Expressive Morphosyntactic Development

The second part of this investigation addresses the extent to which morphosyntactic development in children with DS halts around age 7; or as other research presented within this section suggests, at puberty. Despite claiming that MLU is highly correlated with CA, Rondal (1995:8) states that 'grammatical development is never complete in DS subjects. Some progress is obvious however with increased CA'. Rondal and Comblain (1996) suggest that there is a lack of morphosyntactic development after puberty due to a critical period for language learning at around 12-14 years of age (Lenneberg 1967). However, Fowler (1994:304) proposed that this period may end as early as 7 years of age, on the grounds that children encounter maturational limits to language learning at this age. This was postulated on the basis of 2 longitudinal observations (Fowler 1988). The first- a detailed investigation of a single girl with DS- revealed that a plateau in grammatical development was reached between 7 and 9 years of age. The second investigation involved the study of 10 children with DS aged between 4 and 19 years old. This revealed that the majority of language learning occurred before 8 years of age. This potential plateau in grammatical development is often referred to as a syntactic ceiling. Rondal and Lambert's (1983) research investigating the speech of adults with DS suggests that a syntactic ceiling does occur within DS grammatical development. However, the cross-sectional design of their study means that the age this syntactic ceiling occurs cannot be established. Their analysis of conversational data reveals that less than half of utterances recorded were grammatical sentences. Of the grammatical sentences which were produced, the verb expressed was only inflected approximately half of the time. Thus, the level of morphosyntactic production exhibited by

adults with DS is substantially lower than that expected of TD individuals, suggesting that a halt in their morphosyntactic development has occurred. In addition to the idea that morphosyntactic development slows and potentially halts, Rondal and Comblain (1996) note a decline in speech fluency as individuals mature past late childhood and early teenage years. They suggest that speech production slows further, rates of dysfluencies increase, and speech organisation and word retrieval problems emerge. Despite these findings, there is some debate about the extent to which such a ceiling exists. Boniecki (2013:18) draws attention to a study conducted by Schaner-Wolles (1992) which in contrast, reports no evidence of stagnation or regression of morphosyntactic abilities after puberty in German children with DS. Thus, 'it remains to be determined whether CA exerts a unique effect on language development in children with Down Syndrome' (Fowler 1990:304). This suggests that the length of time that morphosyntactic development continues in individuals with DS, and under what circumstances it plateaus and possibly declines, is open to investigation. In order to evaluate these competing claims, the current investigation will analyse transcripts of speech produced by children with DS at multiple ages, and record the tokens of omitted grammatical morphemes in each. Provided that subjects do show a decrease in morpheme omission over time, a plateau in this decrease would indicate that a syntactic ceiling has occurred. Consequently, whether- and the age at which expressive morphosyntactic development halts will be revealed.

2.3 Explanations for a Morphosyntactic Deficit

To gain further insight into research findings and aid understanding of patterns in the data, it is important to examine possible explanations for the expressive morphosyntactic deficit evident in children with DS. Previous work (Roizen *et al* 1993; McGregor and Leonard 1994; Fowler 1994) has established explanations related to brain structure, hearing loss and linguistic processing, amongst others. Chapman and Hesketh (2000) suggest that the study of the DS morphosyntactic profile is complicated by these children's decreased rates of intelligibility, severe deficits in auditory working memory and fluctuating hearing loss, ascertaining the relationship between these impairments and morphosyntactic production.

2.3.1 Hearing Loss

Hearing loss is suspected to be a primary determinant for the speech production deficit among children with DS. It is suggested by Chapman *et al* (1990) that this can lead to the fragmented encoding of the linguistic signal. As grammatical morphemes often consist of low phonetic substance (McGregor and Leonard 1994), it is possible that children with DS cannot hear them as clearly as other lexical items, resulting in greater omission, and less frequent production of such morphemes. Another explanation relating to the phonological structure of grammatical morphemes is proposed by Fowler (1994:96) and Gleitman *et al* (1984). They suggested that within the total intonation of the sentence, stress is not applied to closed-class terms, i.e., terms which carry grammatical function. Thus, the closed-class system is more reliant on external input than other open-class words. However, on the basis of her cross-sectional study comparing receptive language in children with DS, for whom the only exclusionary criteria were moderate hearing loss, with TD children, Chapman *et al* (1991) suggested that hearing loss only accounted for 4-7% of morphosyntactic variance among children with DS. Thus, other factors must be considered. Although, it is important to note that the extent to which Chapman *et al's* (1991) findings apply to expressive language remains unclear.

2.3.2 Neural-based Explanations

Alternatively, research has suggested that neural-based explanations relating to differences in the brain structure of individuals with DS, cause morphosyntactic variance. From the analysis of regional metabolic data obtained through PET scans, Horowitz *et al* (1990) found that one region of the brain particularly affected by DS is the inferior frontal gyrus including Broca's area. Broca's area is responsible for speech production- specifically, morphosyntax and speech automatization (Rosselli *et al* 2014:1). Thus, any structural differences in this area are likely to result in expressive morphosyntactic variance. Another neurological explanation for a morphosyntactic deficit in children with DS is the declining rate of synaptic growth around birth (Nadel 1986 cited in Rondal 1998:10). This means that children with DS do not develop the brain structure necessary for processing linguistic input to build grammatical knowledge, thus exhibiting a delayed production of morphological features expected from TD children at a given age.

2.3.3 Cognitive Functioning Impairments

A third explanation for an expressive morphosyntactic deficit in children with DS is impaired cognitive functioning. Cognitive functions refer to the internal mental processes responsible for the acquisition of knowledge, and the retrieval and storage of information. These include memory, perception, attention and decision making (Kiely 2014). Crucially, Rondal (1998:7) states that 'early cognitive functioning is relevant for early morphosyntactic development', and that 'a cognitive-semantic basis amounting to what is known by children in DS populations around 5 years-CA, and to typically developing children around 20-24 months, is needed for the grammatical component to start working when such a component is indeed available'. This implies that morphosyntactic variance in children with DS results from a delay in cognitive development. From the analysis of magnetic resonance imaging (MRI) data, Baburamani *et al* (2019) explain this delay as a result of divergent developmental trajectories at the brain level which are apparent from 22 weeks gestation. Consequently, the level of cognitive functioning accommodated by TD children at 20-24 months is not available to children with DS until the age of 5, hence why a morphosyntactic delay is evident. Furthermore, researchers (e.g., Varnhagen and Varnhagen 1987; Chapman *et al*. 1990; Kay-Raining Bird and Chapman 1994; Limongi *et al*. 2000) highlight issues with processing linguistic information among children with DS. If this is the case, information is likely to be entering the auditory system quicker than the rate at which it can be processed. Therefore, it may not be processed sufficiently to be stored in long-term memory (Chapman 1991). Grieco *et al* (2015:137) also ascertain the link between expressive morphosyntactic development and memory. They suggest that morphosyntactic abilities are reduced if phonemic sequences are not consolidated into long-term semantic memory. This illustrates that there is also a link between phonological limitations and problems acquiring grammatical rules. Fowler (1995:127) expands on this, alluding to the idea that 'basic difficulties at the phonological level, in encoding incoming acoustic information into a representational format which can be readily retrieved to serve memory, production and comprehension', contribute to incomplete morphosyntactic development. Essentially, because much of grammatical knowledge is informed by 'acoustically nonsalient elements' (Fowler 1995:127), phonological limitations are a potential contributor to a morphosyntactic deficit in children with DS.

In summary, the literature reviewed throughout this section strongly suggests that morphosyntactic abilities are jeopardised in children with DS. However, findings presented thus far rely primarily on cross-sectional methods to investigate morphological production in comparison to TD children. Notably, there is an absence of longitudinal research in this field which provides an opening to conduct an in-depth investigation into expressive morphological development in children with DS.

3. Methodology

The present section outlines the methodology used to investigate expressive morphosyntactic development in children with DS. Throughout this section, I will explain and justify the type of data used for the investigation, and how this data was accessed. I will then present information on the subjects used to obtain the data, that is, who the subjects were and the existing studies they were taken from. To show that the data reliably indicates a novel production of the child's own grammatical knowledge, I will describe the data cleaning process. Subsequently, to illustrate how computerised language analysis tools (CLAN) can be used to quantitatively analyse speech transcripts, I will state each of the strings run in CLAN, followed by a description of the data they generate. Finally, I will explain how the data searches were carried out to identify tokens of omission and production of the chosen morphemes, and how this data was recorded.

3.1 Selection of Variants

To explore expressive morphosyntactic development in children with DS, I first considered the possible error types exhibited by children with DS. As discussed in section 2, research findings have indicated that a morphosyntactic deficit exists in children with DS, characterised by the omission of function words and grammatical morphemes. Based on these findings, I chose to investigate the omission of grammatical morphemes over time as an index of morphosyntactic development. Specifically, verb inflections were selected, as it was necessary to choose a variant which is produced frequently enough in the child's speech to observe a trend. Verbal inflectional morphemes: past tense *-ed*, progressive *–ing* and present tense 3rd person singular *-s* were chosen to examine. Verb inflections were focused on to ensure the study was feasible, and to ensure that a detailed and insightful account of a single

aspect of the children's speech was composed. This can provide the basis for future comparisons to other aspects of morphological development.

3.2 CHILDES Corpora

To identify omissions of verbal inflectional morphemes, spontaneous speech production was analysed. Given the Covid-19 pandemic preventing face-to-face research, an analysis of existing transcripts was the most practical method of data collection. CHILDES (MacWhinney 2000)- the child language component of the TalkBank system, was used to browse various corpora in order to find suitable transcripts to analyse. Data collected through CHILDES is accessible; it is available to the wider population, enabling the study to be replicated, and it offers a substantial amount of data from vulnerable subjects. A combination of longitudinal and cross-sectional data was used to investigate the omission of verbal inflectional morphemes. The longitudinal Tager-Flusberg: Down corpus (1990) and cross-sectional Rondal: Down corpus (1978) were chosen, as they contain CHAT transcripts with a considerable amount of spontaneous speech from a range of subjects of various ages. In total, from the Tager-Flusberg: Down corpus (1990) and the Rondal: Down corpus (1978), 58 CHAT transcripts were analysed. That is, transcripts from the Tager-Flusberg: Down (1990) subjects at each age of observation, plus transcripts from the Rondal: Down (1978) subjects. These transcripts were downloaded in preparation to be cleaned and inputted into CLAN for analysis.

3.3 Subjects

Data from 12 children with Down Syndrome was accessed via the CHILDES database (MacWhinney 2000). Six of these subjects are taken from the longitudinal Tager-Flusberg: Down corpus (1990). These subjects include 4 boys and 2 girls, from a range of socioeconomic classes. Their language was recorded at regular intervals for a period between 12 and 25 months. Despite a small sample size, the use of existing longitudinal data means that morpheme omission data was elicited for each child, at each age, and for each morpheme. Thus, a sufficient amount of data was obtained to observe trends in the omission of verbal inflectional morphemes over time. Further information on the subjects studied from the Tager-Flusberg: Down corpus (1990) is presented in Table 1 below.

Child	**Age at first visit**	**Length of time followed (months)**	**No. of visits**	**MLU (morphemes) at first recording**
Charles	03;00.15	13	6	1.21
Kate	03;01.22	12	6	2.98
Penny	04;10.22	15	7	2.69
Martin	05;01.08	24	11	1.63
Billy	05;04.28	25	13	1.68
Jerry	06;07.03	24	11	2.86

Table 1. Subject Characteristics (*source:* Tager-Flusberg 1990:5)

However, to provide data from children over the age of 8 years 3 months and 16 days, and to increase sample size, 6 additional subjects from the cross-sectional Rondal: Down corpus (1978) were included. These subjects include 5 girls and 1 boy. All subjects were monolingual speakers of American English. Further information on the subjects studied from the Rondal: Down corpus (1978) is presented in Table 2 below.

Child	**Age**	**MLU (morphemes)**
Ava	10;00.00	3.06
Cassy	10;00.00	3.04
Kimmy	11;01.00	2.92
Missy	11;01.00	2.85
Mat	12;02.00	2.93

Table 2. Subject Characteristics (*source:* Rondal 1978)

Given the research questions, it was deemed necessary to include data from children above the age of 7, because as seen in section 2, the literature reports contrasting claims regarding the age a possible halt may occur in children with DS's morphological development. The analysis of subjects over the age of 8 was useful to observe whether older children omitted substantially fewer morphemes than children aged 7. In which case, a syntactic ceiling would not have occurred. The Rondal: Down corpus (1978) provided this data, and its cross-sectional design was not limiting, as development over time is observed primarily from the

longitudinal Tager-Flusberg: Down (1990) subjects. Despite a large age difference, some subjects from the Rondal: Down (1978) corpus have similar MLU's to the Tager-Flusberg: Down (1990) subjects. This shows that MLU can vary in subjects with DS, confirming the extremely widespread individual variability evident among children with DS (Rondal *et al* 1988). These non-linear fluctuations in MLU reflect differences in the context, interest and mood of the child (Tager-Flusberg *et al* 1990:7).

3.4 Data Cleaning

Before conducting data searches for the frequencies and omissions of each morpheme, the transcripts were cleaned. I excluded all utterances which did not reflect the child's independent grammatical competence, including instances of imitation of a parent's speech, utterances which are marked as unclear, utterances which relate to a memorised routine, and utterances which clearly demonstrate repetition of speech produced earlier in the conversation. Completion of the data cleaning process ensures that the data extracted only represents the child's own morphological production. Once this process had been carried out, the transcripts were ready to be inputted into CLAN.

3.5 Data Searches

The "freq" and "kwal" search strings were run in CLAN for every transcript. The outputs of these searches allowed quantitative data to be gathered, meaning the frequency and omission of verbal inflectional morphemes could be compared across various ages. Firstly, a search for the frequencies of each morpheme was carried out, assisted by the "freq" command. This helped to establish the number of correctly produced morphemes for each child at each age. Obtaining frequency values enabled the percentages of omitted morphemes to be calculated later. Examples 1-3 show the strings used to search for all words which contain the morphemes "ed", "ing" and "s".

(1) freq +t*CHI +s"*ed" @
(2) freq +t*CHI +s"*ing" @
(3) freq +t*CHI +s"*s" @

It was necessary to exclude results which did not demonstrate the *verbal* use of these morphemes. For example, words such as *red, ceiling* and *Mom's.* Moreover, as the "freq"

command only returns potential productions of “ed”, “ing” and “s”, and not the omissions of these morphemes, a “kwal” command was also run, as shown in Example 4.

(4) kwal +s"m;*,|v" +t*CHI +t%MOR @ +f +u -w2 +w2

This returned spontaneous speech in a format from which omissions of the verbal inflectional morphemes: progressive *-ing*, past tense *-ed*, and third person singular *-s* could be identified. The string produced a document of all utterances containing verbs spoken only by the child. It also included a morphological breakdown of each utterance. Additionally, this string instructed CLAN to include two lines of speech preceding and following the key verb. This provided more context surrounding the keyword, aiding a more accurate identification of omissions.

Each set of KWAL results was hand-searched for instances when the child omitted any of the morphemes mentioned above. These were identified in the following ways: identification of ungrammatical strings, for example ‘he sing’, 0-marking in the %MOR tier, and disregarding the verbs which these morphemes would not attach to. For example, past tense *-ed* is only used in conjunction with regular verbs; all irregular verbs can be ignored when identifying omission of this morpheme. Given the impoverished morphology of English, it was not possible to identify *a priori*, a bare verb form following 1st, 2nd, or 3rd person plural verbs as grammatical present tense or ungrammatical past tense. In these cases, preceding and following lines of context were used to determine the probable intended verb form. For example, in the utterance ‘you help me’, it is unclear whether the child intends to produce an imperative utterance, or is referring to an action in the past tense and has omitted *-ed*. These omissions, plus the frequencies of correctly produced morphemes, were recorded in a Microsoft Excel spreadsheet (see Appendix 2). To optimise comparability of the language samples, the opportunity for production of these morphemes had to be accounted for. Thus, the raw tokens of omission were converted into percentages. For each transcript I added the number of produced morphemes to the number of omitted morphemes to obtain the total number of opportunities for production. The number of omitted morphemes was then divided by the total opportunities for production and multiplied by 100 to calculate the percentage of morphemes omitted. This calculation was repeated for each of the 3 morphemes, so that for every transcript the percentages of 3rd person singular *-s*, past tense *-ed* and progressive *-ing* omissions were recorded (see Appendix 2). Once the data was tabulated, I generated suitable charts in Excel to represent the results graphically.

To summarise, this section reported the main features of the methodology used to obtain data, to first, establish whether the omission of verbal inflectional morphemes decreases with CA in children with DS, and second, determine whether expressive morphosyntactic development continues past the age of 7. The following section will present the results obtained through the aforementioned procedure.

4. Results

The present section displays the results of this study. Both hypotheses were tested by means of transcript analyses. The individual speech transcripts can be accessed via the links in Appendix 1. The results of the longitudinal analyses are presented in subsection 4.1. Within this subsection, the raw tokens of morphemes omitted by the Tager-Flusberg: Down (1990) subjects during each observation can be seen in Table 3, and the percentages of morphemes omitted are presented in Figure 1. The results of the cross-sectional analyses are then presented in subsection 4.2. Here, the raw tokens of morphemes omitted by the Rondal: Down (1978) subjects can be seen in Table 4, and the percentages of morphemes omitted are presented in Figure 2. Importantly, a discrepancy between MLU and level of expressive morphosyntax was observed from the results. This is further explained in section 4.3.

4.1 Results of the Longitudinal Analyses

	Past tense *-ed*	3rd person singular *-s*	Progressive *-ing*
Charles			
03;00.15	0	1	0
03;03.00	0	2	0
03;05.09	1	0	0
03;07.10	0	1	0
03;09.20	0	2	1
04;00.14	1	0	1
Kate			
03;01.22	1	3	5
04;01.00	0	2	0
04;03.00	0	1	3
04;05.08	5	0	1
04;07.21	0	0	0
04;10.11	0	1	3
Penny			
04;01.22	0	4	1
05;01.00	2	4	1
05;03.05	0	4	0
05;06.27	4	3	0
05;09.00	1	0	1
05;11.26	3	3	1
06;02.03	1	0	0
Martin			
05;01.08	0	1	0
05;04.00	2	1	1
05;06.06	0	1	1
05;08.05	0	3	0
05;10.10	0	4	0
06;03.06	3	3	1
06;05.22	0	0	2
06;08.10	0	1	0
06;11.05	2	0	0
07;01.06	3	9	3
Billy			
05;04.28	0	1	0
05;07.00	1	6	0
05;09.02	0	1	4
05;11.05	3	1	0
06;01.12	0	7	3
06;03.14	2	9	3
06;05.18	0	8	4
06;07.20	1	6	6
06;09.24	4	1	3
06;11.10	0	2	1
07;01.10	4	7	5
07;03.19	1	2	3
07;06.07	0	1	5
Jerry			
06;07.03	0	2	1
06;09.00	0	3	1
06;11.15	0	1	4
07;01.15	2	1	2
07;03.12	2	0	1
07;07.08	1	1	0
07;09.05	0	0	0
07;11.12	2	0	0
08;01.08	3	2	1
08;03.16	1	0	0

Table 3. Raw tokens of morpheme omission for the Tager-Flusberg: Down (1990) subjects at each age of observation

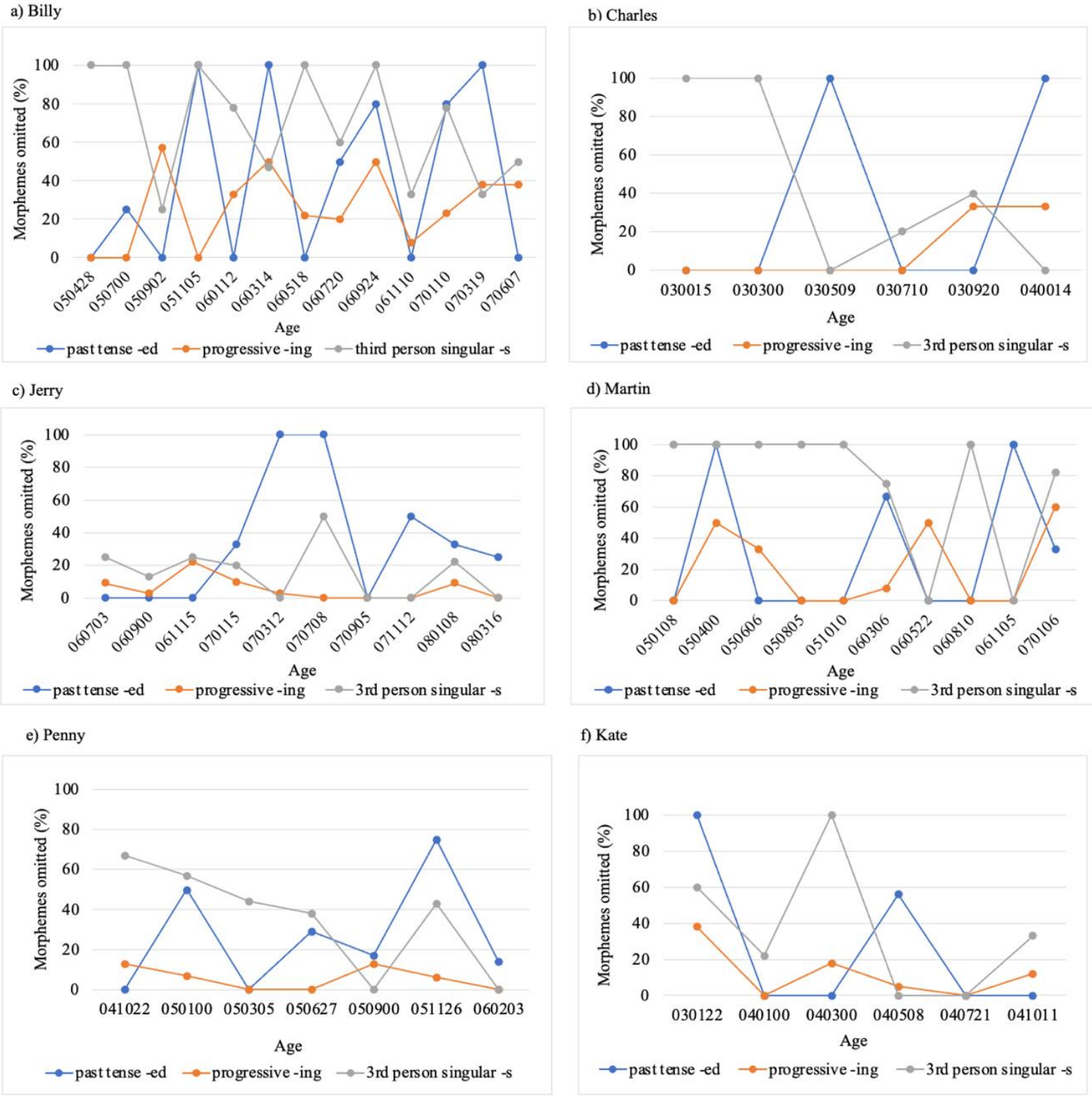

Figure 1. Verbal inflectional morphemes omitted by the Tager-Flusberg: Down (1990) subjects at each age of observation

Note that as shown in Table 3, the raw tokens of omission are generally low across most subjects. Given that the raw numbers do not account for the opportunity for production, percentages of omitted morphemes were used to create the developmental trajectories shown in Figure 1. Any instances where a subject neither omitted nor produced a morpheme will be declared within this section.

Figure 1 shows that there is no clear pattern in the omission of verbal inflectional morphemes observed in any subject. The results show an absence of trends whereby subjects consistently omitted fewer morphemes than recorded at the previous age of observation. For example, Figure 1a shows that during the first observation- at 5 years, 4 months and 28 days, Billy did not omit any past tense -*ed* morphemes. Yet at 7 years, 3 months and 19 days, 100% of Billy's intended regular past tense morphemes were omitted. Therefore, the results in Figure 1 show that in subjects with DS, grammatical morpheme omission does not decrease consistent with CA.

However, Figure 1f shows that for Kate, the percentages of omitted 3rd person singular -*s,* past tense -*ed* and progressive -*ing* morphemes are lower at the final observation than the initial observation, although this decrease was not consistent. Additionally, Figure 1 shows that for each subject, the percentage of omitted 3rd person singular -*s* morphemes is lower at the final age of observation than the initial age of observation. However, the figures in between fluctuate largely. The only result to indicate any *consistent* development in the production of grammatical morphemes is Penny's trajectory of 3rd person singular -*s* omission as seen in Figure 1e. At her first observation, Penny omitted 67% of the 3rd person singular -*s* morphemes she had the opportunity to produce. This decreased consistently until the penultimate observation which saw an increase, however the decrease resumed at the final observation where she omitted no 3rd person singular -*s* morphemes.

Moreover, Figure 1b shows that Charles demonstrates an increase in progressive -*ing* omission with CA. He does not omit any progressive -*ing* morphemes until the 5th observation at age 3 years, 9 months and 20 days, where he then omits 33% of the -*ing* morphemes he had the opportunity to produce. However, it is important to note that although Charles did not omit any progressive -*ing* morphemes during the first two observations, he did not produce any either. Thus, the total number of opportunities for production at ages

03;00.15 and 03;03.00 was 0. This means that the first two plots on the progressive *-ing* trajectory shown in Figure 1b overestimate Charles' production of this morpheme.

The results show a high degree of individual variability between children with DS, as the trends illustrated in Figure 1 differ substantially for each subject. For example, Figure 1c shows that at 6 years, 11 months and 15 days, Jerry omitted no intended past tense *-ed* morphemes, yet Figure 1d shows that at the similar age of 6 years, 11 months and 5 days, Martin omits 100% of intended past tense *-ed* morphemes. Despite this variability, progressive *-ing* morphemes appear to be omitted less than 3rd person singular *-s* and past tense *-ed* in all of the Tager-Flusberg: Down (1990) subjects.

4.2 Results of the Cross-sectional Analyses

Subject	**Age**	**Past tense *-ed***	**3rd person singular *-s***	**Progressive *-ing***
Rhoda	08;08.00	0	8	1
Ava	10;00.00	3	11	3
Cassy	10;00.00	1	2	2
Kimmy	11;01.00	0	2	1
Missy	11;01.00	1	10	0
Mat	12;02.00	2	0	0

Table 4. Raw tokens of morpheme omission for the Rondal: Down (1978) subjects

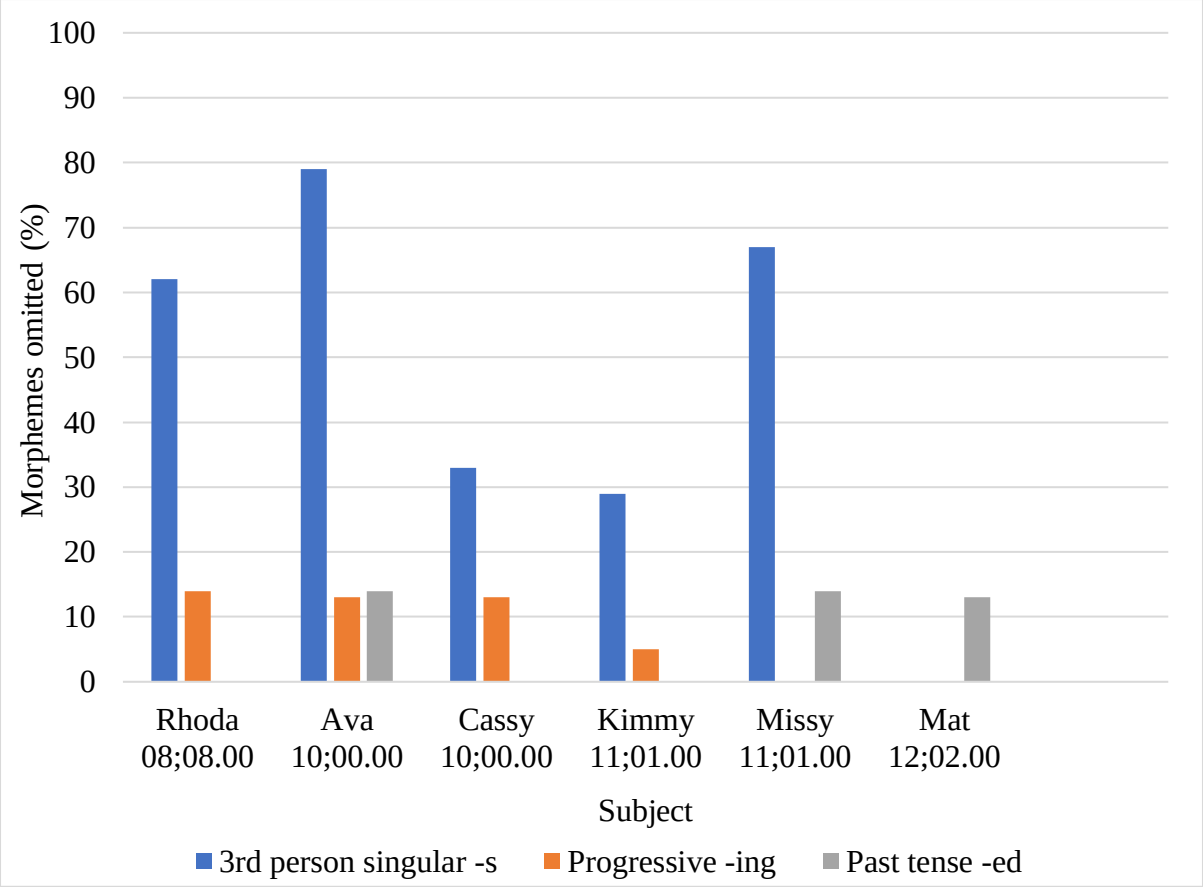

Figure 2. Verbal inflectional morphemes omitted by the Rondal: Down (1978) subjects

Figure 2 illustrates that none of the Rondal: Down (1978) subjects omitted 100% of any of the intended morphemes. This contrasts to the data shown in Figure 1, whereby subjects frequently omitted 100% of an intended morpheme. Mat- notably the eldest of the Rondal: Down (1978) subjects- did not omit any 3rd person singular *-s* or progressive *-ing* morphemes. Each of the Rondal: Down (1978) subjects omitted less than 20% of past tense *-ed* morphemes. This also contrasts largely with the data shown in Figure 1, as the Tager-Flusberg: Down (1990) subjects omitted high percentages of past tense *-ed* morphemes during multiple observations.

Although this data is cross-sectional, Figure 2 shows a consistent decrease in the omission of progressive *-ing* with CA: Rhoda omits 14% of progressive *-ing* morphemes, Ava and Cassy omit 13%, Kimmy omits 5% and neither Missy nor Mat omit any. However, when compared with Figure 1, progressive *-ing* has consistently been the least omitted morpheme, with subjects often omitting 0% at multiple different ages.

Further, all of the Rondal: Down (1978) subjects except Mat omitted 3rd person singular -*s* more than past tense -*ed* and progressive -*ing.* Figure 2 shows no clear decrease in 3rd person singular -*s* omissions by the Rondal: Down (1978) subjects compared with the 3rd person singular -*s* data of children aged 7+ in Figure 1. Notably, in comparing Tables 3 and 4, the raw tokens of 3rd person singular -*s* omission are higher in the Rondal: Down (1978) subjects than the Tager-Flusberg: Down (1990) subjects during most observations. However, due to the increase of produced 3rd person singular -*s* tokens by the Rondal: Down (1978) subjects, this was not reflected in the percentages shown in Figure 2.

4.3 Discrepancy between MLU and Morphosyntactic Ability

As seen from the tables in section 3, MLU varies greatly in children with DS. Kate- at 03;01.22 has an MLU of 2.98 morphemes, while Martin- at 05;01.08 has an MLU of 1.63. Despite this, Kate omits higher percentages of all 3 morphemes than Martin at the aforementioned ages. Additionally, Ava has an MLU of 3.06 morphemes- the highest of all the subjects included in this study. Yet out of the Rondal: Down subjects, she omits the highest percentage of morphemes overall. Therefore, MLU is an inappropriate measure of morphosyntactic ability.

4.4 Summary

To summarise, the data in Figure 1 show that morpheme omission does not reduce consistently with CA up to the age of 08;03.16. However, from Figure 2 we can see that overall, children over the age of 7 omit fewer past tense -*ed* and progressive -*ing* morphemes than the younger Tager-Flusberg: Down (1990) subjects, although this is not the case for 3rd person singular -*s.* From Figure 2, it is also evident that in subjects over the age of 7, omission of progressive -*ing* begins to reduce consistently with CA.

5. Discussion

In this dissertation I present data from the analyses of longitudinal and cross-sectional speech samples, from 12 children with DS. The findings of this study address a number of issues that include whether expressive morphosyntax develops consistently with CA in children with DS, continued development after the age of 7, and individual variability. I will take up each

of these issues in turn. I will then critically evaluate the study and present the implications for the direction of intervention.

5.1 Developmental Course of Morphosyntactic Production

First consider the research question that this study was based on. To what extent does expressive morphosyntax develop in accordance with chronological age in children with Down Syndrome? To answer this question, the percentage of verbal inflectional morphemes omitted by children with DS was used as an index of morphosyntactic development. As stated in section 1, I hypothesised that expressive morphosyntax will develop consistently with chronological age in children with DS. Thus, the percentage of omitted morphemes will decrease as chronological age increases. Firstly, the results of this study correspond to the literature, in confirming that an expressive morphosyntactic deficit, characterised by the omission of grammatical morphemes, is present in children with DS (Rondal 1994; Eadie *et al* 2002; Laws and Bishop 2003). However, the extent to which this deficit becomes less prominent as children with DS mature was left undetermined by existing studies. The findings of this research reveal that expressive morphosyntax does not develop with chronological age in children with DS, as the longitudinal data showed a lack of consistent decrease in morpheme omissions from any of the Tager-Flusberg: Down (1990) subjects. Despite the absence of *consistent* decrease in morpheme omissions with CA, the results show that each of the subjects omitted a lower percentage of 3rd person singular -*s* morphemes at the final age of observation than the initial age of observation. Additionally, Kate omitted lower percentages of all 3 morphemes during the final observation than the initial observation. This indicates that some progress may have occurred with CA. However, the lack of consistent developmental patterns suggests that this is limited, and the rate at which expressive morphosyntax develops is severely delayed compared to that expected of TD children. The only longitudinal result which may suggest clear progression with CA, is Penny's development in the production of 3rd person singular -*s.* As shown in Figure 1e, a downward trajectory in the omission of 3rd person singular -*s* is evident with CA. However, this is the only result out of all the Tager-Flusberg: Down subjects which indicates any consistent reduction in morpheme omission. Therefore, this alone cannot suggest that expressive morphosyntax develops consistently with CA, meaning that the first hypothesis of this study is falsified. Rather, the results suggest that as chronological age increases, the expressive morphosyntactic abilities of children with DS remain compromised.

The study from which these subjects were taken (Tager-Flusberg *et al* 1990) was conducted 'to chart the individual subjects' MLU over the course of time each was followed' (Tager-Flusberg *et al* 1990:7). Interestingly, those results show that all subjects except Jerry showed an increase in MLU with CA. These findings correspond with the claims of Rondal (1995) and Fowler (1990) that MLU and the lexicon *are* highly correlated with CA in children with DS. However, the current findings indicate that this is not the case for expressive morphosyntax. This supports the idea that, as stated in section 4.3, MLU would not be an appropriate measure of morphosyntactic ability; MLU may overestimate morphosyntactic competence in individuals with DS, as utterances may become longer without becoming more complex (Loveall *et al* 2019:89). Given that only limited progression in the production of grammatical morphemes has been found, we can confirm that different areas of language follow different courses of development. Thus, Vicari *et al*'s (2000:635) affirmation that the discrepancy between linguistic domains increases with CA- as stated in section 2.1.1, is also supported.

Note that to ensure feasibility, the production of only 3 grammatical morphemes was investigated in this study. Children with DS could potentially follow different developmental trajectories in the production of other grammatical morphemes. In this case, different conclusions regarding their expressive morphosyntactic development may be reached. Also, children with DS have been argued to demonstrate more advanced syntactic skills in narrative language samples than free speech samples (Chapman *et al* 1998), suggesting that sampling context has an effect on syntax complexity in children with DS. The extent to which this applies to grammatical morphological ability remains unclear. However, it is possible that if this study were to be replicated using narrative samples rather than conversation, individuals would demonstrate greater competence in production of grammatical morphemes.

5.2 Continued Development after Age 7

An analysis of further (cross-sectional) data was conducted to answer the second research question. Does expressive morphosyntactic development continue in children with Down Syndrome after the age of 7? Based on findings from Fowler's (1988) longitudinal observations, I hypothesised that expressive morphosyntax will not continue to develop after the age of 7 in children with DS. Thus, there will be no decrease in morpheme omissions

from children aged 7, to older children. Given the absence of longitudinal observations which continue into adolescence, the only way to address this research question was to compare the language of children above age 7, to that of younger children. Despite Fowler's (1990:304) postulation that the critical period for language learning may end at 7 years old, findings from the analysis of the cross-sectional data suggest that this is not the case. Although a consistent decrease in omissions was not evident from the longitudinal data, results from the cross-sectional data show a reduction in past tense *-ed* and progressive *-ing* omissions in the Rondal: Down (1978) subjects. Therefore, morphosyntactic abilities appear greater in children with DS over the age of 7, suggesting that expressive morphosyntax does continue to develop after this age. A consistent decrease in the omission of progressive *-ing* morphemes was also evident in Rondal: Down (1978) subjects, which was not observed in the longitudinal data. This indicates that rather than plateauing after age 7, morphosyntactic development actually accelerates. Thus, findings suggest that there is a substantial delay in the onset of any considerable morphosyntactic development until at least age 7. Given these findings, Fowler's (1990:304) claim is contradicted, and maturational limits to language learning do not prevent further morphosyntactic development after the age of 7. However, this contradiction may be due to the fact that grammatical development was indexed by MLU in the investigations from which Fowler (1990:304) based her claim. Moreover, the results show little decrease in 3rd person singular *-s* omissions between children aged 7 and children aged 08;08.00-11;01.00. Thus, findings suggest that expressive morphosyntax does continue to develop after age 7, although further progression in 3rd person singular *-s* production is limited. This corresponds with Rutter and Buckey's (1994) finding that out of the 14 grammatical morphemes investigated, 3rd person singular *-s* was one of the only two morphemes failed to be acquired by all 12 subjects with DS.

Interestingly, Chapman *et al* (2002:911) found that 'expressive language acquisition, as measured by MLU of spontaneous utterances in narrative samples', in addition to syntax complexity, 'continues through the teenage years for most individuals with Down Syndrome'. The lack of data from older individuals with DS means that the present study cannot confirm whether this applies to morphological development. However, given that morphological development appears to accelerate after age 7, findings indicate that this is certainly possible. As seen in section 4, Mat- the eldest subject included in this study, omits the lowest percentage of morphemes overall. This suggests that expressive morphosyntactic development continues until at least age 12. On the other hand, Mat still omitted 13% of

intended past tense *-ed* morphemes at age 12. Given that Lenneberg (1967) proposed that a critical period for language learning occurs at age 12-14, it is possible that grammatical morpheme omission remains a feature of expressive morphosyntax in individuals with DS. If this is the case, the findings from the cross-sectional analysis would concur markedly with Rondal's (1995:8) statement as seen in section 2.2. 'Grammatical development is never complete in DS subjects. Some progress is obvious however with increased CA'. However, further research is needed to confirm whether- in line with Lenneberg (1967), development does not continue past ages 12-14, or if in fact expressive morphosyntax in individuals with DS continues to develop throughout adolescence.

5.3 Individual Variability

The use of a longitudinal design allowed the range of individual differences to be explored in children with DS. Existing literature report claims that considerable individual variability exists in the linguistic competence of children with DS (Chapman 2003; Rondal 1988; Martin *et al* 2009; Roberts *et al* 2007). Additionally, Fowler (1990) states that much higher individual variability is found among children with DS than TD children. The findings of the current investigation confirm this strong presence of individual variability, as the data show entirely different trends in morpheme omission between subjects. Thus, it is difficult to make generalisations to the wider DS population regarding the course of expressive morphosyntactic development. Much of this variation can be understood by considering the predictors of the expressive morphosyntactic deficit, as explained in section 2.3. For example, hearing loss has been argued to account for some of the expressive morphosyntactic variance noted in individuals with DS. Given that the degree to which hearing is impaired varies between individuals, morphosyntactic production is unlikely to be affected in the same way for the entire population, resulting in variable linguistic competence. However, although the developmental trajectories are largely variable between subjects, as seen in section 4.1, the Tager-Flusberg: Down (1990) subjects are consistently stronger in producing progressive *-ing* morphemes than past tense *-ed* and 3rd person singular *-s*. This corresponds with Eadie *et al's* (2002) finding that children in the DS group were relatively strong in producing progressive *-ing* morphemes.

5.4 Limitations of the Present Study

The study is limited by the use of spontaneous speech data to investigate the omission of grammatical morphemes. Although spontaneous speech data has high external validity, there is undoubtedly a lack of control. Throughout the data cleaning process, it was difficult to identify the utterances which the child produces naturally and those which the child does not produce naturally. Therefore, although every effort was made to exclude utterances which did not reflect the child's own linguistic competence, this cannot be confirmed. Moreover, spontaneous speech samples do not create a sufficient number of obligatory grammatical contexts for bound morphemes (Chapman 1998:871). As seen from Table 3 presented in the results section, the raw tokens of morpheme omissions are generally low across most subjects. This is potentially due to a lack of opportunity for production during free conversation. Thus, it may be argued that the analysis of free speech samples overestimates expressive morphosyntactic ability. Other methods such as the analysis of elicited language samples, grammaticality judgement tasks or productivity probes may be more suitable to assess morphosyntactic ability, as they directly test the production of specific morphemes.

Another limitation of this study is the absence of a TD control group. Given the lack of time available, it was not possible to conduct any more analyses of speech data from TD subjects. Although the main objective was to investigate expressive morphosyntactic development in children with DS, morpheme omission data from TD children would be useful to compare the developmental patterns of children from the two populations. This would increase the sample size and enable statistical analysis to be carried out to establish any significant differences between the two groups. A control group would also be beneficial in comparing the degree of individual variability present in TD populations and DS populations.

The study is also limited by the use of cross-sectional data to investigate morphosyntactic development after the age of 7. Without further longitudinal data to address this issue, the extent to which morpheme omission has decreased for each individual is unclear. As stated in section 5.3, individual variability between children with DS is rife, meaning that what may appear to be a decrease in morpheme omission based on comparisons with other younger subjects, could possibly be a plateau or even an increase in omission for that individual. Thus, without earlier data from the Rondal: Down (1978) subjects, the conclusion that expressive morphosyntax continues to develop after age 7 is somewhat speculative.

5.5 Implications

This study has important implications for the direction of intervention efforts. The research has provided awareness of the expressive morphosyntactic profile of children with DS, which is crucial in implementing effective strategies to aid development. Based on the findings of this study, I can confirm that a grammatical morpheme deficit is present in the expressive language of children with DS, and the longitudinal data show limited progression with CA. Therefore, the findings strongly suggest that further intervention is needed to aid development in the production of past tense *-ed,* progressive *-ing* and 3rd person singular *-s.* Widespread individual variability means that each individual's language profile should be assessed to determine strategies which target specific areas for development. Given that children with DS have been found to perform better in narrative sampling methods than in free conversation (Chapman *et al* 1998), intervention should target the production of grammatical morphemes in spontaneous speech. Moreover, the Child Talk model (Chapman *et al* 1992 cited in Chapman 1998:869) predicts that the dichotomy between expressive and receptive language exists due to reduced opportunities to talk. Therefore, effective intervention would involve strategies which support *practice* and increasing automatization of morpheme production (Chapman 1998:871). This may involve structured conversation with questions and topics which scaffold the production of grammatical morphemes. Support in such conversations may be provided by confirming the correct production of grammatical morphemes, correction of omitted morphemes, and repetition of structures which contain grammatical morphemes. Crucially, the findings of this study indicate that expressive morphosyntax continues developing after the age of 7, meaning that intervention is warranted for individuals with DS beyond this age.

6. Conclusions

This final section will present the conclusions reached from the study and discuss recommendations for future research in this field. The current research addresses the gap in existing literature, regarding the developmental course of morphosyntactic production in children with Down Syndrome. To answer the two following research questions, I conducted an analysis- assisted by CLAN, of spontaneous speech produced by children with DS. A combination of longitudinal and cross-sectional data was analysed, and verbal inflectional morpheme omission was used as an index of expressive morphosyntactic ability. First, I asked, does expressive morphosyntax develop in accordance with chronological age in

children with DS? Secondly, does expressive morphosyntax continue to develop after the age of 7 in children with DS?

From the findings of this study, I can confirm that an expressive morphosyntactic deficit is present in children with DS, as the grammatical morphemes past tense *-ed,* progressive *-ing* and 3rd person singular *-s* are frequently omitted in conversation. Whilst certain patterns in the longitudinal data indicate that some progression occurs with CA, this data does not provide strong enough evidence to support hypothesis 1, stating that expressive morphosyntax will develop consistently with CA in children with DS. Based on the absence of a consistent decrease in morpheme omission up to the age of 8 years, 3 months and 16 days, I can conclude that expressive morphosyntax does not develop in accordance with chronological age. Thus, hypothesis 1 is falsified.

However, I found that children aged between 8 years 8 months, and 12 years 2 months, omit past tense *-ed* and progressive *-ing* morphemes less than younger children. Also, a consistent decrease in progressive *-ing* omission was found in subjects aged between 8 years 8 months and 12 years 2 months. Therefore, I can conclude that there is a delay in the onset of any clear development in expressive morphosyntax until the age of 7, from which point, development accelerates in children with DS. This means that maturational factors do not inhibit further morphosyntactic development after age 7 as suggested by Fowler (1990:304), and hypothesis 2- stating that expressive morphosyntax will not continue to develop after the age of 7 in children with DS- is falsified. Although expressive morphosyntactic development accelerated after age 7, the results show that morpheme omission remained a feature of expressive morphosyntax until the age of 12. Thus, I can conclude that that an expressive morphosyntactic deficit- marked by the omission of verbal inflectional morphemes, exists until at least age 12 in children with DS.

Future research should investigate the production of other grammatical morphemes which were not included in this study. For example, it would be interesting to compare the present results to a study focused on the omission of nominal inflectional morphemes. Researchers in the field should also aim to conduct similar longitudinal investigations, but follow subjects from childhood through to late adolescence. This could determine whether expressive morphosyntactic development continues throughout the teenage years in individuals with DS. Further, longitudinal investigations into the production of grammatical morphemes should be

conducted using alternative research methods to supplement existing naturalistic studies. For example, the use of elicited production methods which 'help to avoid accidentally providing learners with linguistic models or feedback that might influence their behaviour' (Eisenbeiss 2010:11). Finally, it would be beneficial for a similar investigation into morphosyntactic development in children with DS to take place, however, including a control group of TD children. This way, the course of morphosyntactic development in the two populations could be compared.

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Appendices

Appendix 1A: Web links to the individual Tager-Flusberg: Down (1990) transcripts analysed

Charles:

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Charles/030015.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Charles/030300.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Charles/030509.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Charles/030710.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Charles/030920.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Charles/040014.cha

Kate:

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Kate/031022.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Kate/040100.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Kate/040300.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Kate/040508.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Kate/040721.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Kate/041011.cha

Penny:

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Penny/041022.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Penny/050100.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Penny/050305.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Penny/050627.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Penny/050900.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Penny/051126.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Penny/060203.cha

Martin:

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Martin/050108.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Martin/050400.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Martin/050606.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Martin/050805.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Martin/051010.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Martin/060306.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Martin/060522.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Martin/060810.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Martin/061105.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Martin/070106.cha

Billy:

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Billy/050428.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Billy/050700.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Billy/050902.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Billy/051105.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Billy/060112.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Billy/060314.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Billy/060518.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Billy/060720.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Billy/060924.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Billy/061110.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Billy/070110.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Billy/070319.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Billy/070607.cha

Jerry:

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Jerry/060703.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Jerry/060900.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Jerry/061115.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Jerry/070115.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Jerry/070312.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Jerry/070708.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Jerry/070905.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Jerry/071112.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Jerry/080108.cha

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Flusberg/Jerry/080316.cha

Appendix 1B: Web links to the individual Rondal: Down (1978) transcripts analysed

Rhoda:

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Rondal/DS/rhoda1.cha

Ava:

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Rondal/DS/ava1.cha

Cassy:

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Rondal/DS/cassy1.cha

Kimmy:

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Rondal/DS/kimmy1.cha

Missy:

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Rondal/DS/missy1.cha

Mat:

https://sla.talkbank.org/TBB/childes/Clinical-MOR/Rondal/DS/mat1.cha

Appendix 2: Portion of spreadsheet containing recorded data from the transcript analyses

M6 ƒx

	A	B	C	D	E	F
1	Billy: 3rd person singular -s					
2						
3		Frequency	Omissions	Total opportunities for production	Percentage of morphemes omitted	
4	50428	0	1	1	100	
5	50700	0	6	6	100	
6	50902	3	1	4	25	
7	51105	0	1	1	100	
8	60112	2	7	9	78	
9	60314	10	9	19	47	
10	60518	0	8	8	100	
11	60720	4	6	10	60	
12	60924	0	1	1	100	
13	61110	4	2	6	33	
14	70110	2	7	9	78	
15	70319	2	1	3	33	
16	70607	2	2	4	50	
17						
18						
19	Billy: progressive -ing					
20		Frequency	Omissions	Total opportunities for production	Percentage of morphemes omitted	
21	50428	1	0	1	0	
22	50700	2	0	2	0	
23	50902	3	4	7	57	
24	51105	2	0	2	0	
25	60112	6	3	9	33	
26	60314	3	3	6	50	
27	60518	14	4	18	22	
28	60720	24	6	30	20	
29	60924	3	3	6	50	
30	61110	12	1	13	8	
31	70110	17	5	22	23	
32	70319	5	3	8	38	
33	70607	8	5	13	38	
34						