A Semantic and Pragmatic Study of BSL: Age of Acquisition Effects on Multi-channel Sign Production

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The age of which deaf children acquire British Sign Language (BSL) has been found to have marked differences at the levels of morphology, phonology, and syntax. AoA of semantics and pragmatics is under-researched, and therefore provided the focus of the study. This study was focused on finding whether there was a semantic and pragmatic difference in multi-channel sign production between early-learners and late-learner of BSL, specifically because of AoA differences in when they first acquired BSL. It also considered whether there were differences in other sign productions such as negation, which was used in place of the multi-channel sign. The study found no significant differences in multi-channel sign production and further suggests this may be due to cognitive development and language experience.

Keywords: *British Sign Language, Sign language linguistics, pragmatics, language acquisition*

1. Introduction

Multi-channel signs are constructions that use both manual and non-manual features. The function of this is often to communicate an iconic sign or BSL idiom. This study is concerned with differences in production of multi-channel signs in deaf BSL users because of any age of acquisition (AoA) differences. This introduction section will aim to give a brief overview of deafness, deaf culture, sign language and oralism, to outline the context in which I have approached this study. The hypothesis forming the basis of this study is as follows: There is a difference at the semantic and pragmatic level between early learner (EL) deaf signers and late learner (LL) deaf BSL users because of when they acquired BSL.

1.1 Deafness and Deaf Culture

This study will use the term ‘D/deaf’, which is well-established in BSL literature (Brien, 1992, Sutton-Spence and Woll, 1999; Ladd, 2003; Taub, 2001). Deaf (with a capital ‘D’) refers to people who class themselves as culturally Deaf: often born deaf, they may have gone to a Deaf school, are strong BSL users, are involved in the Deaf community and see being deaf as a positive impact on their life. The use of ‘deaf’ (no capitalisation) refers to the medical model of deafness only, such as diagnosed levels of deafness, use of hearing aids and cochlear implants. The terms ‘deaf’ ‘D/deaf’ and ‘Deaf’ will be used in different contexts when referring to participants themselves, or aspects of cultural or medical deafness.

2. Literature Review

The introduction has briefly discussed the context in which sign language exists for deaf people, and this section aims to give a broad overview on the research done so far concerning sign language. Davidson and Mayberry (2015) suggest that language fluency is dependent on

achieving proficiency at each language level such as morphology, phonology, syntax and so on, and adult proficiency in sign language (SL) may be dependent on language experience during early language acquisition. This therefore suggests that late-learners (LL) will always have a language delay at a grammatical level, however this is often not the case for semantics and pragmatics (Cormier, Smith and Zwets, 2013; Davidson and Mayberry, 2015). This may be due to cognitive processes rather than linguistic ones, and the fact that semantics and pragmatics appear to develop at a longer, continuous rate to other language levels (Cardin et al, 2016a: 35; Rudner et al. 2016; Davidson and Mayberry et al. 2015). This is further supported by research that found that non-native signers have differences in grammar, relative clauses and phonological distinctions, potentially linked to how sign language is activated grammatically in the brain (Mayberry et al. 2017; Cormier et al. 2012; MacSweeney et al. 2008b; Boudreault and Mayberry, 2006) but not necessarily at the levels of semantics and pragmatics (Davidson and Mayberry, 2015; Davidson, 2013; Cormier, Smith and Zwets, 2013). Therefore, the justification for this study comes from the need to provide additional empirical evidence into the role of AoA of BSL for deaf children, which this study proposes to do.

This literature review will discuss the differences and similarities between early and late learners of SL, detailing the evidence through different linguistic levels. It will also consider the effects of auditory deprivation on first language learning to explain how the hypothesis was constructed for this study.

2.1 Neurolinguistics and the Effects of Learning Sign Languages at Different Stages of Brain Development

To begin discussing the differences between early-learners (EL) and late-learners (LL) of BSL, evidence of how language activation might differ in the brain is explored. Similar brain activation patterns in the left frontal gyrus during speech and sign tasks were found to be the same across native language users, whether this was spoken languages or signed languages (MacSweeney et al. 2008b; Huang et al. 2012; Krieger-Redwood and Jeffries, 2014). This is significant because it compounds the evidence that there is no fundamental difference in brain activation for spoken or signed language. However, Cardin et al. (2016a) suggests that the same left lateralised neural networks are activated in a similar manner in both signers and speakers, but the processing load is different in the brain. Cardin et al (2016a) suggested that deaf signers show greater neural activation and the areas that are specifically activated are dependent on hearing status and sign language knowledge. Longer response times to complex phonological task were found in Cardin et al.'s (2016a) study meaning difficulty during the tasks may be a factor in group response differences. If the tasks are perceived to be too difficult it may skew the results, so this has to be kept in mind for my study. Twomey et al. (2017) and Klein et al. (2001) found that brain activation effects differ for those using an L2 dependent on the processing load of the tasks. Twomey et al. (2017) specifically found that for deaf people, processing ability was found to have a greater effect through visuospatial tasks. Visuospatial tasks include sign language, but also other visual modalities such as lipreading which have been suggested as contributing to the 'cognitive reorganisation' of language learning for deaf people, supporting Cardin et al.'s (2016a) study that the areas of the brain specifically activated are those heavily used for sign language or visual modalities used by deaf people (Bavelier et al. 2001; Bavelier and Neville, 2002: 445; Cardin et al. 2016a: 96). This is also in agreement with Bavelier et al. (2001) and Emmorey and McCullough (2008) as they found that deaf signers showed greater sensitivity to visual stimuli. This is further supported by Bavelier et al. (2001: 8941), in which they propose that visual responsiveness proves a 'plasticity' in the brain, suggesting that deaf people have a predisposition for a visuospatial language. Emmorey and McCullough (2008: 129) found that sign language contact and level of deafness were key factors in neural organisation systems. If hearing status and sign language knowledge are factors in which specific areas of the brain are activated, then this may account for the difference in brain development. This is important for my study because it suggests that the EL signers should be more predisposed to use certain signs,

particularly complex multi-channel signs, but that all the signers should show some degree of competence in communicating in BSL.

Most of these studies have examined native signers as a general rule, and the results from the studies discussed can only be applied to small percentage of a small population. Signed languages are not a 'mother tongue' (Deuchar and James, 1985: 45) for many deaf people, and may be considered a delayed first language for Deaf people due to issues in first language acquisition. The next section discusses this issue further.

2.2 BSL as a Delayed First Language and a Second Language

Whilst there is a wealth of evidence that defines BSL as being the language first acquired as infants for some of the deaf population, the reason native BSL language learning is not typical for the D/deaf population because an estimated 95% of deaf babies are born to hearing parents with no prior knowledge of sign (Campbell, MacSweeney and Waters, 2008: 15; MacSweeney et al. 2008b: 437; Mitchell and Karchmer, 2004). Most of the Deaf population cannot be considered as native signers because there is no natural opportunity for a deaf baby to learn SL in a hearing non-signing family (Mayberry et al. 2011; Emmorey and McCullough, 2008). This is unique to sign language because hearing babies learn spoken languages at home from birth, whereas Mayberry et al. (2011) suggest hearing parents can actively choose to not allow exposure to sign language for their deaf children, which would not occur for hearing children acquiring a spoken language with hearing parents (notwithstanding cases of neglect or abuse). However, deaf children of hearing parents that do go on to use BSL as their primary mode of communication do so fluently and could be considered as having BSL as a delayed first language (Cormier et al. 2012; Deuchar and James, 1985). BSL may also be considered as a full second language, with English as a first language. Whilst lipreading will give a deaf person access to some of the spoken language via a visual modality rather than an auditory one, it cannot provide full access to English because it is too imprecise (MacSweeney et al. 2008a: 432; Capek et al. 2008: 1240). Access to the majority spoken language is also co-dependent on factors such as level of deafness or access to hearing aids or cochlear implants. Even with minimal hearing loss, access to English is disrupted and not all methods of aiding hearing are suitable for all deaf people (Mellon et al. 2015; Ladd, 2003). For example, the NHS and NICE criteria suggest deaf children and adults should only be implanted when they have a severe-profound hearing loss (70-90dB), but functional spoken English such as inflectional endings, plural –s, and voiceless phonemes like /p/ and /b/ can be disrupted at a much lower level of hearing loss and affect acquisition of spoken language (Lewis, Valente and Spalding, 2015; NICE, 2009; Crandell, 2006). Bouldreault and Mayberry (2006) and Cormier et al. (2012) concluded that a delayed first language acquisition, whether sign or spoken, affects the syntax of language in adulthood. They also suggest that people who learn sign language as a second language alongside a first language such as English demonstrate near-native competence of grammatical features in their second language, whereas those with a delayed L1 do not display such competence in their delayed first language. This may be down to a 'mismatch in brain maturation and language acquisition' (Boudreault and Mayberry, 2006: 628). However, Bouldreault and Mayberry's (2006) study focused on ASL users and did not provide enough data about how they extrapolated conclusions about delayed L1 and L2 learners. Klein et al. (2006: 366) suggest that for hearing bilinguals, the difference in proficiency in L1 and L2 is due to age of acquisition and proficiency in L1. If this difference occurs due to AoA and language experience for hearing bilinguals, then it should stand that because of the way language is activated, it will be the same for deaf LL. Morford and Carlson (2011) suggest native and non-native signers may focus on different parts of sign language production, suggesting lexical retrieval and storage may be different, but also that the sign language used by EL and LL are markedly different suggesting differences across all language levels.

Ultimately, determining whether BSL can be strictly defined for people as a delayed first language or as a second language is difficult, and studies that have investigated this issue have not reached a definitive agreement. Unlike spoken languages, d/Deaf BSL users have the issue of auditory deprivation creating a barrier to a spoken first language. The next section considers further the effects of acquiring sign language as a native signer, or later in life.

2.3 Age of Acquisition (AoA) Effects on Sign Language

AoA is one of the factors crucial to understanding how language is affected by lack of language immersion because of auditory deprivation from birth for most deaf children (Mayberry et al. 2017; Kyle, 1995: x). If a child is born to hearing parents, they may not have access to true SL models (hearing parents who learn SL are unlikely to be fluent, and often use both sign and speech to communicate) until school or beyond and may not encounter SL learning opportunities or consistent exposure until they are past any sensitive period for language acquisition. This impacts on their development of a functional language system (Mayberry et al. 2017; Mellon et al. 2015). For many deaf children, their signing role models are often other children (Sutton-Spence, 2010: 270). Morford and Carlson (2011: 150) point out that research conducted on sign language focuses on native signers, an atypical population when it comes to the Deaf population because there is so few of them, and late acquisition of sign language is still not fully understood at all linguistic levels.

2.3.1 AoA Differences at the Level of Semantics and Pragmatics

Whilst research on AoA is sparse, it has generally been concentrated on the lower language levels such as phonology and syntax, meaning semantics and pragmatics have been under-researched (Cormier et al. 2012; Mayberry et al. 2011; MacSweeney et al. 2008b; Boudreault and Mayberry, 2006). The studies (which are discussed further down in this section) that have considered AoA differences in semantics and pragmatics have found variable results, with Cormier, Smith and Zwets (2013) suggesting any differences should be attributed to cognitive differences and not linguistic. This means that looking at AoA and semantics and pragmatics together in this study contributes to this gap in research.

Meaningful units in sign language is created by phonological parameters such as handshape, location and movement (Johnston and Schembri, 2012: 108). Certain handshapes such as the ‘A’ handshape trigger a strong semantic representation linked to the meaning of ‘GOOD’ and could therefore be considered iconic signs (Vinson et al. 2010; Johnston and Schembri, 2012; Sutton-Spence and Woll, 1999). Whilst use of iconic signs suggest a proficiency at the level of semantics, it does not necessarily follow that use of these signs are indicative of proficiency at the pragmatic level. Boyes Braem (1999: 178) found that people considered LL as being harder to understand during signed narratives, and posits it is because LL have a smaller vocabulary and use lexical items out of context. When semantic differences were investigated by Ebling et al. (2013) and Rudner et al. (2016), it was found that the signed language may not have close semantic relations with the contact language but more so with a signed language in the same language family.

Marshall et al. (2018: 158) posited that deaf children have lower vocabulary skills when they use a signed language and a spoken language. They suggest in their study that semantic fluency is useful to test out cognitive processes and lexical organisation (Marshall et al. 2018: 157). They conclude that semantic fluency can be a good indicator of lexical organisation, and Marshall et al.’s (2018: 167) results show that delays were a continuing effect on deaf children’s semantic fluency two years later. Emmorey et al. (1995) found native signers outperformed EL and LL on some tasks such as grammaticality performance but the level of semantics was unaffected. This is interesting because age of acquisition may not be the greatest factor in BSL learning, but only part of it, with typical cognitive development and language experience all contributing to adult proficiency levels. Cormier, Smith and Zwets

(2013: 134) found there was no significant difference in their results among native, early and late learners during a constructed action study and that semantic and pragmatic level are affected in the same way as other levels of language. Davidson and Mayberry (2015: 330) also found the semantic and pragmatic level to be unaffected in later learners and posit that it is because of cognitive development and not linguistic development, and functions differently to language differences at a lower level. Studies such as Marshall et al. (2018) and Cormier et al. (2012) findings prove later AoA causes delays at the level of semantics. However, a study by Cormier, Smith and Zwets (2013) on adult semantic and proficiency found there may be no AoA effects at these levels for adults. This uncertainty over how AoA impacts the levels of semantics and pragmatics provides the justification for this study.

2.4 Non-manual Features, Multi-channel Signs and Their Impact on Meaning and Understanding

BSL signs are often categorised into manual signs, multi-channel signs and non-manual features. Multi-channel features are defined in the BSL Dictionary as 'exploiting both manual and non-manual actions' (Brennan, 1992: 32). Sutton-Spence and Woll (1999) suggested that multi-channel signs would be better referred to as parallel hand-mouth signs due to the fact the mouth movement has to co-occur with the hand movement, whereas Johnston and Schembri (2012) suggest that they do not have to co-occur, but that multi-channel signs have a tendency to have a specific mouth movement attached to the lexical sign. Lawson (1983: 97) suggests multi-channel signs function as idioms 'not easily understood by hearing people who do not have native competency'. Lawson (1983: 98) makes the claim that multi-channel signs are used much more frequently by native signers than by 'deaf signers who have good competence in English', but does not corroborate this claim with empirical research.

According to Johnston and Schembri (2012) and Brennan (1992: 33), multi-channel signs are one of the most frequent sign types used, but research is sparse specifically for multi-channel signs at the semantic and pragmatic levels for deaf signers. Hoffmeister and Caldwell-Harris 2014: 232) suggest that deaf children often struggle with metaphors and idioms in the spoken language. As some multi-channel signs can be used as metaphors and idioms in sign language, it is therefore useful to see how these are produced by the participants of this study, and the contexts in which they are used. This is justification for my study because there is a gap in knowledge here, and my research may contribute to filling in this gap.

BSL signs with a longer phrase or multiple-word equivalent in English are often classed as multi-channel signs, with Brennan (1992: 34) suggesting a translation difficulty from BSL to English because multi-channel signs are complex in BSL and require a longer English translation for it to make sense. Brennan (1992: 33) asserts that non-manual features (NMF) do not just occur with multi-channel signs but that they are an obligatory part of the sign production. Johnston and Schembri (2012: 84) mitigate this view by saying NMF are not compulsory but are most closely linked with those signs. This is more likely because without the NMF production, the meaning of the sign still holds. Johnston and Schembri (2012: 224) suggest that semantics in sign language is similar to spoken language in terms of the meanings we convey, understand and use language to 'connect' with people. Part of this way of creating meaning is through iconicity. Iconicity is the clear link between the form and the referent. Whilst spoken languages have iconic words, these tend to be limited in the form of onomatopoeia and do not have the range and prevalence as signed languages. Meir (2013) states that iconicity is the link between semantics and phonology, meaning that iconicity is of importance to processing the meanings of the sign. Brennan (1992: 16) increased iconicity in signed languages allows the signer to use more creativity. Some iconic signs could be linked to D/deaf people's history of communicating with hearing peers because meaning does not have to be linked to a specific lexical utterance, it can be decoded from any sign (Cardin et al. 2016a: 36; Taub, 2001), so by using an iconic sign with clear referents and semantic representation, it facilitates easier communication.

Multi-channel features have often been named as forms of BSL idioms and metaphor (Lawson, 1983: 97, 100). Whilst ASL does not have a definition of multi-channel signs as BANZSL does, metaphorical and idiomatic signs still carry the strong iconicity of sign language where an abstract image is evoked through a concrete sign (Taub, 2001: 3). Many multi-channel features tend not to have a high overt iconicity in sign language, or the referent is often obscure, which may affect how different learners use them (Johnston and Schembri, 2012: 239). Some of the multi-channel signs being targeted in my study do display features of metaphors, specifically the link between concrete and abstract meaning, as described by Johnston and Schembri (2012: 240). Signs such as OVER-MY-HEAD holds two meanings: the visual semantic meaning of something literally going over someone's head and the pragmatic meaning of it referring to not understanding something. This is also the case for the sign ALL-GONE in which the signer demonstrates holding something for it to then 'disappear into thin air'. The 'double mapping' (Johnston and Schembri, 2012: 240; Taub, 2001: 97) of meanings here informs us that the concrete meaning of 'all gone' is that something is no longer present and is evocative of a referent vanishing. This sign is probably the most iconic in this study, with OVER-MY-HEAD a close second. The iconicity of this study varies between having a clear referent or concrete element of the abstract part meaning that the sign can have a high or low iconicity. With multi-channel signs, a high iconicity may mean that they are used more often because they have more of a representation in the signer's mind (Meir, 2013; Taub, 2001).

2.5 Conclusion to Literature Review

This literature review has discussed how AoA impacts levels of language, but the effects on the levels of semantics and pragmatics is still undetermined. This literature review has also considered the effects of auditory deprivation, and the circumstances in which many deaf children do not have the opportunity to acquire language straight away. The hypothesis of this study has therefore been shaped by the existing literature. This work adds to work that has been conducted previously on age of acquisition effects, and expands into semantics and pragmatics, which is currently under-researched.

3. Methodology

This section discusses participants, materials used in the study, data collection, transcription and methods that have been used to carry out the experiment.

3.1 Participants

There are six participants involved in this study. Although it is a small sample, it allows for greater data transcription, therefore providing more in-depth linguistic analysis (Buchstaller and Khattab, 2014: 82-84). The participants were placed in either an early-learner (EL) or a late-learner (LL) group. All participants were born deaf. Three of the participants learnt BSL after the age of 4-5, and three before the age of 4-5 (Mayberry, Lock and Kazmi, 2002). All three LL participants only had exposure to BSL when they started at full-time school, which is the year of their fifth birthday. This age of acquisition (AoA) difference is crucial in finding evidence in support of the hypothesis, because it is this factor that will determine the differences they have as adults. Whilst the AoA difference appears to be small as two of the LL group learnt BSL young, their BSL exposure was non-existent before the age of four/five, although they were exposed to some SSE a few times a week (at part-time state nursery only), and there was no BSL used at home. The EL group all had BSL used at home and in education. There is one native BSL user with Deaf parents.

Table 1 shows mean age, age of acquisition, years of BSL use, and whether they use spoken English. There are three male and three female participants in this study with a mean age of 27. All live in the East Midlands, specifically Derby. They were selected using a snowball

sampling frame: three of the participants are my friends, the other three were their friends or relatives (Buchstaller and Khattab, 2014: 80-81).

Participant group	Mean Age of Acquisition (AoA)	Mean Age in years and months	Mean years of BSL use	Participants who use spoken English
Early Learners (3)	0.8 (10 months) (0-2 years)	26.6 (21-35 years)	25.8 (20.5-35 years)	1
Late Learners (3)	6.6 years (4-11 years)	28.3 (27-31) years)	21.6 (20-22 years)	3

Table 1: Participant groups and mean AoA, age, BSL use, use of auditory technology and spoken English use.

3.2 Materials

To elicit the data to prove the hypothesis in this study, story boards have been used. Storyboards are essentially a pictorial representation of a story (Burton and Mathewson, 2015). The participants are expected to look at the pictures and narrate a story. Storyboards eliminate the use of English and reduce the chances of code-switching, allowing for personal lexical selection. By not signing stories or questions to participants, transference of sign bias such as the use of multi-channel signs is reduced (Burton and Mathewson, 2015: 139). For semantic elicitation tasks, storyboards are used often because they are aimed at specific targeted constructions but also allows for free lexical choice (Burton and Mathewson, 2015). An example of the storyboards used are shown in figure 1.

Figure 1. An example of the storyboards used.

Burton and Mathewson (2015: 135) state the main aim for storyboards is to elicit a targeted linguistic element or construct but allow for free narrative. The storyboards used in this study have been specifically created to elicit multi-channel signs. Use of storyboards in sign language research has been sparse. Burton and Matthewson (2015) suggest that Totem Field Storyboards have used them successfully with ASL, and González (2016) claims storyboards provided them with more naturalistic data in a master's dissertation focused on Catalan Sign Language.

Storyboards were originally chosen due to the ability to exclude English from the test materials and the visuospatial aspect matching the visuospatial ability of BSL. The data from the storyboards provided quantitative data as possible evidence for the different semantic constructions between the BSL user groups. The next section describes the storyboards and explains where the multi-channel sign could have been produced.

3.2.1 Storyboards

This section will discuss the storyboards and the sign elicited, and what meanings the multi-channel signs contain.

Storyboard 1

This storyboard was designed to elicit the multichannel sign ALL-GONE. Storyboard 1 shows person A putting a cake in a bag, leaving it on the table and leaving the room. Person B takes the cake and leaves, person A comes back and is not happy.

Storyboard 2

Storyboard 2 aimed to elicit the multi-channel sign FANTASTIC. The handshape of this sign has a phonological iconicity because it is a 'metaphorical morpheme' (Sutton-Spence and Woll, 1999: 189), it is semantically related to other signs with a positive sense to the meaning, such as GREAT/GOOD. This storyboard showed person A on their driving test. Person A was told that they had passed, and they went home to tell person B.

Storyboard 3

Storyboard 3 aimed to elicit HAVE-NOT. This sign is not transparently iconic because contains no morphemic or phonological markings of negation, although it is a negation marker. Storyboard 3 showed person A asking B if they knew the time, to which Person B responds negatively. Person A then asks person B if they have a car, and person B responds negatively to that one too.

Storyboard 4

This storyboard design attempted to elicit the multi-channel sign OVER-MY-HEAD. This sign is phonologically and semantically related to MISUNDERSTAND and NOT-UNDERSTAND. It can be considered a highly iconic metaphorical sign because it evokes mental imagery of the topic or 'point' sailing over someone's head. Storyboard 4 portrayed child A in a classroom with other children. She is shown as quite happy but gradually becomes more confused as the lesson progresses. Child A then goes to speak to the teacher explaining that she does not understand the subject.

Storyboard 5

Storyboard 5 for the multi-channel sign VEE consisted of two separate storyboards (5a and 5b) attempting to elicit the same multi-channel due to the complexity of the meaning and use

of this sign. This sign does not have an easy English translation, but VEE holds multiple meanings that depend on context for use. These meanings are roughly translated as ‘That is funny’, ‘That is funny (ironically)’, and ‘oh dear’. Different meanings are portrayed with a change of NMF. Storyboard 5a (glossed as VEE1 in ELAN) shows two people skating. Person A skates ahead, almost falls but person B comes to their rescue. Person B is then showing laughing and imagining what would have happened if Person A had fallen. VEE could have been produced in frame 5. Storyboard 5b (VEE2) shows Person A on their mobile phone whilst watching TV. She puts the phone down and leaves. Person B comes in, mistakes the phone for a television remote control and has difficulty changing the channel. Person A comes back in and points out her mistake.

3.2.2 Questionnaires

The questionnaires used to collect metadata contained a range of questions and are based on the ones used in data-collection during the creation of the BSL Corpus (Schembri, 2008). The questions started simple and became more complex towards the end. The questionnaires have been utilised in the analysis for metadata such as: participant age, age of acquisition and length of BSL use. It also collected qualitative data such as reported BSL use in day-to-day life, education, hearing aid or cochlear implant use and so on. This allowed for a well-rounded and in-depth analysis because the sample selection is quite small.

3.3 Procedure

The participants were asked to produce a BSL narration from the storyboards in their own words to me. I explained the task in BSL and gave a brief example of a storyboard. I am profoundly deaf, and a late-learner of BSL (from the age of 6), and it is my preferred language as an adult. Informed consent was obtained through both BSL and a signed paper copy in written English, and participants were given the opportunity to ask questions before the task started. This study elected not to discuss the story too much in depth beforehand, being mindful of not using the multi-channel signs before the study had taken place (Burton and Mathewson, 2015: 146). However, each participant was given the chance to practice with a storyboard that was not filmed, and to think about how they would narrate the story for each story.

The narrative data was collected on a Huawei P10 mobile phone, using a small unobtrusive tripod in the hopes of stimulating natural sign production. After the narrative data was recorded, a questionnaire was then conducted immediately after for all participants except SR35MEL who elected to scan and send me a copy later the same week. The participants could choose to either have the questionnaire signed to them, or to fill it out themselves. Four elected to sign their answers, which were then transcribed by me.

3.4 Data Analysis

This section details how I analysed quantitative data collected from the storyboards after it was annotated and translated through ELAN, and how I analysed the qualitative data from the questionnaires. Once all the video data had been annotated or ‘coded’ using ELAN, the analysis of the data was conducted by using ELAN’s annotation statistics function to collect and compare the multi-channel sign production between early learners and late learners, and the semantic and pragmatic context it used (Perniss, 2015). This provided the evidence to support the proposed hypothesis of this study. ELAN, a computer software program designed to annotate videos, uses tiers to allow for different glosses and translations on the same video (Padden, 2015: 151).

Figure 2. An ELAN example of the tiers

Figure 2 gives an example of the tier labelling used. The tier names were taken from the labels that was used in annotating the BSL corpus (Cormier and Fenlon, 2014). ID-GLOSS indicates that the tier is a very literal sign-word annotation; it is the English orthography of the BSL sign (Crasborn, 2015). An id-gloss will always be in capitals such as in figure 3:

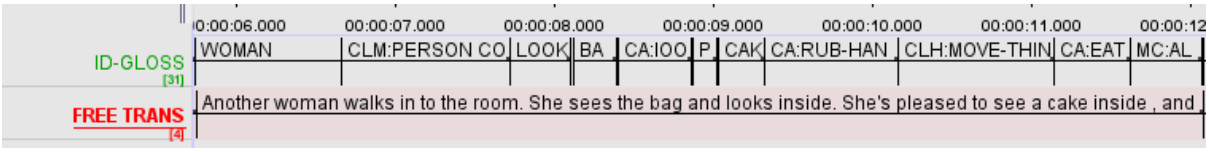

Figure 3. An example from ELAN of the annotations.

When discussed in this dissertation, BSL signs will always be capitalised as a gloss to distinguish it from English. 'Free trans' is the tier which allows for a free translation of the BSL sign. This is particularly important for signs which need a longer English phrase to be an accurate interpretation. Each video has been coded using a similar method to BSL corpus (Cormier and Fenlon, 2014) by using the first and second initial, age, sex and EL or LL to indicate whether they are an early or late learner of BSL. An example of this would be: CW26MLL. By coding in this way, it allows for easy categorisation of different variables. There is also a tier for comments in which I have noted where a multi-channel sign could be used in the narrative, and anything ungrammatical or slightly unusual such as code-switching between BSL and another SL.

4. Results

In this section, I present the results from five storyboard tasks. The storyboard tasks were designed to elicit five multi-channel signs, provided an opportunity in the narrative for the multi-channel sign to be produced at least once per storyboard. The storyboard experiment was carried out in order to either provide support or to refute the hypothesis. There were 17 instances of multi-channel linguistic features occurring across five storyboard tasks. This study found that there was a 6% difference in the use of multi-channel signs, with the EL group using multi-channel constructions more in a semi-structured narrative (EL= 9, LL = 8). Therefore, this is not a statistically significant finding and does not confirm the hypothesis of this study. The reasons as to why the study's hypothesis may not have been supported when other studies focused on AoA have found clear differences between EL and LL will be explored in this section and in the discussion. This results section focuses on multi-channel constructions found across all storyboards and what this means for the hypothesis.

As mentioned in section 3.4, the participants are assigned a code that is suffixed with EL or LL to make it clear to which group the participants were assigned. The multi-channel construction being elicited is also coded as an ID-gloss in the results, to make it clear what multi-channel sign a particular storyboard was aiming to elicit, for example, storyboard 1 aims to elicit ALLGONE1.

4.1 BSL Tokens from all Storyboards

Firstly, every sign annotated in ELAN was recorded for each storyboard. These are known as the BSL tokens. The total and the mean for each separate storyboard was recorded, and the total and mean for all the storyboards administered to each separate group is also recorded. This was to look at patterns and differences that may occur between the two groups of BSL users.

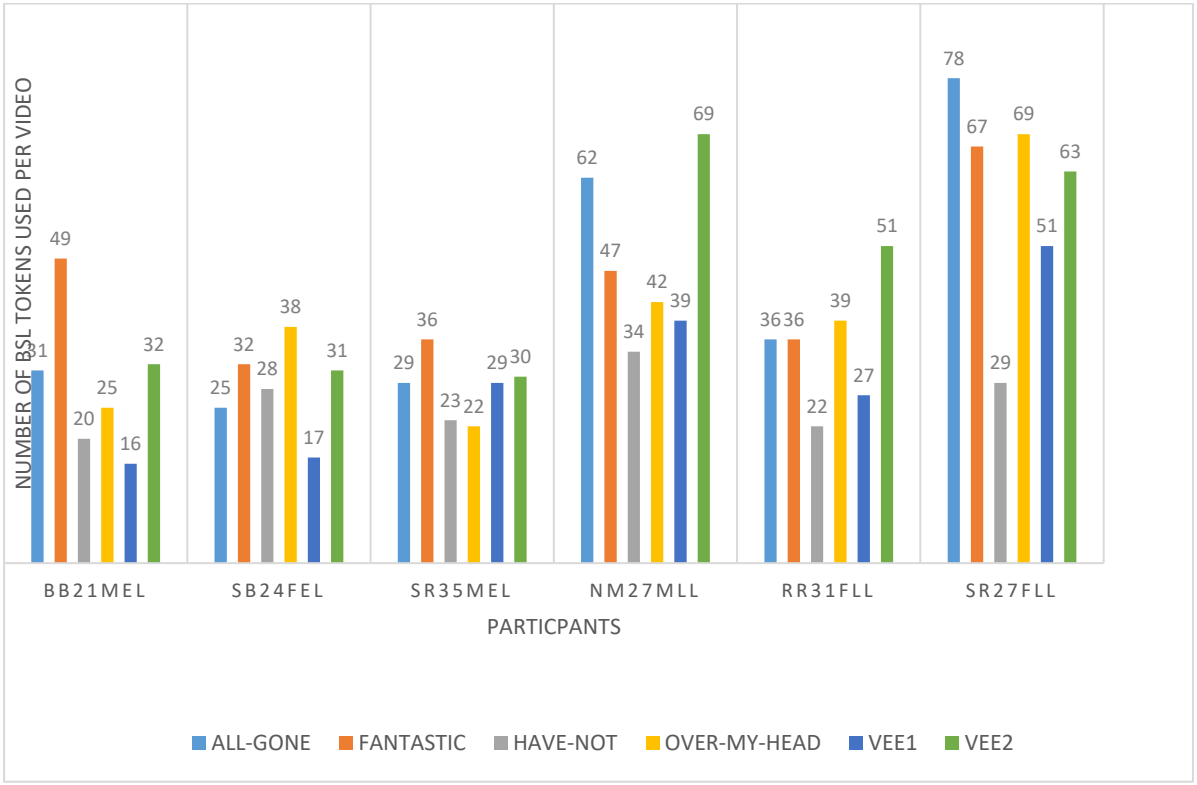

Figure 4. A chart depicting the number of BSL tokens per storyboard for each participant.

There were 1,374 BSL tokens collected in total, with the LL group accounting for 861 tokens, and the EL group accounting for 513 of the overall tokens. This was a mean of 85.5 tokens per storyboard for the EL group and 143.5 for the LL group. Figure 4 illustrates the distribution of BSL signs across all participants. As can be seen from the chart, the three LL (NM27MLL, RR31FLL, SR27FLL) show a greater frequency in the number of tokens they produce, suggesting that they are using more signs because they do not have a full grammatical grasp of BSL, potentially due to the acquisitional age of BSL. The results show that the LL selected 40.4% more signs in their narrative stories than the EL group. This suggests that the LL are using more lexical items to tell a story, and this could possibly be because the LL do not have the BSL vocabulary that the EL group do or are signing in an English syntactical order (SSE). One participant noticeably signed in SSE from the LL group, and produced no multi-channel constructions (NM27MLL). These results differ from Marshall et al. (2018) who suggest that from their semantic fluency experiment conducted with children, native signers produce fewer BSL lexical tokens because they have a smaller vocabulary.

4.1.1 Age of Acquisition, Years of BSL Use and Multi-channel Sign Production

This study analysed participants mean age of acquisition (AoA) and years of BSL use alongside their mean multi-channel use as table 2 below shows. This was to compare when participants learnt BSL, how long they used it for and what their multi-channel production response was in this study.

	Mean Age of Acquisition (AoA)	Mean years of BSL use	Mean use of multi-channel signs
Early Learners (3)	0.8 (10 months) (0-2 years)	25.8 (20.5-35 years)	3
Late Learners (3)	6.6 years (3-11 years)	21.6 (20-23 years)	2.6

Table 2: Mean of AoA, age, years of BSL use, and multi-channel sign use.

On average, there is a 15% increase in the usage of multi-channel signs by early-learners than late-learners. From these results, there appears to be causality in AoA, and multi-channel sign production: those that learnt BSL earlier used more multi-channel signs. It is not significant however, there is a mean difference of 5.8 years but only a mean difference of 0.4 multi-channel sign use between the EL and LL groups. Whilst there is a difference, it is insignificant, and without further research, there is not enough data from only six participants to provide evidence that near-native fluency of BSL can be achieved by LL.

In the next section of the analysis I will detail the findings for the multi-channel signs, and what this means in terms of support for the hypothesis.

4.2 Findings for Multi-channel Signs

Multi-channel signs represented 1.2% of all BSL tokens collected. The EL group used most of the multi-channel signs at 54.4% (n=9) of all multi-channel tokens, an increase of 6% compared to the LL group (n=8). This may appear to support my prediction that there is a difference between BSL users because of AoA, however a difference of one sign does not make it a significant finding. The results in table 3 show that all the participants except one (NM27MLL) used at least one multi-channel construction during the entire experiment. Table 3 shows how many multi-channel constructions were used per participant per storyboard.

	EL Group			**LL Group**		
	BB21MEL	SB24FEL	SR35MEL	NM27MLL	SR27FLL	RR31FLL
Storyboard 1	3	1	1	0	2	1
Storyboard 2	0	0	0	0	0	0
Storyboard 3	0	0	0	0	2	0
Storyboard 4	2	0	2	0	2	0
Storyboard 5	0	0	0	0	0	1

Total MC signs per participant	5	1	3	0	6	2	% Difference
Total MC signs per group			9			8	6%
Mean MC signs per group			3			2.6	

Group	**ALL-GONE1**	**ALL-GONE2**	**FANTASTIC**	**HAVE-NOT**	**OVER-MY-HEAD**	**VEE**
EL	4	1	0	0	4	0
LL	2	2	1	2	1	0
% of all MC signs	35%	18%	6%	12%	29%	0%

Table 3: A breakdown of multi-channel signs by storyboard, group and participant.

Table 3 depicts an uneven spread of multi-channel sign usage across the storyboards and participants, with storyboard 2 not eliciting a single multi-channel sign and participant NM27MLL not producing a single multi-channel sign. Another LL—SR27FLL—also appears to be an outlier in the results because she was the most productive signer of multi-channel signs, not just out of her experimental group, but out of all six participants. This has skewed my results because she is contributing 75% of all the LL multi-channel signs.

By looking at how multi-channel signs are distributed across storyboards, we see a slightly different picture. Storyboard 2 was designed to elicit the multi-channel sign FANTASTIC which it did not, but this multi-channel sign was produced in another storyboard, the one designed to elicit OVER-MY-HEAD. It can also be seen that ALL-GONE1 was produced during storyboard 5, which was designed to elicit VEE. The next section will consider multi-channel construction findings, and the semantic and pragmatic factors that have affected production.

4.2.1 Multi-channel Sign ALL-GONE

This section will detail the results per multi-channel sign and how it affects the support for the hypothesis.

Storyboard 1 was designed to elicit the multi-channel sign ALL-GONE1. ALL-GONE1 was elicited six times, with four of those instances by the EL group, and two instances from the LL group. Another multi-channel sign which holds the same meaning of 'all-gone' (ALL-GONE2) was elicited three times during the storyboard 1 task, the results were still recorded for this because it was a valid multi-channel sign production with a similar meaning. This sign means 'empty-surface' and would be used in context such as 'clean-plate' or 'clean-shelf' (Brien, 1992: 541). The storyboard was about a cake that 'disappeared', meaning ALL-GONE1 was the most appropriate sign, and it was not expected that participants would produce ALL-GONE2. However, the pragmatic context in which ALLGONE2 features needs to be considered. In two of the situations where ALL-GONE2 was produced, both signers (SR27FLL and BB21MEL) used it in context with a person eating the cake. In storyboard 1, it is not pictured that the cake is eaten but taken away by one of the characters. Both the EL and LL have used additional narration to describe the cake being eaten, and therefore in those

contexts, the use of ALL-GONE2 is appropriate, and holds its meaning. The LL, SR27FLL, uses this sign more than once. In the first instance, her usage is appropriate as described above. In the second production of the sign, she uses it to mean the cake has 'disappeared', an inappropriate pragmatic use of the multi-channel sign.

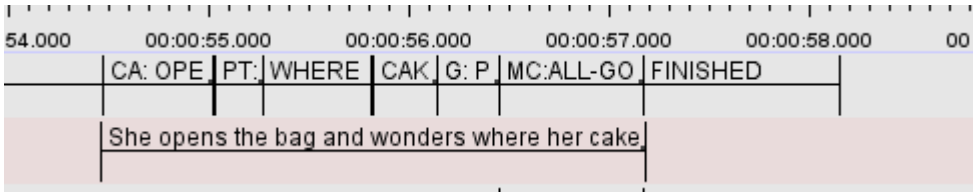

Figure 5. A screenshot of SR27FLL's production of ALL-GONE2.

This suggests that whilst SR27FLL's sign production is good, her BSL knowledge has insufficiencies to allow her to recognise the correct pragmatic context for signs with similar meanings. This inappropriate use of lexical items by LL was also found by Boyes Braem (1999: 178), who also suggested this was common issue to all LL of signed languages because of gaps in knowledge and insufficient early language experience (Mayberry, Lock and Kazmi, 2002).

With the multi-channel sign ALL-GONE accounting for the highest proportion of all the targeted signs elicited, it also suggests that ALL-GONE has a high semantic fluency for both EL and LL (Marshall et al. 2018), particularly supported by ALL-GONE1 and ALL-GONE2 being highly iconic as signs. A high semantic fluency is also supported by the untargeted production of ALL-GONE by a LL (RR31FLL) in storyboard 5, and further lends support to the theory that deaf people have a cognitive predisposition for sign language, whether as a first language or a delayed first language.

4.2.2 Multi-channel Sign OVER-MY-HEAD

The second most frequent targeted multi-channel sign construction was OVER-MY-HEAD at 29% (n=5) of the overall multi-channel signs. It is also significant because this was produced mostly by the EL group (n=4), with only one production by a LL participant (SR27FLL). For this particular sign, it illustrates the differences between the BSL users. As discussed previously, the multi-channel sign for OVER-MY-HEAD can be viewed as a BSL metaphor. Metaphors in languages are used by people with a full grasp of the target language, and how the sign may work on two levels. It has to work as a double mapping of a literal meaning and a non-literal meaning within context of the communicative situation (Johnston and Schembri, 2012: 255; Taub, 2001: 97-99; Sutton-Spence and Woll, 1999). It therefore suggests that those LL who did not use it may not be aware of how to use this multi-channel sign in different contexts, confirming Lawson's (1983: 98) theory that native signers are more adept at using multi-channel signs. The significance of this result is that it is a clear demonstration of how the difference between EL and LL manifests itself at the level of pragmatics.

4.2.3 Multi-channel Signs HAVE-NOT and FANTASTIC

The multi-channel signs HAVE-NOT and FANTASTIC were elicited only by a participant of the late-learner group (SR27FLL). SR27FLL was the most productive signer out of all six participants with a total of six multi-channel signs. This signifies the difference at the level of the individual participant, because she has been productive for almost every target sign that it may not just be age of acquisition in BSL, but also length and quality of use of BSL that contributes to adult competency.

4.2.4 Multi-channel Sign VEE

The only targeted sign not to be produced by any participant was VEE. It may be that this sign is too informal (Johnston and Schembri, 2012: 255). It may also be the case that storyboard 5 did not create the right narrative context to elicit the sign 'VEE', because of the sign's complexity in terms of attached literal and non-literal meanings. This study found that where VEE was not elicited, other semantically-related signs were produced instead however there is not space in this paper to discuss this.

4.3 Summary of Findings for Multi-channel Signs

In conclusion, multi-channel signs are used 6% more by the EL group but it is not a statistically significant finding. There are some differences in lexical selection between the two groups, particularly for the multi-channel sign ALL-GONE1 and OVER-MY-HEAD, and differences that occur at the levels of semantics and pragmatics influencing EL and LL selection of these signs. If we consider the targeted signs in terms of their semantic and pragmatic meanings, ALL-GONE1 and ALL-GONE2 have the same literal meaning: they both refer to entities that are no longer there. However, as discussed previously have a deeper non-literal and contextual meaning, and do not refer to the same context of ALL-GONE. Non-native signers may not have the same cognitive organisation to draw on these non-literal meanings. This is also the case for OVER-MY-HEAD which is a metaphorical sign that works on two levels. However, this study would need to be extended in terms of sample size and composition of the sample, and experimental materials in order to prove this any further. The next section considers whether participants used semantically-related signs in place of where a multi-channel could be produced.

5. Discussion

The aim of the study was to support or reject the hypothesis that there is a difference at the semantic and pragmatic level because of differences in AoA between early-learners and late-learners of BSL. The study did not find any significant evidence to prove this holds to be true, and the hypothesis is therefore rejected. The study intended to elicit five multi-channel signs from two participant groups of Deaf BSL signers that had acquired BSL at different ages. The study elicited all but one of the target signs, but the spontaneous production of another multi-channel sign, semantically related to a target multi-channel sign was included (ALL-GONE). The study found that the EL group had a marginal increase in the production of multi-channel signs and negation signs (Multi-channel: EL = 9, LL = 8; Negation: EL = 6, LL = 5) depicting an insignificant difference between the two groups. The data is somewhat unreliable here because one LL produced no multi-channel constructions at all, and another produced 75% of the LL group entire total of multi-channel productions. A much larger sample group would help to mitigate any outliers, which is not possible in a study this small. In terms of multi-channel sign, this study did find that the multi-channel signs which were more frequently produced were signs that were highly iconic (Johnston and Schembri, 2012: 255; Taub, 2001: 95).

While AoA has been found to affect phonological, syntactical and grammatical linguistic levels, studies focusing on semantics and pragmatics such as Davidson and Mayberry (2015), Surian, Tedoldi and Siegal (2009) and Cormier, Smith and Zwets (2013) to name but a few, found no significant differences at these levels, in agreement with the results I have found. This points to the possibility that language experience may be a deciding factor in LL sign language proficiency. Morford and Carlson (2011) found no significant differences between their EL and LL participants but stated their LL had over 30 years of using SL and Mayberry et al. (2017:392) suggests that signing experience is a crucial factor for proficiency. Similarly, the participants of this study, both groups had a mean of over 20 years of signing experience (EL = 25.8, LL = 21.6).

Participant differences may also be a factor explaining why there were differences in multi-channel sign production, and why there seemed to be a lack of differences found in semantic and pragmatic factors in lexical selection. Two early-learners (BB21MEL and SR35MEL) attended Deaf schools from the ages of 5-18, whilst SR27FLL, the most productive signer in terms of multi-channel constructions, had one-to-one BSL interpreting for her entire time in education. Two participants (SB24FEL and NM27MLL) attended schools with a Deaf unit or specific Deaf pastoral support but the emphasis was very much on oral methods of teaching. RR31FLL was mainstreamed with specialist support until sixth form and then attended a Deaf oralist school. Schooling is mentioned because it is acknowledged that it has an impact on sign production (Johnston and Schembri, 2012; Ladd, 2003; Sutton-Spence and Woll, 1999) because of the push towards the oral majority language, and perceived inferior status of sign language (Ladd, 2003; Kyle, 1995: 134, 136). All participants with the exception of NM27MLL had BSL contact at home with either a parent or a deaf sibling. The participants of this study all had contact with BSL users (native and non-native) growing up, and this exposure to BSL from a young age may have been influential enough during a sensitive acquisition period for LL to acquire enough BSL knowledge to close any significant gaps in their pragmatic and semantic functions. Further research into this area is also needed to determine the effect of signing experience on AoA effects.

This study has a few limitations which will be discussed here. The main issue with this study was the size of the participant sample, data from only six people is very difficult to make any generalisations from. There were also issues with English reading ability and BSL use and fluency, it was very difficult to determine any results through self-report for this because it was not provable. The participants may also have adjusted their register and lexicon for this experiment. It was hoped that using snowball sampling would encourage participants to feel more relaxed because they knew me beforehand, and therefore elicit more natural signing. However, conducting a field experiment with visible camera equipment still creates an artificial communicative environment, what Joos (1967: 28) described as a ‘consultative’ language situation, whereby the participants used a less relaxed and natural sign production. This could possibly be because the participants thought that was what the context of the situation demanded (Johnston and Schembri, 2012: 255). If multi-channel signs are still considered in the Deaf community as idiomatic, then participants may consider them as too informal to use in this elicitation study (Lawson, 1983: 97).

The results for this study are not statistically significant because there is not a great deal of difference between EL and LL. Whilst it does show the late-learners as using fewer multi-channel signs, the results may suggest (with further research), that similarly to Bavelier et al.’s (2001) findings, deaf people have a linguistic predisposition for sign language and there is a compensatory effect to learning SL later in life, allowing many Deaf people to reach near-native proficiency without SL input at birth. The LL group had a considerable difference in age of acquisition compared to the EL group yet produced multi-channel signs comparably with the EL with a few differences. The lack of significance in these results may also be attributed to the language contact between EL and LL, non-native SL users often mix with native signers and may therefore assimilate language faster.

6. Conclusion

In summary, this study did find a difference in multi-channel sign production, but it was only marginal and therefore insignificant. This study may provide the start for a much larger study into the semantics and pragmatics of BSL users, and how this level of language is affected by AoA. It is highly likely that the reason for the lack of significant results is because of the amount of language experience the participants have, and this effect on their cognitive development, however, this cannot be proved without further research. A way this study would be extended in the future would be to follow up on how they individually defined the target constructions. This would give a greater insight into BSL usage differences between early and late-learners.

A truly comprehensive study may be able to contribute to improved understanding about how deaf children access language, and what form improvements could take in this area.

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