Sociolinguistic variation in the nativisation of BSL fingerspelling

Matt Brown, Kearsy Cormier∗

Abstract

British Sign Language (BSL) is a visual-gestural language distinct from spoken languages used in the United Kingdom but in contact with them. One product of this contact is the use of fingerspelling to represent English words via their orthography. It has been suggested that fingerspelled loans are likely to become “nativised”, adapting manual production to conform more closely to the native lexicon’s inventory of phonemic constraints. Much of the previous literature has focused on one-handed fingerspelling but, unlike the majority of sign languages, BSL uses a two-handed manual alphabet. What is the nature of nativisation in BSL, and does it exhibit sociolinguistic variation? We apply a cross-linguistic model of nativisation to conversation and narrative data from 150 signers from the BSL Corpus from 6 UK regions. Mixed effects modelling is employed to determine the influence of social factors. Results show that region is the most significant factor, with increasing age also making a contribution to the production of non-nativised sequences in Glasgow and Belfast, although age is not significant for the production of more nativised forms. Gender and parental language background are not found to be significant. The findings also suggest a form of reduction specific to London and Birmingham.

Keywords: British Sign Language, phonology, fingerspelling, manual alphabet, corpus linguistics, sociolinguistic variation, nativisation, lexicalisation

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1 Introduction

British Sign Language (BSL) is the language of the British Deaf community. BSL is not “English on the hands”: it is a different language in a visual-gestural modality and has its own phonology, morphology, syntax and semantics. Many Deaf users of BSL possess a cultural and linguistic identity distinct from that of English speakers. Nonetheless, BSL has regular contact with English and can represent English orthography with its manual alphabet.

How is English orthography represented within the BSL lexicon? In spoken languages, uni-modal (spoken-to-spoken) loan words are often adapted to the phonemic inventory of the borrowing language, but how are cross-modal (written-to-signed) loans adapted? Is the manual alphabet employed in the same ways and for the same purposes by different users of BSL or are there any clear patterns of sociolinguistic variation? The current study tests a previous proposal about nativisation processes in BSL (Cormier et al. 2008) and the extent to which these processes relate to sociolinguistic variation in conversation data from the recently created BSL Corpus (Schembri et al. 2014).

1.1 The BSL manual alphabet

Manual alphabets are not a direct representation of spoken language but a way of encoding orthography, the written form of a language (Brennan 2001). The act of fingerspelling consists of producing sequences of manual alphabet letters to represent complete words, abbreviations or initials. The manual representation of writing systems varies across different sign languages, even where the written language being represented is the same.

In BSL, the contemporary manual alphabet is a set of 26 “hand arrangements” (Sutton-Spence 1994) representing the modern Roman alphabet letters used in the written form of English. Phonological variants do exist, notably for the letters -b-, -c-, -m-, and -s- (Sutton-Spence 1994; Brennan 2001). But unlike the majority of the
world’s sign languages which use a one-handed fingerspelling system, BSL has a
two-handed manual alphabet.¹ This has a number of consequences, discussed below.

1.2 Is fingerspelling “non-native”?  
It has been questioned whether foreign language elements such as fingerspelling
should be considered part of sign languages at all. Brentari & Padden (2001)
characterise this as an “ideological anxiety”: the Deaf community and sign linguists
have worked hard to demonstrate that sign languages are not a code for spoken
languages. The determination of what is and is not “native” BSL is therefore both a
sociolinguistic issue (Sutton-Spence 1994) and a political one (Sutton-Spence and
Woll 1999). Unlike native sign language vocabulary and syntax, the first manual
alphabets were constructed by hearing educationalists. For some, fingerspelling may
be uncomfortably related to the historical suppression of signed language in favour
of English “oralism”.

However, use of fingerspelling in the Deaf community is diverse. It has been
suggested that certain social groups (e.g. older people, Scottish people) might use
fingerspelling more or less frequently (e.g., Sutton-Spence et al. 1990; Sutton-Spence
1994; Brennan 2001; Schembri and Johnston 2007). Register and conversational
partners may also have a marked effect (Sutton-Spence 1994).

Whether the existence of English influences on BSL should be considered as
peripheral to the native lexicon or not, the role that fingerspelling plays is important.
Full fingerspelling is used to represent proper nouns from English and other
concepts for which there may (or may not) be a lexical gap in the native lexicon.
Furthermore, some fingerspelling forms have become part of the core BSL lexicon
(Brennan 2001). Borrowing is normal for a living language: we might welcome this
positively as yet further evidence that BSL meets that definition.

¹ Two-handed systems are used in the BANZSL family (Johnston 2003), which includes BSL, Auslan (Australian
Sign Language) and NZSL (New Zealand Sign Language), and also in Indo-Pakistani Sign Language (Zeshan
2000) and Turkish Sign Language (Tasci 2013).
1.3 Nativisation versus lexicalisation

Brentari & Padden (2001) consider fingerspelled elements in American Sign Language (ASL) to be non-native in origin, yet they are nonetheless subject to many of the same phonological constraints as the native vocabulary. The phonological structure of loan elements can be altered in order to make them more “sign-like” – a process known as nativisation (Brentari and Padden 2001). In both one- and two-handed systems, fluent fingerspellers are unlikely to produce a static, punctuated series of citation form letters: the transitions from one letter to the next will be “smoothed” so that handshapes and movement flow from letter to letter (Brennan 2001). With some words, letters might be deleted entirely. For ASL, Wilcox (1992) described the pattern of movements in a fingerspelled word as a “movement envelope” and suggests that learning to fingerspell involves learning to coordinate the transitions between letters just as much as learning the hand configurations themselves. Child learners of ASL can recognise and try to produce these movement envelopes some time before they understand them as separate letters that spell out a written word.

Nativisation is therefore a restructuring process that moves a sequence of letters closer to conformity with the phonological constraints of native signs (Brentari and Padden 2001). In the current study, “nativisation” is considered distinct from “lexicalisation”, i.e. the extent to which a production outside the core, native lexicon takes on a conventionalised form and meaning that is not fully predictable from its constituent parts and has become accepted as part of the language’s vocabulary (Sutton-Spence 1994; Janzen 2012). The two concepts are inarguably related, as any loan word which becomes more lexicalised is also likely to become more nativised, and possibly vice versa. However, it is important to distinguish phonological restructuring from conventionalisation of form and meaning across a community of users. We emphasise this difference because the literature on fingerspelling occasionally use the terms “lexicalised” (the extent to which a production has
become conventionalised both in form and meaning across a community of users) and “nativised” (the extent to which a foreign loan has adapted to the phonological constraints of the host language) interchangeably (e.g., Brentari 1995; Brennan 2001; Brentari and Padden 2001).

1.4 Phonological constraints on native signs

Just as the phonemic inventories of different spoken languages will vary, different sign languages may have differing sets of “acceptable” phonological parameters. For example, there are handshapes in ASL that are not used in BSL. Brentari & Padden (2001) suggest that a sign’s conformity to these inventories can be used to determine the degree of nativisation that a fingerspelled non-native loan has obtained.

Historically, researchers (e.g., Stokoe 1960; Battison 1978) have described four primary phonological parameters that differentiate signs from one another: handshape, movement, orientation and location. Much of the earlier literature focused on ASL, although research since then has shown that many of these hold for other sign languages as well. Well-formed signs appear to obey the following over-arching phonological constraints:

• Signs may be one-handed or two-handed. Two-handed signs are subject to the following constraints:
  - When both hands are moving, the Symmetry Condition (Battison 1978) specifies that both hands must have the same mirrored location, the same handshape, and the same movement (either simultaneous or alternating).
  - The Dominance Condition (Battison 1978) specifies that if they do not share the same handshape, then the non-dominant hand remains stationary and is “acted on” by the dominant hand.
• For both one-handed and two-handed monomorphemic signs, a number of “two-type” constraints apply. A sign can have at most:
- two different movements (Sandler 1993; Brentari 1998);
- two different locations (Sandler 1989);
- two different handshapes, i.e. one handshape change (Sandler 1989).

• In monomorphemic signs, handshape changes can co-occur with movement (Brentari 1998) but if the movement contacts two different body locations then the handshape cannot change.

These phonological constraints can be applied to manual alphabet letters as well as signs. Languages with one-handed manual alphabets like ASL are typically specified only for handshape and orientation (and in a few cases also movement), as shown in Figure 2. Also, one-handed fingerspelling occurs in the space just in front of the dominant shoulder, different from lexical signs which are produced in various locations in the body or in “neutral” space centrally in front of the signer’s chest. For BSL, the two-handed alphabet requires the hands to contact each other (in 25 out of 26 cases) and fingerspelling is typically articulated in the same “neutral” space where two-handed lexical signs are commonly produced. This entails that phonologically, BSL manual alphabet letters are fully specified for handshape and location (and in two cases, -h- and -j-, for movement), as shown in Figure 1. BSL fingerspelling therefore has an additional constraint on the potential phonological variation of spelling-related signs in comparison to one-handed systems like ASL. This does not mean that BSL fingerspelling’s productivity for sign formation is necessarily more constrained, but that BSL manual alphabet letters are arguably “more sign-like” from the very start: Brennan (2001:55) suggests that BSL fingerspelling might be “already more formationally integrated into the sign language than one-handed systems”.

Figure 1: BSL fingerspelling system (from BSL SignBank; http://bslsignbank.ucl.ac.uk/spell/twohanded.html; Fenlon et al. 2014a).

Figure 2: ASL fingerspelling system (from BSL SignBank; http://bslsignbank.ucl.ac.uk/spell/onehanded.html; Fenlon et al., 2014a).
1.5 Loans of one letter: initialisation versus SMLS

An immediate consequence of the additional phonological constraint on BSL manual alphabet letters is that the phenomenon of “initialisation” found in ASL (in which a sign is formed from the handshape of a manual alphabet letter but with added movement and location parameters) is by necessity less frequent in BSL. Instead we more frequently see the use of Single Manual Letter Signs (SMLS), which are more limited in their variation of movement and location. Previous BSL research occasionally treated these two phenomena as different manifestations of the same thing (e.g., Sutton-Spence 1994; Brennan 2001). Here however, we view SMLS as phonologically distinct from initialisations.

The manual features of SMLS are often identical to a manual alphabet letter, possibly with repeated movement to contact between the two hands (referred to as “double articulation” by Sutton-Spence 1994). SMLS seem to be frequent in semantic categories such as family relationships (e.g. MOTHER, FATHER, DAUGHTER) and time/duration (e.g. MONTH, MINUTE, YEAR). Different signs formed from the same letter can be disambiguated by an accompanying English mouth pattern and/or from context.

Signs closer in nature to ASL initialisations are still possible in BSL, such as the verb RECOMMEND (the letter -r- moving between locations associated with indexed referents) and the number MILLION (an -m- making a short movement away from the body). There are others but these are not nearly as common as SMLS in BSL.

In ASL, Brentari & Padden (2001) observe that in addition to the phonological constraints listed above, for single letter initialisations the handshape parameter will have very limited scope for alteration, in order to preserve the manual alphabet letter’s form. In contrast, it has been observed in BSL (Sutton-Spence 1994) that there are a few fingerspelled-based signs which change the handshape or movement of the letter. Two such examples are DIGITAL and GOLD (see Figure 3), which start with a
manual alphabet initialisation and then add a non-letter handshape change or a movement or both.

![Figure 3: BSL GOLD.](image)

The lone exception to the constraints imposed by two-handed fingerspelling in BSL’s (present day) alphabet is the letter -c-, which specifies only one hand and has no location or movement parameters specified. As a result, it is comparatively free from restrictions on movement, location and orientation and we see several examples of initialised signs that employ it with a variety of locations and movements, such as COMMUNITY, COURSE, and CONFIDENCE (see e.g. Figure 4). Sutton-Spence (1994) found that moving signs incorporating the letter -c- occurred more frequently than any other letter in her study.

![Figure 4: BSL CONFIDENCE.](image)
1.6 Loans of more than one letter

In ASL, there are some fully spelled English words (perhaps with some restructuring) that are broadly accepted and have been termed “loan signs” (Brentari and Padden 2001). Loan signs of this type appear to be less prevalent in BSL. Battison (1978) originally proposed in his seminal work on fingerspelling that lexicalised ASL fingerspellings formed from abbreviations are the result of a progressive restructuring, involving successive deletions of letters from a fully fingerspelled word. Such restructuring does not appear to occur in BSL in the same way. In her analysis of BSL fingerspelling, Sutton-Spence (1994) did not find any evidence of intermediate restructurings and suggested that for BSL, the majority of abbreviated fingerspelling loans are “created that way from the outset”. Lexicalised abbreviations using two or more letters are not especially common in Sutton-Spence’s data in comparison with SMLS and appear to favour the first and last letters of a word (such as CLUB or ABOUT) while non-lexicalised but at least partly nativised loans more frequently use the first two letters (-t-h- and -e-x- being notable, with the latter representing 7 different English words). Non-lexicalised multi-letter borrowings can also be reflections of typical written English abbreviations (such as “doctor” to -d-r-, months of the year as -j-a-n-, -f-e-b- etc.). As always, there are exceptions, such as the lexicalised but only partly nativised two-letter sign PROJECT.

Fingerspelled loans in BSL can also form part of a compound with a native lexical item (Sutton-Spence 1994). These often represent English loans which are themselves polymorphemic, such as -m-i-d-SPOUSE (“midwife”) and -s-t-e-p-FATHER (the latter additionally interesting because FATHER is itself a lexicalised SMLS, -f-f-). A different type of compound loan uses an initial SMLS to represent a full English term compounded with a native lexical sign with a related meaning, in order to disambiguate the lexical sign: Sutton-Spence & Woll (1999) cite examples -g-LAND (“geography”) and -c-LOOK-AFTER (“crèche”) among others.
An important example of (partly) nativised but non-lexicalised fingerspelling usage is the creation of temporary formations employed during dialogue as a kind of “local lexicalisation” (Brentari 1995; Brentari and Padden 2001) – this may be better considered as local nativisation instead, as part of a drive for economy. In ASL, an English term might be fingerspelled in full the first time it is deployed and referred to successively with an extemporised reduction (Valli and Lucas 1992), by the signer(s) in that particular dialogue. There is however no established “go-to” lexicalised form for these loans in wide community use. In BSL, a “nonce” SMLS is more likely to be used as a form of local nativisation, formed from the first letter of the English term alone, perhaps with an accompanying English mouth pattern (Sutton-Spence 1994).

1.7 Models of non-native lexicon nativisation

We have established that a sign language may incorporate non-native loans from other sign languages and from spoken language written systems and that these loans may undergo nativisation. For ASL, Brentari & Padden (2001) proposed a model which divides the non-native lexicon into five overlapping categories, ranking the extent to which loans in ASL conform to the phonological constraints described above. Cormier et al. (2008) suggested that this model does not account for some patterns found in two-handed fingerspelling systems. In ASL, handshape alone is usually enough to distinguish a manual alphabet letter, while in a two-handed system, a much smaller set of handshapes is used in different combinations with both hands, which means that sequences of letters may be able to retain the same handshapes (thereby conforming with phonological constraints) for longer than is possible in ASL. Furthermore, several ASL letters use handshapes which are not otherwise found in the native lexicon, while in BSL, only one variant of one manual alphabet handshape is not used by native signs (-m-).

Previously Cormier et al. (2008) presented a cross-linguistic working model of fingerspelling nativisation which describes the range of nativisation possible for
fingerspelled loans with varying numbers of letters, across one-handed and two-handed systems (see Figure 5). This model was based on examples from the literature and from the authors’ knowledge of the sign languages involved. The current study aims to apply this model of fingerspelling nativisation to spontaneous corpus data, and additionally to study the relationship between nativisation and sociolinguistic variation in BSL fingerspelling. Before we do this, we provide some background on previous studies fingerspelling in the BANZSL family – i.e. BSL, Auslan (Australian Sign Language) and NZSL (New Zealand Sign Language) which all use the same two-handed manual alphabet.

<table>
<thead>
<tr>
<th>Number of letters represented in surface form</th>
<th>Native</th>
<th>Non-native</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entire word</td>
<td>Fully nativised single-letter signs</td>
<td>Partially nativised single-letter signs</td>
</tr>
<tr>
<td>1 letter</td>
<td>BANZSL GARAGE, ENGLISH, MOTHER2</td>
<td>BANZSL MOTHER, BSL UNCLE</td>
</tr>
<tr>
<td>2 letters</td>
<td>BSL HIGH-SCHOOL, THURSDAY,</td>
<td>BANZSL ROMAN-CATHOLIC, EXCUSE</td>
</tr>
</tbody>
</table>

### Figure 5: Working model of nativisation of fingerspelling in ASL and BANZSL

(adapted from Cormier et al. 2008).

1.8 Previous analyses of BANZSL fingerspelling

Sutton-Spence (1994) conducted a comprehensive analysis of fingerspelling influences on BSL production as a doctoral thesis, using a dataset of BSL derived from the long-running BBC television programme *See Hear!* as well as data from elicitation tasks, with some key results already referred to above. Nativisation extent
and the usage of more nativised forms was analysed, but not explicitly in terms of an
over-arching model of nativisation. It was suggested that older signers tend to
fingerspell more, particularly if they are also Scottish, Welsh or Irish: this was
attributed to changes over time in regional education methods but also to family
language background (whether or not their families were deaf native signers).
Findings from this same See Hear! dataset were additionally reported in Sutton-
Spence, Woll & Allsop (1990), but with a different regional breakdown to the current
study.

McKee & Kennedy (2006) used the Wellington Corpus of NZSL to analyse the
lexical frequency of signs, including fingerspelled items. 2.5% of the 100,000 tokens
analysed had a fingerspelled component. It was observed that 46.8% of the
fingerspelling tokens were “initialised”, defined as “only the first letter
fingerspelled” (i.e. no distinction was made between an initialisation and an SMLS).
In a separate sociolinguistic study, McKee & McKee (McKee and McKee 2011)
observed that older signers of NZSL made minimal use of the manual alphabet.

Schembri & Johnston (2007) conducted a pilot study employing a mixed effects
analysis of fingerspelling use in a corpus of Auslan. The study did not have a
particular focus on nativisation, but did investigate the variance of non-lexicalised
fingerspelling across social factors: interactions with age, gender, region, social class
and language background (deaf or hearing family) were analysed. Schembri &
Johnston concluded that increasing age was the most significant social predictor for
increased use of fingerspelling in Auslan. Region was also found to have a significant
effect, though the participants were divided into just two regional groups and the
impact of the effect was mild. Gender, social class and language background were
not found to be significant. It is noted that the software used (GoldVarb X) has since
been replaced with a more robust alternative (Rbrul) which is less prone to Type I
errors: individual speakers should properly be treated as a random effect, and for a
conservative approach in mixed effects modelling the Bonferroni correction should
be applied to significance thresholds (Johnson 2009).
The BSL Corpus is relatively new and there has been no previous in-depth study of manual alphabet use within it, although a general reckoning of frequency placed non-nativised fingerspelling use at 3.0% of 25,000 tokens of manual productions from conversation data from two regions (Bristol and Birmingham) including gestures, pointing, classifiers and constructed action as well as lexical signs (Fenlon et al. 2014b).

1.9 Research questions

It is clear that fingerspelling can undergo nativisation in order to more closely resemble signs in the native lexicon. Studies have also suggested that non-nativised fingerspelling is employed more frequently by specific sections of the community. This study sets out to analyse data from the BSL Corpus with the following questions in mind:

- How frequently are nativised and non-nativised forms of fingerspelling employed by BSL signers?
- Do social factors such as age, region, gender and language background correlate with fingerspelling use, in terms of the relative frequencies of nativised and non-nativised forms?
- For more nativised forms, how is fingerspelling altered to conform to the general phonological constraints on sign formation?
- How is fingerspelling in the BSL Corpus spread across the proposed model of nativisation shown in Figure 5 above?

2 Method

2.1 Selection of participants, social factors and tasks

Participants for the original data collection stage of the BSL Corpus (2008-2011) were recruited from eight UK cities with the aim of creating a representative sample in terms of age, gender, ethnicity, region and language background, despite some
difficulties in defining what a representative sample of the Deaf community might look like (Schembri et al. 2013). A quota system was employed with recruitment of participants from specific social factor groups halting when the quota had been reached. The data collection phase was completed in 2010 and the annotation phase is (at the time of writing) ongoing. To date, 55,000 sign tokens have been annotated and made available online (http://www.bslcorpusproject.org); additionally, these annotations have been used to produce an online corpus-based dictionary, BSL SignBank (Fenlon et al. 2014a).

For this study, we focus on data collected from the conversational and personal narrative components of the BSL Corpus. Specifically, we focus on a subsection of the BSL Corpus conversation data: 101 signers from 4 cities in the UK (Birmingham, Bristol, London, and Manchester). We also include a subsection of the BSL Corpus narrative data: 49 signers from 2 UK cities (Glasgow and Belfast). A sample of 100 signs from each of the conversation and narrative files was annotated using ID glosses as described above, resulting in a set of 15,000 signs. In Table 1, the distribution of participants according to several social categories is provided.

<table>
<thead>
<tr>
<th>Region</th>
<th>Gender</th>
<th>Age</th>
<th>Language background</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>16-30</td>
<td>30-45</td>
</tr>
<tr>
<td>Belfast</td>
<td>12</td>
<td>13</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Birmingham</td>
<td>16</td>
<td>10</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Bristol</td>
<td>12</td>
<td>12</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Glasgow</td>
<td>12</td>
<td>12</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>London</td>
<td>13</td>
<td>12</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Manchester</td>
<td>12</td>
<td>11</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>77</strong></td>
<td><strong>70</strong></td>
<td><strong>25</strong></td>
<td><strong>41</strong></td>
</tr>
</tbody>
</table>

Table 1: Distribution of participants according to social categories.

Consideration was given to whether the situational variety of the two different tasks (i.e. conversation and personal narrative) were directly comparable. It was
noted that for all participants, the conversation and narrative tasks were filmed in the same session with the same conversational partners, who knew each other but were not too close (Schembri et al. 2013). The narratives are therefore not context-free monologues: they retain elements of conversational interaction such as accommodation, back-channelling, and requests for clarification (both explicit and implicit). Conversely, for the conversation tasks, it would reasonably be expected that no dialogue will ever be perfectly balanced between participants or require brief conversational turns: conversations are likely to involve some personal narrative. It was therefore felt that the setting of the two tasks were sufficiently comparable for the purposes of this study.

Region has been found to be important in previous studies of BSL fingerspelling (e.g., Sutton-Spence et al. 1990; Sutton-Spence 1994). In terms of location (city/region) in the BSL Corpus, participants who had been lifelong residents of that region were preferred at recruitment, with living or working in that area for the previous 10 years being the minimum requirement. Age has also been found important for fingerspelling – e.g. Sutton-Spence (1994) found that older signers tend to fingerspell more. Since few signers are born to signing parents\(^2\), large centralized deaf schools appear to have played a primary role in transmitting the language from generation to generation. Variation in educational policy within such schools therefore has the potential to impact upon patterns of use. Recruitment to the BSL Corpus Project was designed to reflect this variation by ensuring that participant selection was evenly spread across four age groups (ranging from 16 to 94 years of age). The division of participants into these age groups was partly motivated by changes in language policy in deaf education during the twentieth century (e.g. from education that emphasised the exclusive acquisition of speech and listening skills to increasing acceptance of sign language in the classroom and more recently a shift

\(^2\) The number of native signers in the UK is unknown, but it is largely thought that roughly 5-10% of deaf people are born into signing families, following similar proportions documented in other countries (Mitchell and Karchmer 2004).
away from specialist schools for the deaf to units or provision in mainstream schools; see Woll and Ladd 2011 for an overview).

In terms of language background, nearly half (42%, n = 42) were native signers (i.e. they had at least one signing parent who was deaf). Of the remaining number (58%, n = 85), 79 reported having learnt to sign before the age of 7, 5 reported having learnt to sign between the ages of 8-12, and 1 reported having learnt to sign between the ages of 13-18. Research has demonstrated that the age of sign language exposure has a considerable effect on sign language proficiency generally in adulthood (Emmorey 2002; Mayberry 2010), and it has been observed that children who are native signers frequently learn to fingerspell before they learn to read (Sutton-Spence 1994). Therefore, we might expect to see variation in fingerspelling reflecting a signer’s age of BSL acquisition.

Our participants were balanced for gender overall. Gender is also a relevant factor in language change. Studies based on spoken and signed language communities have indicated that women often lead processes of language change (e.g. Rickford et al. 1995; Schembri et al. 2009).

Examining the ethnicity data for the corpus participants as a whole, 91% identify as White with the remaining 9% (just 22 individuals) split between the various Black, Asian and Other top level groups. While this is not radically different to the proportions of ethnic labels found across the UK (Office for National Statistics 2013), analyses of interactions with such small factor groups are unlikely to be reliable, particularly when only six of the eight corpus regions are being sampled. Ethnicity was therefore not selected for analysis.

Participant education level and social class data were available and considered for analysis but had to be excluded. The latter was partly derived from the former; both factors also lack independence from age and region due to historical/local changes in deaf education methods and equality legislation. Mixed effects modelling requires full independence of factors.
2.2 Coding

The working model proposed by Cormier et al. (2008) as in Figure 5 has the number of letters and extent of nativisation as continuous axes. For coding purposes for the current study, a discrete nativisation scale of N1, N2 and N3 was devised, corresponding respectively to the model’s definitions of non-, partly- and fully-nativised fingerspelling based on conformity with the phonological constraints described in §1.4 above. The number of letters in a sequence was represented as L1 (one letter), L2 (two letters) and L3 (three or more letters). This system produced an annotation code in the form LnNm, with n and m having a value of 1-3, producing a 3x3 grid of nine annotation codes. A description of the typical tokens the codes were applied to is found in Error! Reference source not found.

To locate all instances of fingerspelling in the Corpus sample, two different general classes of existing gloss annotations had to be considered: “non-nativised” fingerspelling, annotated as such using the FS: fingerspelling prefix according to the BSL Corpus annotation guidelines (http://bslcorpusproject.org/cava), and partly- or fully-nativised signs related to the manual alphabet, each with their own unique ID gloss referring to a citation form listed in the BSL SignBank lexical database. BSL SignBank is a free online dictionary and lexical database of BSL (http://bslsignbank.ucl.ac.uk), the first online BSL resource to be both research-based and usage-based. BSL SignBank also functions as the lexical database reference source for annotations in the BSL Corpus: every SignBank entry consists of a video showing the sign in citation form, a set of English translation equivalents, an “ID gloss” (a unique alphanumeric code usually related to one of the English translation equivalents), as well as a number of searchable properties describing the phonology and other linguistic features.

<table>
<thead>
<tr>
<th>N3 (fully nativised)</th>
<th>SMLS or initialisation which violates no phonological constraint, e.g. DAUGHTER</th>
<th>A two-letter “sign” that violates no phonological constraint, e.g. MANCHESTER</th>
<th>None (a 3+ letter sequence always violates a phonological constraint)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N2 (partially nativised)</td>
<td>SMLS-like sign which violates a constraint or uses a handshape not found in the native lexicon, e.g. MOTHER with 3-fingered handshape</td>
<td>A two-letter “sign” that does not fully meet phonological constraints, representing a longer word, name or phrase, e.g. PARENTS, TELEVISION</td>
<td>Sequence of 3 or more letters which represent an abbreviated word or which smooths fingerspelling phonology, e.g. BIRMINGHAM02, -d-a-y-</td>
</tr>
<tr>
<td>N1 (non-nativised)</td>
<td>Literal intended representation of a single letter, e.g. -m-ONE for the M1 motorway</td>
<td>Literal intended representation of a two-letter word, eg. -s-o-, -b-y-</td>
<td>Literal, (near-)exact representation of a 3+ letter word</td>
</tr>
</tbody>
</table>

Table 2: Description of the typical "type" of token described by each L-N- annotation code.

All published SignBank entries were systematically inspected by the first author and two Deaf native signers of BSL. Each sign identified as derivable from BSL fingerspelling was assigned a unique tag (“lexis:fingerspell”), allowing these signs to be searched for and exported easily. A sign was deemed to be a candidate if the sign clearly began or ended with a hand arrangement that resembled a BSL manual alphabet letter corresponding to a letter in an English translation equivalent of that sign (usually the first letter). This definition was intended to exclude handshapes which iconically resemble written orthography in some way but do not resemble a BSL manual alphabet letter (for example, signs such as LIVERPOOL which employ a handshape depicting a written capital L – identical to the one-handed ASL letter -l- shown in Figure 2) or borrowed signs incorporating fingerspelling systems from foreign sign languages (for example the sign N002 which is likely a loan from ASL).

This process produced 133 lexical items which were tagged as having a fingerspelling component from the 2,362 in the public BSL SignBank database at that
time. Each of the citation forms was then given an LnNh annotation code from the coding scheme above.

The corpus sample of 15,000 tokens (150 participants, 100 tokens each) was then searched for each of these 133 ID glosses. Once located, an annotation was created on a new tier with the appropriate annotation code for that specific instance of the sign. Additionally, a suffix was used to indicate whether each token in the corpus was more (+), less (-) or equally nativised (=) in comparison to the SignBank citation form.

Following this, all non-lexicalised fingerspellings (annotated in the BSL Corpus with the tag “FS:”) were searched for, inspected and coded. SMLS-like signs consisting of a repeated letter, for example FS:N-NOTTINGHAM (-n-n-) or the nativised sign MOTHER (-m-m-), were treated as just one letter, in line with the Corpus fingerspelling annotation conventions (Cormier et al. 2015). Fingerspelling annotations embedded in possible compounds, e.g. FS:MID^SPOUSE ("midwife"), were also included, as well as those embedded within “SN:” sign name\(^3\) annotations. In all cases, glosses denoting any uncertainty, ambiguity, hesitancy, or provisional status were excluded (e.g. UNKNOWN, INDECIPHERABLE, FALSE-START).

On completion, a consistency check was arranged: a random sample of 20\% of the tokens was cross-checked by a hearing BSL signer with sign linguistics training who was provided with the coding scheme and instructions above, with no cases of disagreement.

2.3 Statistical analysis

Rbrul (Johnson 2009) was selected to perform analysis, as it has a number of advantages: it was designed specifically with linguistic analysis in mind and is more robust for relatively small data sets than predecessors such as GoldVarb. Before analysis began, we noted that 3 of the 150 participants did not produce any

\(^3\) Sign names identify persons, places and brands. They can be derived from a range of sources including the BSL native lexicon, the manual alphabet (with or without phonological variation) and descriptive signs (Sutton-Spence & Woll 1999).
fingerspelling-related tokens of any type. These participants were excluded from analysis as recommended by Guy (1988) and Johnson (2010), leaving 147. This data set, with 931 tokens from 147 participants, was deemed to be within Rbrul’s tolerance for sample size and tokens-per-participant as suggested by its documentation (Johnson 2010).

As the dependent variables in question (nativisation extent and number of letters) were coded for with three-value codes (N1, L3, etc.) creating a set of nine discrete values (L1N1, L1N2 etc.), but logistic regression requires a binary value for analysis, three tests were planned: firstly non-nativised against partly- and fully-nativised usage (N1 v N2+N3); fully nativised versus partly- or non-nativised usage (N3 v N1+N2); and SMLSs, the most common type, versus all other codes (L1 v L2+L3). We planned for all three tests as there was no clear theoretical, statistical or practical motivation for preferring any of these two-way splits over another. Furthermore, these three perspectives enabled a more nuanced picture of variation in manual alphabet use in the event that any differences might arise in the interactions between these differing groups of codes.

Age was treated as a continuous variable and centred on the mean to avoid tolerance issues (uncentred continuous ranges can cause modelling difficulties, e.g. when calculating the standard deviations of fixed effects). Gender and language background were treated as binary values, region as a category with six values.

Descriptive statistics of the data were prepared, and cross-tabulations of pairs of social factors were first visually inspected for obvious patterns. Mixed effects variable rule modelling with stepwise regression was then performed with all four social factors to establish any interactions between them.
3 Results

3.1 Descriptive statistics

3.1.1 All tokens

The 147 participants produced 931 fingerspelling-related tokens within the 14,700 sign tokens in the corpus sample (6.3%). Of this 6.3%, 3.4% were non-lexicalised “FS:” fingerspelling annotations (including possible compounds and sign names) which were at least partly nativised or non-nativised while 2.9% were lexicalised fingerspelling-related signs from BSL SignBank. Figure 6 shows a breakdown of the 931 tokens between non-lexicalised “FS:” fingerspelling annotations (including possible compounds and sign names) which were at least partly nativised (26.5%) and non-nativised (28.2%) versus lexicalised fingerspelling-related signs from BSL SignBank (45.2%).

Figure 6: Breakdown of 931 fingerspelling tokens by annotation type.

Table 3 shows the distribution of the 931 tokens across the Cormier et al. (2008) nativisation model represented by the coding categories described in §2.2. SMLS (category L1N3) accounted for over 44% of the tokens, with non-nativised multiple
letter fingerspelling sequences (L3N1) taking up nearly 23%. No fully nativised (i.e. fully constraint-conforming) sequences of 3 or more letters (L3N3) were identified. In comparison, two letter sequences (L2) were more evenly spread across the nativisation continuum.

<table>
<thead>
<tr>
<th></th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>N3</td>
<td>412 (44.3%)</td>
<td>48 (5.2%)</td>
<td>0 (0.0%)</td>
<td>460 (49.4%)</td>
</tr>
<tr>
<td>N2</td>
<td>78 (8.4%)</td>
<td>82 (8.8%)</td>
<td>48 (5.2%)</td>
<td>208 (22.3%)</td>
</tr>
<tr>
<td>N1</td>
<td>11 (1.2%)</td>
<td>41 (4.4%)</td>
<td>211 (22.7%)</td>
<td>263 (28.2%)</td>
</tr>
<tr>
<td>Total</td>
<td>501 (53.8%)</td>
<td>171 (18.4%)</td>
<td>259 (27.8%)</td>
<td>931 (100%)</td>
</tr>
</tbody>
</table>

Table 3: Distribution of fingerspelling-related tokens by number of letters (L) and nativisation (N).

3.1.2 Region

Table 4, Figure 7 and Figure 8 show the distribution of tokens across the Cormier et al. (2008) nativisation model by region. Table 4 shows that while Bristol signers appear here to have produced the most tokens, especially in the non-nativised multi-letter category (L3N1), this is due in large part to the outlying production of just two participants (see Discussion). Glasgow and Belfast signers also produced a high number of L3N1 tokens. Figure 7 shows that London was the leader in terms of the most nativised signs (N3), with a comfortable majority of nativised SMLS/initialisations (L1N3) as per Table 4.

<table>
<thead>
<tr>
<th></th>
<th>Belfast (n=25)</th>
<th>Birmingham (n=26)</th>
<th>Bristol (n=24)</th>
<th>Glasgow (n=24)</th>
<th>London (n=25)</th>
<th>Manchester (n=23)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1N1</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>L1N2</td>
<td>12</td>
<td>9</td>
<td>25</td>
<td>9</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>L1N3</td>
<td>60</td>
<td>75</td>
<td>85</td>
<td>43</td>
<td>98</td>
<td>51</td>
</tr>
<tr>
<td>L2N1</td>
<td>10</td>
<td>2</td>
<td>7</td>
<td>14</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>L2N2</td>
<td>17</td>
<td>17</td>
<td>8</td>
<td>12</td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>L2N3</td>
<td>6</td>
<td>5</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>L3N1</td>
<td>48</td>
<td>14</td>
<td>56</td>
<td>46</td>
<td>16</td>
<td>31</td>
</tr>
<tr>
<td>L3N2</td>
<td>9</td>
<td>5</td>
<td>9</td>
<td>5</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>L3N3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>166</td>
<td>128</td>
<td>200</td>
<td>137</td>
<td>156</td>
<td>144</td>
</tr>
</tbody>
</table>

Table 4: Distribution of fingerspelling-related tokens across nativisation model per region.

Figure 7: Distribution of fingerspelling-related tokens across nativisation model (N only) per region.
Figure 8: Distribution of fingerspelling-related tokens across nativisation model (L only) per region.

### 3.1.3 Age

Table 5 shows the frequencies of fingerspelling-related tokens per age band, showing the counts of non- and partly/fully-nativised tokens and the mean number of tokens per participant. Figure 9 displays this data as a histogram, suggesting at first glance that non-nativised fingerspelling production appears to increase from age 60 and above, while nativised fingerspelling production does not display such clear variation related to age. Figure 10 and Figure 11 depict the proportions of L and N codes per age band, indicating a possible trend for an increase in non-nativised fingerspelling with increasing age and a clear preference for multi-letter fingerspelling over age 75. It should be noted that the 75-90 group is underrepresented.
Table 5: Distribution of fingerspelling-related tokens by age band.

<table>
<thead>
<tr>
<th>Age bracket</th>
<th>Number of participants (total 147)</th>
<th>Number of tokens (total 931)</th>
<th>N1 tokens (non-nativised)</th>
<th>N2+N3 tokens (partly/fully nativised)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-30</td>
<td>25</td>
<td>167</td>
<td>34</td>
<td>133</td>
</tr>
<tr>
<td>30-45</td>
<td>41</td>
<td>258</td>
<td>42</td>
<td>216</td>
</tr>
<tr>
<td>45-60</td>
<td>41</td>
<td>218</td>
<td>59</td>
<td>159</td>
</tr>
<tr>
<td>60-75</td>
<td>30</td>
<td>180</td>
<td>61</td>
<td>119</td>
</tr>
<tr>
<td>75-90</td>
<td>10</td>
<td>108</td>
<td>67</td>
<td>41</td>
</tr>
</tbody>
</table>

Figure 9: Mean number of N1 and N2+N3 tokens produced per participant in each age band.
Figure 10: Distribution of fingerspelling-related tokens by nativisation category (N only) and age bracket.

Figure 11: Distribution of fingerspelling-related tokens by nativisation category (L only) and age bracket.
3.1.4 Gender

Figure 12 and Figure 13 break down the fingerspelling tokens across the nativisation model by gender. The percentage of tokens per nativisation category does not appear at first glance to vary substantially by gender.

![Figure 12: Distribution of fingerspelling-related tokens by nativisation category (N only) and gender.](image1)

![Figure 13: Distribution of fingerspelling-related tokens by nativisation category (L only) and gender.](image2)
3.1.5 Language background

Figure 14 and Figure 15 break down the tokens produced per annotation category by language background (i.e. participants with Deaf native BSL-using family members, or not). From a visual inspection alone there appears to be a small variation between backgrounds across the categories, particularly N1 and N3.

![Figure 14: Distribution of fingerspelling-related tokens by nativisation category (N only) and by family language background.](image)

![Figure 15: Distribution of fingerspelling-related tokens by nativisation category (L only) and by family language background.](image)
3.2 Mixed effects variable rule analysis

3.2.1 Non-nativised tokens (N1) versus partly or fully nativised (N2+N3)

For the first analysis, we compared least nativised tokens (N1) with partly or fully nativised tokens (N2+N3). All possible interactions between region, age, gender and language background were modelled with stepwise regression (see Table 6), with participants treated as a random effect and age as a centred continuous variable. The best model was increasing age (p<0.001) + region (p<0.001) with none of the other factors making a significant contribution when region and age were included. Older participants in Glasgow and Belfast had a reasonably similar increased likelihood of using non-nativised forms of fingerspelling; those in Bristol and Manchester both fell close to the mean thus not particularly favouring or disfavouring non-nativised forms of fingerspelling; those in Birmingham and London showed a similarly decreased likelihood of using non-nativised forms of fingerspelling. The magnitude of the effect of region was moderate (minimum to maximum factor weights of 0.312 to 0.703). The magnitude of the effect of age was fairly mild, suggesting an increased likelihood of using non-nativised forms (N1) at a logodds of 0.028 per additional year of age. There was considerable variation between individuals, with only 33% of the variation accounted for by the best fit (coefficient of determination R² = 0.332)

<table>
<thead>
<tr>
<th>Region</th>
<th>Token count</th>
<th>Logodds</th>
<th>Proportion N1/N2+N3</th>
<th>Centred factor weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glasgow</td>
<td>137</td>
<td>0.863</td>
<td>0.453</td>
<td>0.703</td>
</tr>
<tr>
<td>Belfast</td>
<td>166</td>
<td>0.719</td>
<td>0.373</td>
<td>0.672</td>
</tr>
<tr>
<td>Bristol</td>
<td>200</td>
<td>0.020</td>
<td>0.330</td>
<td>0.505</td>
</tr>
<tr>
<td>Manchester</td>
<td>144</td>
<td>-0.060</td>
<td>0.257</td>
<td>0.485</td>
</tr>
<tr>
<td>Birmingham</td>
<td>128</td>
<td>-0.753</td>
<td>0.133</td>
<td>0.320</td>
</tr>
<tr>
<td>London</td>
<td>156</td>
<td>-0.789</td>
<td>0.122</td>
<td>0.312</td>
</tr>
</tbody>
</table>

Table 6: Mixed effects variable rule analysis of N1 v N2+N3, interaction with region.
3.2.2 Fully nativised tokens (N3) versus non- or partly-nativised (N1+N2)

For the second analysis, we compared the most nativised tokens (N3) with non- or partly nativised tokens (N1+N2). All possible interactions between region, age, gender and language background were modelled with stepwise regression (see Table 7), with participants treated as a random effect and age as a centred continuous variable. The best model was simply region (p<0.01) with none of the other factors making a significant contribution to the model when region was included. London and Birmingham participants slightly favoured the production of nativised forms of fingerspelling-related signs; Manchester and Bristol fell more closely to the centred weight of 0.5 thus neither particularly favouring or disfavouring use of nativised forms of fingerspelling-related signs; Belfast and Glasgow showed some disfavour for using nativised forms of fingerspelling. The magnitude of the effect was mild to moderate (minimum to maximum centred factor weights of 0.346 to 0.643) but there was considerable variation between individuals, with only 27% of the variation accounted for by the best fit (coefficient of determination R² = 0.269).

<table>
<thead>
<tr>
<th>Region</th>
<th>Token count</th>
<th>Logodds</th>
<th>Proportion N3/N1+N2</th>
<th>Centred factor weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>London</td>
<td>156</td>
<td>0.586</td>
<td>0.654</td>
<td>0.643</td>
</tr>
<tr>
<td>Birmingham</td>
<td>128</td>
<td>0.586</td>
<td>0.625</td>
<td>0.642</td>
</tr>
<tr>
<td>Manchester</td>
<td>144</td>
<td>0.078</td>
<td>0.493</td>
<td>0.519</td>
</tr>
<tr>
<td>Bristol</td>
<td>200</td>
<td>-0.051</td>
<td>0.460</td>
<td>0.487</td>
</tr>
<tr>
<td>Belfast</td>
<td>166</td>
<td>-0.563</td>
<td>0.398</td>
<td>0.363</td>
</tr>
<tr>
<td>Glasgow</td>
<td>137</td>
<td>-0.636</td>
<td>0.358</td>
<td>0.346</td>
</tr>
</tbody>
</table>

Table 7: Mixed effects variable rule analysis of N3 v N1+N2, interaction with region.

3.2.3 SMLS and initialised signs (L1) versus multiple letter forms (L2+L3)

For the third analysis, we compared SMLS and initialised signs (L1) with forms consisting of two or more letters (L2+L3). All possible interactions between region, age, gender and language background were modelled with stepwise regression (see
Table 8), with participants as a random effect and age as a centred continuous variable. The best model was simply region (p<0.001) with none of the other factors making a significant contribution. Participants in London and to a lesser extent Birmingham show a preference for SMLS and initialised signs over other forms of fingerspelling; Bristol only very slightly favours them; Manchester, Belfast and Glasgow show some disfavour SMLS and initialised signs over other forms of fingerspelling. The magnitude of the effect is moderate (minimum to maximum centred factor weights of 0.332 to 0.716) but there is considerable variation between individuals, with only 32% of the variation accounted for by the best fit (coefficient of determination R² = 0.32).

<table>
<thead>
<tr>
<th>Region</th>
<th>Token count</th>
<th>Logodds</th>
<th>Proportion L1/L2+L3</th>
<th>Centred factor weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>London</td>
<td>156</td>
<td>0.927</td>
<td>0.724</td>
<td>0.716</td>
</tr>
<tr>
<td>Birmingham</td>
<td>128</td>
<td>0.588</td>
<td>0.664</td>
<td>0.643</td>
</tr>
<tr>
<td>Bristol</td>
<td>200</td>
<td>0.249</td>
<td>0.565</td>
<td>0.562</td>
</tr>
<tr>
<td>Belfast</td>
<td>166</td>
<td>-0.474</td>
<td>0.458</td>
<td>0.384</td>
</tr>
<tr>
<td>Manchester</td>
<td>144</td>
<td>-0.590</td>
<td>0.417</td>
<td>0.357</td>
</tr>
<tr>
<td>Glasgow</td>
<td>137</td>
<td>-0.699</td>
<td>0.394</td>
<td>0.332</td>
</tr>
</tbody>
</table>

Table 8: Mixed effects variable rule analysis of SMLS (L1) vs. multiple letter forms (L2+L3), interaction with region.

4 Discussion

The frequency of fingerspelling found is generally consistent with previous studies. For example, the 3.4% frequency of non-lexicalised fingerspelling across our corpus sample of 14,700 tokens from 6 regions is close to the finding of 3.0% from 25,000 tokens from 2 regions (Fenlon et al. 2014b), suggesting that something in the 3-4% range could be the rate found across the BSL Corpus generally. Additionally, the 44.3% rate of SMLS/initialisations versus longer fingerspelling found here for BSL (out of the set of fingerspelling-related tokens) is fairly close to that of the 46.8% rate
found in the McKee & Kennedy (2006) NZSL study, suggesting a similar rate of SMLS across these two varieties of BANZSL.

In terms of social factors involved in nativised and non-nativised fingerspelling, we found that gender and language background were not significant but that age and region were. Our results are consistent with previous suggestions that non-nativised fingerspelling is used more frequently by the BSL community in certain regions, especially Scotland and Northern Ireland, and by older members of those regions in particular. The correlations have dependable levels of significance, although the variation of individuals from the models is quite high. Approximately 65-75% of this variation is unaccounted for, indicating that at least one other factor is having a substantial effect. It is possible that this could be some other demographic factor that was not considered. However, given that proper nouns and “technical” vocabulary are a primary use of fingerspelling (Sutton-Spence 1994), it seems likely that the register and topics selected by the participants make a considerable contribution to the variance.

Regional variation makes more of a contribution than age in fingerspelling nativisation patterns, with age only having a marked effect on non-nativised fingerspelling production in specific regions. More than 20 years have elapsed since the most recent usage-based study of BSL fingerspelling variation (Sutton-Spence 1994). The generations of Scottish signers who were in statutory education pre-1950, for whom fingerspelling might have been a more common teaching tool than their contemporaries in England, are now in their seventies at the very least; the youngest of those who received compulsory education in England after the 1968 publication of the Lewis report (Department of Education and Science 1968) – which possibly made it more acceptable to fingerspell in schools, but not necessarily to sign – were at least in their fifties at the time the BSL Corpus data was collected. Looking at the general distribution across age groups in Figure 9, the production of non-nativised fingerspelling for the sample as a whole is more uniform below the age of 60.
Assuming no further radical changes in deaf education policy across the UK, it is possible that in another 20 years we might see no effect of age at all.

It is also noteworthy that when fully nativised manual alphabet forms (N3) are modelled against non- and partly-nativised fingerspelling (N1 and N2, see §3.2.2), age is not a significant factor, though region remains so. Taken together, these findings indicate that while older BSL users are more likely to employ non-nativised fingerspelling in certain regions (i.e. Glasgow and Belfast), they remain as likely as younger signers in the same region to use more nativised manual alphabet constructions. Using the apparent time hypothesis which states that age differences are indicative of language change (Bailey et al. 1991), this suggests that language change is underway in non-nativised fingerspelling (but not nativised fingerspelling) in Glasgow and Belfast.

4.1 Outliers in Bristol

In Figure 16, the mean ages of non-nativised (N1) fingerspelling tokens and partly/fully nativised ones (N2+N3) are shown graphically, separated by region. Each circle is centred on the mean age of that category of tokens in that region; the size of each circle is proportional to the number of tokens produced. There is little difference between the mean ages for each category of token in London and Birmingham, and a more distinct difference for Glasgow and Belfast, reinforcing the conclusion that age is more of a contributing factor in those latter two regions. The appearance of Bristol in the graph requires some explanation: in contrast to the statistical models, it appears at first glance to have an even more extreme difference, but this is accounted for by the extensive fingerspelling production of just two participants (BL01 and BL02), who were two of the three participants in the entire sample aged 85-90. Together they accounted for 24% of all fingerspelling tokens from Bristol (24 participants); they are the first and fifth most productive fingerspellers in the entire sample. If they are removed, Bristol’s chart closely resembles Manchester’s in the middle ground. Mixed effects modelling should not allow small numbers of outliers
or under-represented groups to make a disproportionate contribution, but to allay any concerns in this regard, two confirmatory re-analyses were performed: firstly, modelling was performed using the same methods but with the 11 participants aged over 75 (7.5% of the sample) excluded; secondly, participants were grouped into five age bands which were analysed using logistic regression rather than linear. In both cases, none of the main interactions or conclusions drawn were affected.

Figure 16: Mean age of participants for all non-nativised (N1) and partly/fully nativised (N2+N3) tokens per region.

4.2 Older signers in Glasgow and Belfast

In addition to the typical use of fingerspelling for names, places and typical written abbreviations, almost all of the participants in Glasgow and Belfast over age 60 made repeated use of full spelling to represent concepts for which there exists at least one lexical sign in native BSL vocabulary, examples being *sugar, salt, boarding, years, flu, been, war, school, tree, house, speech, castle, but, outside*. In some cases there was
evidence of an English influence beyond vocabulary on the syntactic structure of the narratives, with fingerspelled representation of English phrasal verbs such as “used to” and “go ahead”, although some of these represent reported English speech and should be taken as examples of code-switching rather than borrowing. These phenomena were by no means confined to Glasgow and Belfast and can be found in individuals elsewhere, but were most common in these two regions in older signers.

4.3 SMLS/initialisations in London and Birmingham

London, and to a lesser extent Birmingham, showed more frequent use of one-letter signs (see §3.2.3). In the corpus sample as a whole, all L1 codes accounted for 54% of fingerspelling tokens; in London this was 72% and in Birmingham 66%.

Of the 113 L1 tokens in London, 37 (33%) were non-lexical items; of Birmingham’s 85 L1 tokens, 43 (51%) were non-lexical. A good number of these represented proper nouns which could have been fingerspelled more fully or for which a native lexical sign equivalent exists (eg. Plymouth, Brighton, Nottingham, Georgia, Madrid). Others could be classed as nonce usage where native lexical signs may or may not exist but signers may prefer for whatever reason to express the concept in English, for example SMLS representing the English words annual leave, clinic, pound, west, shilling, tool, sand, and festival. Of the L1 tokens from the native lexicon, approximately 60-70% were signs in semantic categories discussed above as common for SMLS use such as family relationships and time/duration, most of which appear in every region and are among the most frequent SMLS tokens across the sample.

It is therefore not so much the frequency of lexicalised SMLS that makes these regions’ usage distinctive, but the propensity to employ nonce SMLS. While the focus of this study has been on the manual phonology of fingerspelling and signs, one previously mentioned strategy for disambiguating an SMLS from other terms beginning with the same letter is that they can be accompanied by an English mouth pattern, especially in cases where the initialised letter is more frequently used than
other letters (e.g. -c-, -g-, -m-, -y-). However, the reverse also holds: the co-production of a single manual alphabet letter may help to disambiguate a mouth pattern, for lip-reading purposes. Two different mouthed words may be very difficult to tell apart, for example “Dublin” and “tablet”: the co-production of a manual alphabet letter might help to identify the context. It is possible that the more frequent SMLS use in London and Birmingham is better explained as a preference for or a willingness to switch to and from spoken language mouth patterns, rather than an example of regional lexical variation per se – this would be a fruitful area for future research.

4.4 Nativisation and lexicalisation in the BSL Corpus and BSL SignBank

As described in the Methodology, fingerspelling annotations for lexical database items were given an additional suffix to indicate whether the corpus instance was more, less or equally nativised phonologically in comparison to the SignBank citation form. Analysis of these suffixes reveals that variation from citation form was uncommon. 392 of the 421 lexical item tokens (93.1%) were deemed to be “equally nativised”, that is, they were either articulated very closely to the citation form itself, or in cases where they did vary, they did not remove or resolve any violations of native phonological constraints or add any native parameters.

Only 3 tokens (0.7%) were deemed “less nativised”: arguably all three are more indicative of inconsistency in annotation. For example, the citation form of BY smooths the transition between letters by retaining the non-dominant handshape of the -b- throughout, conforming with Battison’s Dominance Condition. This corpus instance was simply citation form -b-y-, breaking that constraint, and perhaps should have been annotated as FS:BY.

27 tokens (6.4%) representing 13 different items were deemed to be “more nativised” in that they reduced the violation of phonological constraints, deleted manual alphabet letters or added native parameters not present in the citation form. More nativised variants which occurred more than once (e.g. SOUTH and PORTSMOUTH) were only produced by conversational partners: their relative
frequency might be explained by accommodation of each partner with each other. Several more (eg. IF, OR, EAST, WEST) represent examples of SignBank specifying an unusually non-nativised form that is fingerspelled in full or specifies an initialised manual alphabet letter not seen in Corpus production. This likely reflects principled decisions about citation forms for fingerspelled loans in SignBank – i.e. that given a set of related nativised variants for potential inclusion in SignBank, the citation form shown is the one that appears to be least nativised (Cormier et al. 2012). However, it is important to note that BSL SignBank is a work in progress, and that degree of nativisation is just one of several criteria considered when selecting a citation form – others being for example, token frequency in corpus, association with a priority social group, etc. (Cormier et al. 2012). As more annotation is undertaken of the BSL Corpus in future, a clearer picture of frequency and other criteria will emerge which may affect citation forms chosen to represent particular variants in BSL SignBank.

A similar issue arose with the lexical status of some SMLS and fingerspelled loans. For example, the tokens GARAGE and FS:G-GOSSIP as identified in the BSL Corpus were identical in terms of manual phonology and reduction from the full word, yet the former is considered a lexical item (listed in BSL SignBank) while the latter is not. Furthermore, apparently lexicalised loans such as CHANCE, EXCUSE02, GEOGRAPHY, UNCLE and YOGHURT did not occur once in this project’s sample, while non-lexicalised nonce SMLS and SMLS/native compounds representing loans of the English words arthritis, but, club, to, west and Woolworths all appeared more than twice and from more than one participant. This was certainly a matter of chance, and the larger the corpus sample, the clearer the picture of frequency and therefore of lexicalisation becomes. Again, the fact that SignBank is a living dictionary and can change according to newly arising data from the corpus means that changes can be made when more evidence emerges about signs’ lexical status.
4.5 Local nativisation

Although (as noted in the introduction) local nativisation is argued to be common in ASL, very few instances of local nativisation were identified in this study during analysis, reinforcing the view of Sutton-Spence (1994) that in BSL, reductions are most often created that way from the start. In one of the few examples of local nativisation, BL15 spells the name “Norman” in full the first time, and refers to him thereafter with a reduced sign name consisting only of -n-.

However, a phenomenon that might be referred to as “local de-nativisation” was as often observed. For example, BF18, recounting an incident at an airport, initially refers to the word *terminal* with a nonce SMLS of -t-, and not long afterwards spells out the word almost in full. In cases like this, it may be that signers sense that the initially produced “nonce SMLS” was not understood.

4.6 Assessment of the theoretical model’s application in practice

Overall, the BSL Corpus fingerspelling data did all fit into the various positions set out in the working nativisation model in Cormier et al. (2008), as shown in Figure 5. Two minor issues are of note.

With regard to one-letter signs in BSL, as most SMLS conform to phonological constraints from the outset, the top level category (L1N3 in this study) makes no distinction between simple SMLS such as FATHER and initialisations which have added native parameters such as RECOMMEND and GOLD. The partly-nativised single letter category (L1N2) was only found to contain SMLS that use the citation form of the letter -m- and single letters compounded with native signs. The split between L1N2 and L1N3 is more even in ASL, where there is a larger number of fingerspelled letters that contain parameters (specifically handshapes) that do not occur in the native lexicon. There are simply few letters that do not conform to native phonology in BSL – possible examples included in Cormier et al. (2008) include the -m-handshape in MOTHER, and the sign UNCLE in which the pinky finger of the non-
dominant hand may move to facilitate contact with the dominant hand. But there may not be many more in BSL.

One way to address this is to consider the model in terms of a continuum rather than a set of discrete categories, as suggested by Cormier et al. (2008). It may be that BSL signs like RECOMMEND and GOLD should be more appropriately considered even more nativised than L1N3 (“L1N4”).

It was also noted that in BSL fully nativised sequences with three letters or more (L3N3) are hard to find. In the current study, no tokens were given this code. The only BSL example cited in Cormier et al. (2008) was the sign listed in BSL SignBank at the time of writing as ABOUT03*, described as being the end result of a “nativisation path” which had 3+ letters at a mooted earlier point (-a-b-o-u-t > -a-b-t > ABOUT > ABOUT03*), as shown in Figure 17. However, full constraint conformity is only achieved when all but the letters -a- and -t- have been deleted (the sign ABOUT), replacing them with a circular movement; ABOUT03* arguably loses even those. As noted in Cormier et al. (2008:30), it can be difficult to know with fully nativised forms whether these have non-native origins in the first place, and this is particularly true of multiple letter loans like ABOUT03* which look very much like any native sign and where fingerspelling origins may be difficult to see at all. Nativisation pathways such as that for -a-b-o-u-t- as shown in Figure 17 can help provide some evidence of a non-native form, and Deaf native signer intuitions can help as well. But if such a pathway no longer exists and/or if the etymology of a given form cannot be traced back to determine if its origins are indeed non-native, then this can prove a challenge.
In the current study an “annotate only what you see” approach was taken, and for all four instances of the sign ABOUT in the sample, no more than two letters were seen. ABOUT03* itself was not lemmatised at the time of writing and was therefore not counted (a cross-check found only one instance of it in the sample). Even with this approach however, determining the number of letters that are in a given form can be difficult. For example, in the current study, the sign SEX (see Figure 18) was categorised as L2N3 as it was considered to contain -s- and -x-. However, it is also possible to argue that SEX contains all three letters (-s-, -e- and -x-) in which case it could be categorised as L3N3. Thus it is clear that determination of the number of letters actually contained in a fingerspelled loan is to some degree subjective. Additionally, while highly nativised fingerspelled forms certainly do exist in BSL (as
evidenced by the number of N3 signs in Table 3), the strong preference for reduction to a single letter (i.e. SMLS, L1N3) means that multiple letter fully nativised forms are not as common in BSL.

Figure 18: BSL SEX.

4.7 Conclusions

We have established empirically that the range of fingerspelled borrowing in BSL is diverse, from full letter-by-letter renditions of external orthographies, through deletions and abbreviations, to highly nativised forms which are constrained by native BSL phonology. Out of the 14,700 token sample as a whole, 6.3% of utterances were fingerspelling-related, but only 1.8% were entirely non-nativised full renditions of words, with the remaining 4.6% being partly or fully nativised forms of fingerspelling. 2.9% of the sample represented lexicalised and at least partly nativised signs with a manual alphabet component.

Looking at fingerspelling production alone, we see that single letters including SMLS and initialised signs are the most common form and form a slight majority, constituting 53.8% of all fingerspelling tokens. Non-nativised full or near-full production of English spelling is the second most common at 22.7%. Literal renditions of single letters are rare (1.2% of tokens) and partly nativised SMLS signs are uncommon (8.4%) as the vast majority of single manual alphabet letters in BSL already conform to phonological constraints from the outset. Partly-nativised multi-
letter sequences (L3N2) are relatively rare (5.2%) and usually consist of letter deletion from 4+ letter sequences, but can include subtler phonological blending. Finally, the L3N3 category of fully nativised multi-letter forms of fingerspelling was found to be empty in the sample from this study which appears to be due to the propensity for highly nativised forms to only clearly show a maximum of two letters.

In addition, the likelihood that a particular form of fingerspelling occurs within an individual user’s production has been shown to be dependent on social factors. There was no effect of gender or language background, but both region and age were significant. As earlier work has suggested, while topic and register may contribute the most towards the prediction of the frequency of non-nativised fingerspelling, geographical region has been shown to be the most significant factor for early 21st century BSL. Glasgow and Belfast residents show a relative if moderate favouring towards non-nativised fingerspelling production, while in comparison signers in Birmingham and London moderately disfavour them; Bristol and Manchester occupy the middle ground. In addition, for Glasgow and Belfast, increased age (60+) is also a significant predictor of favouring non-nativised fuller fingerspellings (and suggests language change in non-nativised fingerspellings in these two regions), but this does not correlate with a preference for using more nativised forms. In London and to a lesser extent Birmingham there is a marked preference for using SMLS (one-letter) signs: from a review of tokens in that category, it appears that what is unusual in those regions is not the production of lexicalised SMLS but the ad hoc creation of “nonce SMLS”. In future it would be interesting to see which of these patterns signers are aware of, what attitudes they hold about fingerspelling and SMLS, and how these relate to their own social factors. The implications of accompanying mouth patterns mentioned in §4.3 above also warrant further investigation. A future study looking at co-produced mouth patterns with fingerspelling would be useful to see whether mouth patterns are being used by certain social groups to disambiguate fingerspelling loans, or whether the fingerspelling is being used to clarify mouth patterns.
Lastly, no comparable studies of the sociolinguistic variation in nativisation extent for one-handed manual alphabet systems have been carried out. It would be illuminating if future research could demonstrate whether the type of model considered can be usefully applied to usage data from one-handed fingerspelling systems with a view to reinforcing the case that it is a cross-linguistic model.

**Abbreviations/conventions used**

- Manual alphabet fingerspelling is represented by lower case letters surrounded by hyphens, e.g. -a-l-p-h-a-b-e-t-, -z-.
- Lexical BSL signs are represented by the unique ID gloss of the citation form listed in the BSL SignBank lexical database (http://bslsignbank.ucl.ac.uk) in small capitals, e.g. LUCK, VISIT02. Unpublished signs not available to the public at the time of writing are suffixed with an asterisk, e.g. ABOUT03*. Researchers can register with BSL SignBank to access the full database including unpublished ID glosses.
- Single Manual Letter Signs are indicated with an additional underscore below the letter the sign is formed from, e.g. MOTHER, GARAGE.
- The FS: prefix indicates a specific fingerspelling annotation as used in the BSL Corpus, followed by the fingerspelled word in all caps e.g. FS:WOOLWORTHS, as per the BSL Corpus annotation conventions (available at http://bslcorpusproject.org/cava).

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Figure 5 and Figure 17 are from “One hand or two? Nativisation in fingerspelling in ASL and BANZSL”, Sign Language & Linguistics 11:1 (2008), reprinted with kind permission from John Benjamins Publishing Company, Amsterdam/Philadelphia. [www.benjamins.com].

**Competing Interests**

The authors declare that they have no competing interests.
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