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# “Two hands are powerful”. Handedness variation and genre in New Zealand Sign Language

Rachel McKee<sup>a,\*</sup>, Mireille Vale<sup>a</sup>, George Major<sup>b</sup>, Sara Pivac Alexander<sup>a</sup>,  
Miriam Meyerhoff<sup>c</sup>

<sup>a</sup> Victoria University of Wellington, New Zealand

<sup>b</sup> Auckland University of Technology, New Zealand

<sup>c</sup> University of Oxford, United Kingdom

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## ABSTRACT

The use of a lesser-used or minority language in new media is typically a stimulus for genre development and stylistic variation. This study considers online video texts in New Zealand Sign Language (NZSL) as a window on such variation and style change, specifically in handedness (whether signs are produced with one or both hands). Sign language research has previously identified that variation in sign handedness is patterned by phonological environment and as well as discourse context: reduction of a two-handed form by dropping the weak hand (WD) is associated with relaxed and spontaneous registers, while the addition of the weak hand to a one-handed sign ('weak prop' – asymmetrical, or symmetrical 'doubling') has been noted as a feature in performative genres such as poetry and public speaking. To explore whether handedness variation marks an emerging genre of online video posts in NZSL, and whether this may be part of a shift towards greater use of two-handed forms in NZSL, this study examines the distribution of variable features in a corpus of online posts, conversations and personal narratives, and compares usage in recordings made across 17 years. The effect of signers' sociolinguistic characteristics is also analysed. To explore the social meaning of this variation, metapragmatic insights sought from NZSL users about perceived stylistic effects of hand doubling in the data contribute qualitatively to an understanding of genre and style development.

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## 1. Introduction

Like oral languages, signed languages systematically use phonetic variation to reflect linguistically and socially meaningful information (Eckert and Labov, 2017). The articulators involved in sign language variation – hand shape, place of articulation, movement, number of hands – differ from the phonetic articulators of oral languages because of their different modalities, but the principles are fundamentally the same. There is much orderliness to the heterogeneity observed in all human languages (Weinreich et al., 1968).

There has been much less close investigation of the orderliness of variation in signed languages than there has been of variation in spoken languages, but in recent years, a number of research programmes world-wide have addressed variation in a range of signed languages (Schembri and Johnston, 2013). This work has suggested a number of analogues and parallels in the functions that variation serves in signed languages to those that it serves in spoken languages (Lucas et al., 2001). This paper has three purposes: first, it further documents the nature of phonetic variation in signed languages. It does this by

\* Corresponding author. School of Linguistics and Applied Language Studies, Victoria University of Wellington, PO Box 600, Wellington, 6012, New Zealand.

E-mail address: [rachel.mckee@vuw.ac.nz](mailto:rachel.mckee@vuw.ac.nz) (R. McKee).

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focusing on an under-researched feature of sign languages – the number of hands used to realise a sign. Second, it demonstrates that, like in spoken languages, phonetic variation in sign languages is polyfunctional and expresses pragmatic, interactional and structural information. Third, the data contributes directly to a growing body of research that interrogates the extent to which non-standardised languages (or languages that have very loose and often polycentric standards) exhibit the same kinds of style shifting, or genre-based variation, that is typically found in standardised spoken languages, such as English, French or Spanish (Meyerhoff et al., 2020). We draw on both quantitative and qualitative data to obtain a sense of the varied pragmatic functions of the variation observed. The quantitative analysis draws on a richly coded corpus of New Zealand Sign Language (NZSL) (monologic and dialogic) interactions, while the qualitative data comes from focus group interviews with members of the deaf community in NZ to explore their sociopragmatic meaning (cf. Palfreyman, 2020).

### 1.1. *Some background to NZSL*

NZSL is a sign language that has enjoyed a reasonable amount of academic attention, and lately, institutional support since its legal recognition in 2006 (McKee, 2017). The language is closely related to British Sign Language (BSL) and Australian Sign Language (Auslan), but there is also a history of episodic contact with American Sign Language (ASL). Since the mid-1980s, NZSL has absorbed many loans from ASL. Borrowing has recently accelerated by exposure to the large volume of online content in ASL which is of cultural interest to the New Zealand deaf community. Moreover, the hybrid code of International Sign (IS) which is used for trans-national information sharing has become a vector for circulation of lexicon from world sign languages, among which ASL has a prominent role (Whynot, 2016; Kusters 2020). A recent study of ASL loans and morphological features indicates that many ASL borrowings in NZSL are so thoroughly integrated that most NZSL users are unaware of their external origin, and suggests that some of these variants are genre specific, being especially prevalent in online informative texts (McKee et al., 2022). International mobility, facilitated by virtual deaf networks, and a generally open disposition among the NZSL community towards lexical borrowing also support externally motivated lexical and style change in modern NZSL (McKee and McKee, 2020). These developments in the sociolinguistic context represent profound changes to the functions and dissemination of discourse in the NZSL community, inevitably re-shaping language form and styles.

### 1.2. *Impact of new media on NZSL*

Introducing a minority language into new domains and media stimulates expansion of the lexicon and discourse styles to meet new communicative purposes such as political rhetoric (Sani, 1988), school instruction (Fedina, 2015), and broadcasting (Shulist, 2012; Simper-Allen and Mesch, 2019). Novel uses and dissemination of a lesser-used language through digital media is recognised as a powerful tool of language revitalisation, although this can stimulate ideological contention within a speaker community over impacts on linguistic norms (Eisenlohr, 2004). Until the mid-1980s, New Zealand Sign Language (NZSL) was used socially among deaf interlocutors who were known to one another and who shared local contextual knowledge. In these circumstances, there was little observable evidence of register differentiation. Status change in recent decades has brought NZSL into more diverse and public domains. Along with expanded rights and opportunities to use NZSL in face-to-face settings, digital online technology has enabled asynchronous sharing of monologic texts to a national deaf audience in the manner of informal broadcasting. While sign language translators and presenters have featured in conventional broadcast (TV) media since the 1980s in many countries such as the UK (Woll, 1994), France (Abbou, 1994), and Italy (Kellett Bidoli, 2010), this has rarely occurred in New Zealand. However, the internet has enabled deaf individuals and organisations to autonomously disseminate NZSL content, ranging from short posts such as announcements of community events to more extended texts such as translations of public service information.

New usage contexts and media contribute to sign language contact and local innovation (Ilkbaşaran 2015; Kusters 2020; Wilkinson 2013). The current study examines stylistic variation in online informative texts as a new genre, contrasting the online informative texts with monologic narratives and natural conversations over time. This gives us the perspective needed to determine whether there is a change taking place, and if so, whether it is spreading through the community generation by generation or spreading across all users of NZSL in the novel genre. We consider two variables: (i) the doubling of a sign by adding a second articulator (hand) that is not canonical in the citation form, and (ii) the dropping of an articulator (hand) in some canonically two-handed signs. The second variable – weak (hand) drop – has been relatively well-studied. The first – which consists of two strategies, hand doubling or a weak (non-dominant) hand propping of the main articulator – is much less studied (Tamminga et al., 2020).

Most research on these variables has emphasised the phonetic or cognitive bases of handedness variation, invoking notions such as the ease of production and enhanced perception achieved by symmetry (Battison, 1974; Crasborn, 1995; Frishberg, 1975; Napoli et al., 2014) as well as assimilation to phonetic context (Nishio, 2009; Paligot, 2018; Xavier and Barbosa, 2013). We consider possible structural constraints on weak drop and weak prop (specifically doubling), and as we will see, there are significant structural constraints on the use of these variables in NZSL. But our quantitative analysis explains only a relatively small amount of the variation observed. We gain a fuller picture of the variation by drawing on metalinguistic commentary from focus groups conducted with a number of NZSL signers. The users of NZSL have good metalinguistic skills for discussing pragmatic aspects of these variables, including awareness of contextual factors in the variation. Moreover, their perspectives provide richer information about the role that genre plays in the distribution and interpretation of these variants than we are able to derive from our quantitative analysis of variation in usage data.

### 1.3. Genre variation in signed languages

Linguistic features of different discourse contexts in signed languages have been variously described in terms of register, text type, and genre. In this article we adopt the term *genre* to mean modes of talk which have a specific function and socially agreed-upon features of grammar and lexicon that develop over time (Bawarshi and Reiff, 2010; Halliday, 1978). A social constructionist perspective posits that genre both responds to, and simultaneously constructs, recurring situations, and achieves shared communicative purposes through the use of expected language forms (Bawarshi and Reiff, 2010, p. 57). In an overview of new media and genre, Bawarshi and Reiff (2010) describe a turn towards investigating 'genre re-mediation', or the adaptation of familiar genres in new media - for example, blogs as a descendant of the journal or written log, and email as re-mediation of the written memo. Recent research suggests (indirectly) that new media contexts are prompting re-mediation of genre features in signed languages. For example, a study of signers delivering televised news bulletins in Swedish Sign Language identified that signers map referents in the signing space by using directed gaze, sign directionality and torso movement in more deliberate ways (than dialogic discourse) to maximise clarity of reference in the absence of feedback from a co-present audience (Simper-Allen and Mesch, 2019). Cormier (2018) discusses the role of digital storytelling in supporting sign language literacy and cultural identity, which could be seen as the re-mediation of traditionally live storytelling in the deaf community.

Genre features in signed languages are relatively under-described and rarely systematically studied (Gabarró-López and Meurant, 2014; Sallandre et al., 2019). Several studies of genre features comprise rich description of small data sets, in some cases analysing discourse produced in contrived conditions (for an imagined rather than authentic context/audience). Nevertheless, a number of studies identify lexical, phonological, morphosyntactic and discourse-level features associated with formal or casual registers in various signed languages (e.g. Cohen-Koka et al., 2023; Gabarró-López, 2019; Johnston and Schembri, 2007; Paligot and Meurant, 2016; Stone, 2011; Zimmer, 1989). Features reflecting English contact are described in formal and explanatory registers in BSL (Sutton-Spence and Woll, 1999), ASL (Lucas and Valli, 1989) and Auslan (Napier, 2006). Some studies have investigated specific text types or communicative events such as lectures (McKee, 1992; Roy, 1989; Winston, 1991), narratives (Beal-Alvarez and Trussell, 2015; Perniss, 2007; Quinto-Pozos, 2007), poetry (Crasborn, 2005; Mesch and Kaneko, 2017; Russo et al., 2001; Sutton-Spence, 2005) and television broadcast (Simper-Allen and Mesch, 2019; Stone, 2009). Distribution of lexical types by genre—mainly with a focus on frozen vs productive signs—has been reported in corpus-based studies (e.g. Fenlon et al., 2014; Ferrara, 2012; Johnston, 2012; Morford and MacFarlane, 2003; Takkinen et al., 2018). In the genre of ASL vlogs, Wilkinson (2013) found significantly higher use of the reflexive pronoun SELF (than in conversation and narrative), which she concludes serve an emphatic function, possibly prompted by the absence of audience feedback to online monologues. As noted by previous writers (Lepic, 2019; Sáfár and Crasborn, 2016), further usage-based evidence is needed to accurately characterise genre features in signed languages. Genre has not been directly investigated in NZSL (for the contextual reasons explained above), although one previous variation study found a small genre effect of less subject (pro) deletion in interviews than in conversation (RMcKee et al., 2011).

The following section introduces the target variants analysed in this study – weak prop (especially doubling) and weak drop.

### 1.4. Handedness of signs

The configuration of two-handed lexical signs is broadly categorised into two main types as 'balanced' (symmetrical), in which the two hands have identical handshape and movement, and 'unbalanced' (asymmetrical), in which the hands differ by one or more parameters (handshape, movement, orientation). In unbalanced signs, the hands either move together or with the dominant hand<sup>1</sup> moving while the weak hand forms a location for the dominant hand (Battison, 1974; Sandler, 1993; van der Hulst, 1996). Cross-linguistically, it is generally reported that around half the signs in a conventional sign lexicon are one-handed and approximately half are two-handed (Battison, 1974; Crasborn and van der Kooij, 2023; Nilsson, 2007; Sandler, 2017).

We consider two variables where variation involves the number of hands used to realise the sign. These are:

1. One-handed signs that are
  - a. 'Doubled' by the addition of a symmetrical handshape and movement.
  - b. Supported by the addition of an asymmetrical handshape (weak prop/weak add)
2. Two handed signs that are reduced to one-handed (weak drop).

Weak drop (WD) has been investigated in other studies of sign language variation (see below). However, weak prop and doubling are under-studied. On the face of it, this is surprising since one might reasonably think that the two strategies (weak prop/doubling and weak drop) might be in some way complementary because they both involve the same articulators. This

<sup>1</sup> Signers may be right- or left-hand dominant, as in writing. Hence 'dominant' hand is relative to each signer.

study explores this possibility, examining the structural constraints on weak prop/doubling and WD as well as perceptions about the social and pragmatic meaning of doubling.

#### 1.4.1. Weak drop (WD)

Battison (1974) observed that two-handed signs are subject to phonetic reduction by deletion of the non-dominant hand, subsequently referred to as ‘weak drop’, in which the weak hand is omitted (Padden and Perlmutter, 1987) and weak hand lowering, in which the weak hand plays a reduced role by being articulated at a lower height than the dominant hand (Paligot and Meurant, 2016). WD is attested in various signed languages (Brentari, 1998; Crasborn, 2011; Deuchar, 1981; Johnston and Schembri, 1999; van der Kooij, 2001) and is thought to reflect a general tendency in languages to reduce articulatory effort (Crasborn, 1995; Napoli et al., 2014; Rimor et al., 1984). Early description of WD predicted higher occurrence in symmetrical or balanced signs (Battison, 1974; Frishberg, 1975). A corpus-based study of German Sign Language (DGS) (Nishio, 2009) found that symmetrical signs, non-alternating signs and signs without contact were more likely to undergo WD. In Sign Language of the Netherlands (NGT), native signers judged that 90% of a list of 328 two-handed signs allow WD, including signs with alternating movement and body contact (van der Kooij, 2001). However, a later corpus analysis of the same language found that the rate of WD in symmetrical and asymmetrical signs did not differ (Paligot et al., 2016), nor in French Belgian Sign Language (LSFB) (Paligot, 2018). Symmetrical signs which resist WD tend to be those that contain metaphorical or iconic motivation for the two hands interacting – in other words, semantic content encoded in the weak hand seems to disfavour WD (Crasborn, 2005; Paligot et al., 2016; van der Kooij, 2001). On the other hand, Becker’s (2023) experimental study of perceptions of WD variation in ASL found that signers judge WD as more acceptable or natural in iconic two-handed signs than in non-iconic signs, suggesting that phonological reduction in iconic signs has less semantic impact (although this preference was not necessarily matched in participants’ own production of handedness variation).

Phonological environment – or the effect of adjacent signs – has an important role in variable production of sign parameters. Processes of anticipation, perseveration and assimilation have been shown to condition variation in the realisation of sign location (e.g. Schembri et al., 2009) and handshape (e.g. Fenlon et al., 2013; Lucas et al., 2001). Assimilation to the features of a preceding or following sign also conditions variation in handedness (i.e. the addition or loss of a hand to the citation form of a sign): McCaskill et al. (2020) found phonological environment to be significant in the selection of one or two-handed variants by Black ASL signers corpus-based studies report WD to be more likely following, preceding or between one-handed signs (Nishio, 2009; Paligot, 2018; Paligot et al., 2016).

Discourse context is also known to affect WD: Sutton-Spence and Woll (1999) observe that WD is more prevalent in casual BSL, and studies of ASL (Zimmer, 1989), BSL (Stone, 2011) and LSFB (Paligot and Meurant, 2016) all report the complementary finding that WD occurs less in formal registers of these languages. Using a mixed effects model to analyse sociolinguistic factors conditioning WD in a corpus of LSFB, Paligot and Meurant (2016) found more WD in conversation, explanation, and spontaneous (unprepared) text types, also with high frequency signs, and among male signers. No age effects were found. In a study of variation associated with Black ASL, McCaskill et al. (2020) report that older Black signers who attended southern segregated schools are less inclined to WD than younger signers who attended integrated schools. This was part of a wider pattern of all younger signers, regardless of ethnicity or region, using more one-handed, or WD, variants.

In sum, this suggests that WD is a linguistic variable that occurs in similar conditions cross-linguistically. There is no clearcut evidence that change is taking place, with younger generations of signers systematically using it more or less than older signers, but WD is available as a resource for signalling non-linguistic information, e.g. informality or other social meanings that may interact.

#### 1.4.2. Weak prop

Phonological restructuring of a one-handed sign by symmetrically replicating its handshape and movement on the non-dominant hand was described by Frishberg (1975) as increasing perceptual salience through visual redundancy. The addition of the weak hand to an underlying one-handed sign was later termed ‘weak prop’ (Padden and Perlmutter, 1987), ‘weak hand copy’ or ‘addition’ (Lucas et al., 2001). Stern (2019) uses the term ‘weak add’ to encompass various forms of weak hand addition to one-handed signs.

Our study focuses on doubling, defined as “signs that are one-handed in citation form, but produced with both hands active and performing *the same movement at the same height*” (Nilsson, 2007, p. 11, emphasis added). This is distinct from other degrees of weak hand involvement in one-handed signs such as ‘echo articulation’ (Sandler, 1993) and ‘mirroring’ (Nilsson, 2007) in which the non-dominant hand mirrors the handshape and orientation of the dominant hand at a lower level, but does not fully participate in the production of a symmetrical sign. By this definition, doubling results in a balanced sign form, as in the examples of doubled variants in our corpus in Fig. 1.

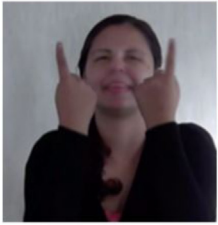
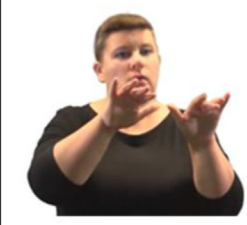






Instances in corpus				
Citation Form (per dictionary)				
Gloss (word class)	UNDERSTAND (V)	WHO (Q)	THANK-YOU (Excl)	ME (Pro)

Fig. 1. Examples of symmetrical doubling in NZSL<sup>2</sup>.

Weak prop (WP) is a related phenomenon whereby the weak hand is used to provide some kind of additional, although optional, semantic information, e.g. a surface for writing on, as shown in Fig. 2. The addition of a second hand as a variant for one-handed signs has been investigated in ASL by Tammimga et al. (2020), but they do not make the distinction between doubling and weak prop (WP) that we do. We also exclude from this study additions of the weak hand which contribute to information structure of discourse, as examined in studies such as Nilsson (2007) and Gabarró-López and Meurant (2014).



	
WRITE 1H traditional (earlier) usage	WRITE 2H weak prop - with 'base' hand (modern usage)

Fig. 2. Variants with and without a weak hand with semantic content.

Battison (1978, p. 61) originally observed that doubling occurs “only when the sign is marked for emphasis or intensity, or more rarely, plurality, and occasionally as a stylistic whim”. These observations foretell subsequent findings about this phenomenon. In Brazilian Sign Language, Xavier and Barbosa (2013) describe semantically motivated doubling relating to plurality, aspect, and intensification and report that non-semantic doubling also occurs in what they call free variation. As with WD, phonetic environment plays a role in doubling, which is found to occur more frequently adjacent to a two-handed sign (Nishio, 2009; Paligot, 2018; Xavier and Barbosa, 2013).

<sup>2</sup> To mask the identity of signers in our corpus, their features have been changed with Adobe Photoshop generative AI.

However, WP and doubling differ from WD in their association with non-linguistic information. Stylistically, doubling can be seen as hyper-articulation, as suggested in an analysis of International Sign interpreters who were observed to “amplify the message by producing double-handed signs where a one-handed sign could ... be produced, thus increasing its visual impact” (McKee and Napier, 2002, p. 34). Amplification is also indicated in Nilsson’s (2007) study of Swedish Sign Language, in which doubled 1H signs all occurred within “stretches of signing that are produced with a certain kind of intensity” (p.11).

Discourse context also affects doubling. Zimmer (1989) described a tendency for doubled sign production in formal ASL contexts, along with larger signing space and movement, presumably to augment visibility in larger spaces/audiences. Poetry is another context which favours the selection of two-handed symmetrical signs (particularly in iconic depicting constructions) for stylistic effect, as described in Italian Sign Language (LIS) (Russo et al., 2001), BSL (Sutton-Spence, 2005) and NGT (Crasborn, 2005). Crasborn (2005) found the ratio of two-handed signs in poetry to be almost twice as high as in narratives, with many one-handed signs being doubled for aesthetic symmetry. Crasborn notes that the doubling of one-handed signs in other contexts has been little studied in a sizeable corpus compared to the process of WD, and comments that “the prediction that the two hands are used even less in standard conversational signing remains to be tested” (p. 71). These findings about contextual and stylistic use of doubling suggest that we might expect more doubling in the public-facing, more performative genre of online announcements than in conversational data.

### 1.4.3. Significance of changes in handedness

Phonological variation in handedness is premised as a pathway to diachronic change from older to modern sign forms in American and French Sign Languages (Frishberg, 1975; Woodward and DeSantis, 1977). Frishberg (1975) observed instances of diachronic change towards symmetrical sign forms, and also theorised that two-handed (2H) signs which contact the face, especially balanced signs, may reduce to one-handed (1H) over time. Re-visiting Frishberg’s account, Stern (2019) considers whether 1H signs located below neck level (without contact) are candidates to undergo ‘weak add’ (WP) and thereby become lexicalised as 2H symmetrical signs to increase their perceptibility in peripheral vision. However, Stern’s (2019) re-examination of these generalisations in diachronic ASL dictionary sources concludes that not all instances of historical WD and WP conform to these principles, and that WP is rare as a process of historical change from 1H→2H forms. Rather, Stern concludes that WP occurs mainly for semantic, iconic or lexical reasons. He proposes two explanations for WP, one of which is: “the conventionalization of hyperbole and avoidance of homonymy” (p. 48). By conventionalization of hyperbole, Stern refers to a set of earlier 1H verb and adjective signs that express emotion (including, for example, ANGRY, AGGRESSIVE, THANKYOU, HONOR, RESPECT) which, over time, have become double-handed. Stern argues that the original emphatic impact of the 2H form has bleached over time, thus becoming hyperbolic, while the 1H forms have disappeared in the lexicon.

Frishberg (1975) observed the historical addition of a flat base hand (WP) to some originally 1H signs in ASL such as SHIP. Stern (2019, p. 39) describes the addition of a flat base hand (without semantic motivation) as a ‘movement terminus’ in modern 2H ASL signs such as CHOOSE, GOOD, THAT, IMPOSSIBLE. Flat base hand addition is a WP variant that we examine in our analysis, as a potential form of change towards two-handedness, but we retain a distinction between this and doubling.

A pilot study of weak hand variation in Philadelphia ASL as a potential historical pathway towards one-handed signs (Tamminga et al., 2020) did not find evidence in data from four signers for Frishberg’s prediction that WD occurs more in head-located than body-located signs. As noted by Crasborn (2005), Tamminga et al. also observe that doubling is less common than WD, and state the need for more research on weak hand involvement and its possible role in 1H→2H change in sign lexicons. Our focus is to identify genre and time-related variation with respect to handedness in lexical signs.

## 2. Method

The study addresses the main research question of whether variation in handedness of signs (through doubling, weak prop or weak drop) is significantly related to the new genre of public online posts. We consider this question in the context of other linguistic and social factors potentially affecting variations in handedness, including changes in NZSL over time. We combine quantitative and qualitative methods to investigate whether WP (particularly doubling) and WD are features of stylistic variation. We use statistics to examine the relative effects of the linguistic and non-linguistic factors systematically coded in our corpus. We supplement this with thematic analysis of focus group data which reveals how NZSL signers perceive the pragmatic and stylistic impact of doubling, which is by far the more common type of variation in our corpus.

### 2.1. Data

The corpus, as summarised in Table 1, consisted of 73 texts from 52 individuals, recorded in three different time periods. Texts were sampled from three genres and two modes (online and face-to-face). A total of 124 min, and 12,052 lexical tokens were annotated. This total excludes categories of signs in which handedness is not lexically specified, such as name signs, depicting constructions, gestures (e.g. shrugging shoulders), and list buoys (numeral signs that are held on the non-dominant hand as a proform to refer back to while the dominant hand continues to sign information).

NZSL recordings from four sources were included. The first source was 28 online informative texts in NZSL, comprising announcements of community events and public service information, which were posted on Deaf organisation websites or public social media in 2020–2021. Nearly all of these videos were shorter than 3 min.

Secondly, with the intention of comparing data from the same individuals in informative online posts and in conversation, we planned to invite signers in the 28 online texts to be recorded in two-person conversations. However due to impacts of the COVID-19 pandemic throughout the data collection period in 2021, we were unable to achieve this for all signers. Seven pairs of younger deaf signers (born after 1990) who appeared in the online texts were recorded in face-to-face and Zoom conversations. For the remaining (currently middle-aged) signers who appeared in the online texts, we identified samples of their conversational discourse within an earlier NZSL corpus recorded between 2005 and 2007. By this method, we formed a parallel sample of online posts and conversational discourse for a subset of 11 participants, in which to examine intra-individual variation between genres.

The corpus was expanded with data from existing NZSL corpora, in order to analyse change over time and sociolinguistic factors in the target variants. The third source in the dataset was excerpts from 10 recounts of Deaf participants' experiences with the health system (Major et al., 2017), and the fourth, excerpts from 21 personal experience recounts and conversations collected in an earlier variation study in 2005–2007 (McKee and McKee, 2011). Excerpts of 1–3 min from each of these pre-existing recordings were included.

Although the pandemic necessitated adaptation of data collection, the resulting timeframe that is covered by the different sources from which we drew our corpus proved to be fortuitous. We were able to compile a corpus that spans exactly the period during which NZSL signers began to be able to share signed texts online freely.

Corpus source are summarised in Table 1, and participant demographics in Table 2.

**Table 1**  
Corpus sources.

Source	Time period	Genre/text type	Mode	No. of individuals	No. of minutes	No. of tokens
Variation corpus	2005–2007	Conversation/Recount	Face-to-face	11	25	2601
Health stories	2016	Recount	Face-to-face	10	20	1617
Public posts	2020–2021	Informative	Online	28	53	3931
New recordings	2021–2023	Conversation	Face-to-face	7	14	1776
		Conversation	Online	7	12	2127
<b>Total</b>					<b>124</b>	<b>12,052</b>

**Table 2**  
Corpus participant demographics.

Gender	Age group (year of birth)			Ethnicity		
	1940–1979	1980–1999	2000–2009	Pakehā/NZ European	Māori	Other
Female (n = 33)	14	15	4	18	10	5
Male (n = 19)	6	11	2	11	7	1
Total (n = 52)	20	26	6	29	17	6

Data was glossed and annotated using ELAN video annotation software (ELAN version 6.7, 2023; Crasborn and Sloetjes, 2008). Wherever possible, glosses conformed with entries in the Online Dictionary of New Zealand Sign Language (D. McKee et al., 2011). Dictionary entries also served to determine citation form (CF) handedness and grammatical class(es) of signs. As noted by previous writers on the topic of handedness variation (Crasborn and van der Kooij, 2023; van der Kooij, 2001), the determination of CF as one or two-handed can be ambiguous due to variation between, and beyond, dictionary entries. Nevertheless, the dictionary was the benchmark for coding; our findings about handedness may inform future revision of this information in some dictionary entries.

The activity of each hand was annotated on separate tiers for dominant and non-dominant hand. A sign that was produced with both hands has the same gloss repeated on both tiers, whereas a one-handed sign is only glossed on the dominant hand tier. The tiers 'Hands' and 'HandsVar' respectively code handedness of a sign in citation form (either 1-handed, 2-handed (unbalanced) or double-handed (balanced) and its actual (variable) production in the data. For example, in Fig. 3 it can be seen that the sign TODAY (<https://www.nzsl.nz/signs/2589>) is a one-handed sign in citation form (as seen in Hands), but was doubled in this instance (in HandsVar).

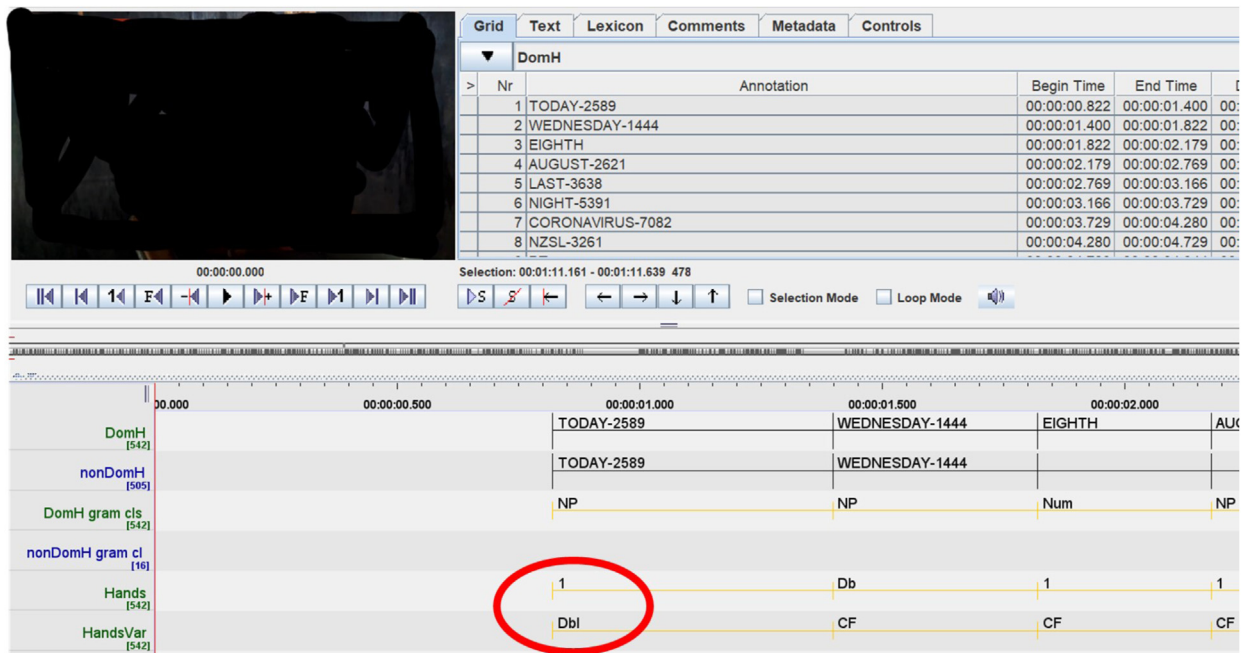


Fig. 3. Annotation tiers in ELAN.

## 2.2. Variables and factors

Target variants (independent variables) were ‘weak prop’ (hand doubling and addition of a base hand), and ‘weak drop’.

In addition to contextual variables of genre, mode, and time period, the effects of linguistic variables and social variables were analysed. Linguistic factors included in analysis were as follows:

- Citation form handedness of signs produced with two hands: is the sign unbalanced/asymmetrical (‘two-handed’) or balanced/symmetrical (‘double-handed’)?
- Phonetic context: one-, two- or double-handed realisation of the previous and following sign.
- Grammatical word class of the target sign.

Lexical effects: signs were coded as ‘high frequency’ if they appear in the top 350 signs from a previous lexical distribution analysis, (McKee and Kennedy, 2006). In McKee and Kennedy’s analysis, 11 signs accounted for 20 percent of their NZSL corpus, 64 signs constituted 40 percent, and 665 signs accounted for 80 percent. However, Nation (2001) points out that there is a very steep initial dropoff after the first small set of very frequent words, and “no clear dividing line between high and low frequency words” (p. 168). As the corpus used for McKee and Kennedy’s (2006) study was not fully lemmatised and had content leaning towards particular topics, this gives us an imperfect measure of frequency. Nevertheless, we deemed that a measure of frequency independent of our research data would provide an opportunity to explore the potential significance of this factor. We set the cut-off point for high frequency at 350 signs, which accounted for 70 percent of tokens in our research corpus (with the 5 most frequent signs accounting for 15% of tokens in that corpus). All other signs (1858 types, 5079 tokens) were coded as ‘low frequency’.

With regard to social factors, previous research has shown age group and region to condition lexical variation in NZSL (McKee and McKee, 2011); age and a small degree of gender variation in the numeral system and fingerspelling use (McKee et al., 2008; Pivac Alexander, 2008), and a study of phonological variation showed effects of region and gender, and to a lesser degree, ethnicity and language background (Schembri et al., 2009).

For the current study, we anticipated that age group would be a significant factor in relation to the target variables, but that ethnicity, gender and region would likely not be salient. In early statistical modelling, we confirmed that ethnicity and gender were not significant predictors of either WP or WD. However, we continued to include region in the model in case the decrease in congregated deaf education or other population changes have had regional effects. We did not collect detailed language background information for all participants in the corpus (although all are known to be NZSL users from childhood who attended various deaf education settings) and therefore this factor was omitted. Social factors included for subsequent models were therefore:

- Age group (based on decade of birth; 3 groups)
- Region (at time of filming)
- Signer as random intercept

### 2.3. Analysis

To carry out multiple logistic regression, we ran models in R (R Core Team, 2023) using the mixed-effects variable rules software package RBrul (Johnson, 2009) and lme4 version 1.1–35.1 (Bates et al., 2015).

Separate models were created for analysis of doubling and WP (with data consisting of tokens of signs that were one-handed in citation form) and WD (with data consisting of tokens of signs that were two-handed and double-handed signs in citation form).

### 2.4. Qualitative data: metapragmatic perceptions

To investigate signers' perceptions of pragmatic and stylistic meaning associated with doubling, we convened five online focus groups, each comprising three deaf participants and a facilitator. As part of a larger study of several variable features, the focus groups viewed and discussed examples of six sets of target variants excerpted from the corpus. One of these features was doubling, which is reported in this article. The 15 participants (see Table 3) were selected to represent a range of age groups, locations, and levels of metalinguistic awareness; i.e., we tried not to limit our participant group to NZSL teachers or translators who are likely to have higher metalinguistic awareness than individuals who are not engaged in language-related work.

**Table 3**

Focus group participant demographics.

Gender	Age group		Location		NZSL related occupation	
	Under 40	Over 40	North	Central	Yes	No
Female (n = 13)	2	11	9	4	9	4
Male (n = 2)	1	1	2	0	0	2
Total (n = 15)	3	12	11	4	9	6

During the focus group sessions, the facilitator played a short montage of instances of doubling excerpted from the data (in clauses or phrases), and guided participants to discuss these questions:

1. What is the similar thing you notice in the clips?
2. Why/when do signers do that? What is the impact?
3. Do you see this in face-to-face chat, or more in online posts? Any other comments?

This procedure generated rich metapragmatic discussion. The recorded discussions in NZSL were translated into English by the facilitators, cross-checked for accuracy among three researchers and transcripts were thematically coded using NVivo version 14 (Lumivero, 2023). Codes were emergent from the data, capturing common perceptions and ideas about the target feature.

## 3. Results

In the corpus overall, one-handed signs comprised 59.8% of the tokens or 7704/12,052. Signs that are one-handed in citation form were the most frequent type in conversation/recount (texts (62.6%), with 37.4% being two-handed types. Public posts had a relatively higher proportion of signs that are two-handed or double-handed in citation form (46%).

### 3.1. Doubling

Of 7124 one-handed signs in the corpus, 87.8% (6254) were in CF, while 12.2% (870) were doubled.

Mixed effects logistic regression revealed that the likelihood of doubling was affected by grammatical class of the sign, handedness of the preceding and following signs, text genre, signer's age (grouped by decade of birth), and sign frequency (all predictors significant at  $p < 0.05$ ). Signer was included as a random effect to control for the potential skewing of data by one or two very heavy or very light users of a target variant (Brezina and Meyerhoff, 2014; Johnson, 2009). Mode (face-to-face or online) had no effect. The signer's region and the time of filming were marginally significant in the first regression model but as expected, these predictors showed an interaction factor (region  $vif > 5$ , time filmed  $vif > 10$ ). We omitted these factors in the final model. Table 4 shows the RBrul output for doubling.

**Table 4**  
RBrul output for doubling.

Application value: Dbl	Factor	Log-odds	Tokens	Response proportion	Factor weight
Grammatical class	Negator	1.424	122	0.385	0.806
	Interrogative	0.920	262	0.305	0.715
	Conventional/exclamation/discourse marker	0.861	477	0.262	0.703
	Verb (including auxiliary)	0.317	1364	0.186	0.579
	Preposition	0.115	160	0.156	0.529
	Adjective	-0.077	628	0.148	0.481
	Adverb	-0.460	345	0.104	0.387
	Conjunction	-0.773	250	0.064	0.316
	Pronoun/determiner	-1.116	2220	0.057	0.247
	Noun/numeral	-1.210	1296	0.052	0.230
	Following nr. hands	Doubled	0.651	451	0.273
Double-handed		0.166	1635	0.161	0.541
2-handed		-0.377	1202	0.106	0.407
1-handed		-0.440	3836	0.093	0.392
Previous nr. hands	Doubled	0.642	463	0.272	0.655
	Double-handed	0.077	1679	0.157	0.519
	2-handed	-0.256	1135	0.118	0.436
	1-handed	-0.463	3847	0.090	0.386
Genre	Public post	0.269	2084	0.169	0.567
	Conversation/recount	-0.269	5040	0.103	0.433
Sign frequency	Low	0.151	1775	0.131	0.538
	High	-0.151	5349	0.119	0.462
Age (by decade of birth)	1940–1979	0.348	1983	0.139	0.586
	1980–1999	0.210	4372	0.126	0.552
	2000–2099	-0.558	769	0.056	0.364
Model (n = 7124)	df 21 intercept -1.49 mean 0.184				

The total R2 value was 0.259, indicating that the independent variables accounted for approximately 26% of variation in the data. This is our first clue that something other than linguistic factors and socio-demographic factors are influencing signers' use of doubling. We return to this in our discussion of the focus group data.

The most significant effects on doubling were linguistic, the strongest being grammatical class of the target sign. Determining word class is notably difficult in signed languages, as many signs serve multiple grammatical functions (contextually determined), or have inconsistent inflection patterns (Johnston and Schembri, 1999; Zwitterlood, 2010). Notwithstanding possible inconsistencies in our grammatical coding judgments, results show that negators, interrogatives, discourse markers, exclamations and conventional utterances (such as greetings) and verbs (including auxiliary verbs) favour doubling, whereas nouns, numerals, determiners and pronouns are least likely to be doubled. These results suggest that word classes which have wider scope over a proposition (e.g. negators and interrogatives) are more likely to be doubled variants than word classes that do not have scope over the proposition (e.g. nominals and determiners). Lexemes that have wider scope over a proposition might lend themselves to phonetic reinforcement, consistent with the idea that a motivation for doubling is to increase the perceptual and interactional salience of a sign. Given that the two classes which most strongly favour doubling are negator and interrogative, with discourse markers also favouring doubling, it is possible that certain lexemes occurring in these classes may have an effect, including ambiguity in determining whether the CF handedness indicated in the dictionary is a true reflection of their most typical usage.

As per previous studies of handedness variation, phonological environment was found to condition hand doubling. Doubling is most likely following or preceding another doubled variant, creating chains of doubling. A balanced 2H sign (Db) preceding or following a target sign also slightly favours doubling, whereas a 2H unbalanced or 1H sign preceding or following disfavours doubling.

The remaining linguistic variable, lexical frequency, had a weak but significant effect. Lower frequency signs were slightly more likely to be doubled than the most frequent 350 NZSL signs. It should be noted that frequency rates within the 'high frequency' group as defined in this article still varied greatly. Table 5 shows the 10 signs with the most instances of hand doubling along with their frequency ranking in our research corpus and in McKee and Kennedy's (2006) corpus. All of these signs were in the high frequency category, with 4 of the top 5 most frequent signs also having the most instances of hand doubling. However, when taken as a proportion of instances in the corpus, hand doubling rates varied between 3.3% (for PT:PRO1) and 100% (for WOW). The weak effect we found of low frequency signs favouring hand doubling slightly is therefore still worth reporting.

**Table 5**  
Frequency characteristics of signs with the most instances of hand doubling.

Sign	Instances in research corpus	Frequency ranking in research corpus	Frequency ranking in McKee & Kennedy	Instances of hand doubling	% hand doubling
Good	218	5	3	107	49.1
What	138	8	13	57	41.3
PT:	590	2	1	36	6.1
PT: PRO1	781	1	1	26	3.3
Have	119	11	16	23	19.3
Nothing/not have	34	47	19	21	61.8
PT: PRO3	349	3	2	18	5.2
Look/watch	85	14	36	18	21.2
Um	44	29	290	17	38.6
Wow	17	143	245	17	100

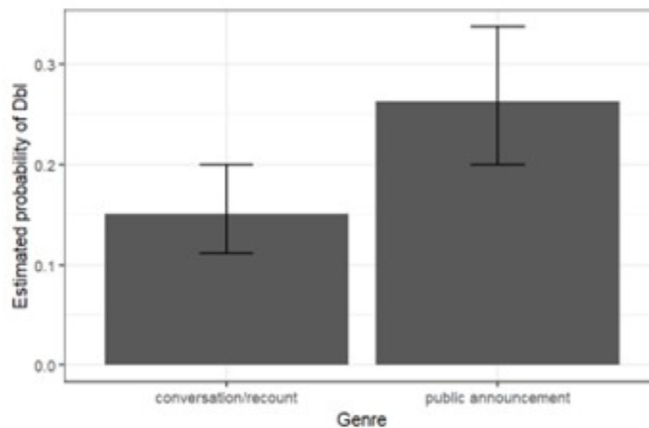
Genre was found to have a significant effect on doubling. The overall proportion of doubling of eligible 1H signs in the corpus is 13.2% of tokens.

We repeated the multiple logistic regression with the inclusion of 80 tokens of asymmetrical weak prop, mostly the addition of a flat base hand, bringing the total number of tokens to 7204 and the proportion of weak hand addition (doubling or WP) to 13.19%. The same independent variables were found to be significant although effect sizes differed slightly. When all tokens of weak prop are considered, prepositions become more likely to experience addition of a weak hand and pronouns and determiners become least likely to. Overall, the same categories that favour and disfavour weak prop in general were found to favour/disfavour symmetrical doubling. This could indicate the effects of the form of signs in certain grammatical categories; i.e., pronouns and determiners are nearly all one-handed pointing signs, and thus unlikely candidates for WP.

To analyse the significance of genre contrast further, we repeated our mixed effects model with the subset of 11 participants who contributed both online public announcements and conversational data.

Since in this smaller data set, there were few observations in some grammatical classes, these word classes were re-coded into groups (according to similarities in doubling likelihood in the larger dataset).

A likelihood ratio test determined that the likelihood of doubling differed between public announcement and conversation/recount ( $p < 0.001$ ), after adjusting for previous and following hands, word class and lexical frequency. In particular, we estimate that the probability of doubling is significantly higher for online public announcements (0.263) compared to conversation/recount (0.150), averaging over the other variables. The estimated probabilities of doubling and the 95% Confidence Intervals are shown below in Fig. 4.



**Fig. 4.** Doubling by genre.

The only significant social determiner of hand doubling was found to be the age of the signer (grouped by decades of birth). Older signers are more likely to use doubling, while the youngest age group strongly disfavours it.

Including variation between individuals in the model (i.e., running the model with 'Signer' as a random intercept) did not make a large difference to results:  $R^2$  'random' was around 2, indicating that only 2% of variation in hand doubling is accounted for by baseline variation between individuals. We interpret this as validation that participants constitute a single, rather homogenous national 'speech community' (at least in relation to this feature). This is notable given how much time elapsed between the oldest and newest recordings, and that signers live in different areas and are engaged in different regional and activity networks.

Although hand doubling was slightly more prevalent in the middle-time period of recordings (in which the predominant genre in the corpus is personal recounts), followed by the most current texts (in which the predominant genre is public posts and conversations), there was no significant evidence of a time-related change towards double-handed variants.

### 3.2. Weak drop

The weak drop model included a total of 4848 tokens. WD was a less frequent phenomenon than doubling, with only 4.56% of tokens experiencing WD, as shown in Table 6.

**Table 6**  
Proportion of WD variants in corpus.

	Unbalanced (2H)	Balanced (Db)	total	
CF	1833	2794	4627	95.44%
WD	35	186	221	4.56%
<b>Total</b>	<b>1868</b>	<b>2980</b>	<b>4848</b>	

Genre was the most significant factor ( $p < 0.05$ ), with WD being highly unlikely in online public announcements. In the matched sample dataset of 11 signers, 5.8% of eligible 2H signs were realised as WD in the conversation/recount samples, but no tokens of WD were present in online announcements.

This complements our finding that doubling is most likely in this genre and that these public posts also had a relatively higher proportion of signs that are two-handed or double-handed in citation form.

The significant linguistic factors in our model are consistent with previous studies of WD. In particular, we found that WD was more likely in balanced signs than unbalanced signs, as per earliest observations about this variation (Frishberg, 1975). Also, there was evidence of assimilation effects in that WD was more likely either preceding or following a one-handed sign. WD was least likely to be preceded or followed by a doubled variant.

We also found grammatical class to be a significant factor, however unlike doubling, there was no clear distinction between classes with a wide or narrow scope.

Lexical frequency was not significant for WD. None of the social factors (region, decade of birth) were significant, nor were mode or time filmed.

### 3.3. What pragmatic and stylistic meaning do NZSL users attribute to doubling?

In the focus group transcripts, 27 turns addressed the semantic, pragmatic and stylistic effects of doubling. Thematic analysis showed that participants' perceptions were nuanced and consistent. The overarching theme is that doubling has augmentative effects. Eight key ideas (some being inter-related) about perceived motivations and impacts of doubling are summarised below.

- *Gaining and holding audience attention, especially on-screen.* Doubling is a strategy not only for attracting audience attention, but also for retaining viewer gaze in an online environment. A participant commented: "I think using double hands is more powerful to get the attention of an audience and to get people to watch what someone is saying." The lack of a present audience for recorded texts was mentioned: "You've got no one actually in front of you, so to try get people's attention you sign 'hey' [two-handed] directly into the camera". Another observed the effect of managing fleeting attention in online environments: "I think doubling happens more in online videos because you need to quickly catch people's attention. It's easy to glaze over, scroll past, and move on when looking at online material. So it can be used to keep people watching."
- *Signalling that information is important:* Several participants described doubling as 'empowering' a message. One participant explained it this way: "You have in the back of your mind that it's going to be disseminated widely, so you want the video to be powerful ... for the information to be clearly enforced ... empower the message in a way. To make it look stronger." Another suggested that doubling can flag salient information in a message: "I think hand doubling reinforces what the person is trying to say or trying to ask. Doubling the sign WHAT (as a rhetorical question<sup>3</sup>) means there will be important information following ... it makes people pay closer attention."
- *Intensification and emphasis:* Several participants commented that doubling intensifies an utterance: "it shows emphasis when you use both hands". One participant likened it to vocal intonation: "Using both hands with signs like HAVE or MUST is like how hearing people show intensity in their tone of voice." Another described examples of semantic or affective intensification: "For a big win, you might use both hands to sign WIN ... (or) if you really already know something, then you might use two hands (demonstrates doubled KNOW)".

<sup>3</sup> An article examining the use of rhetorical questions and other information structure devices as a genre feature in online video texts is in preparation.

- *Visibility*: participants suggested that hand doubling enhances perceptibility: “It could possibly be used to make things clearer to see ... for example, a one-handed ‘WHAT’ may be missed by the audience. However, a two-handed ‘WHAT’ is clear to see.” Doubling is regarded as a kind of hyper-articulation that adds visual clarity for viewers.
- *Public address style and large audience*: Two elements were present in this theme: a large audience, and formality of the context. Participants noted that double-handed sign production occurs when addressing a large audience. On the number of interlocutors, one participant explained: “It could depend on the audience, whether you’re talking to one person or a whole crowd. You wouldn’t use a two-handed sign for ‘everyone watch me’ if you’re only talking to one person. So I think two handed signs will be used less in one-to-one conversations.” Although the video clips viewed by focus groups were all from online texts, participants also associated doubling with F2F public speaking. One remarked, “I imagine hand doubling is used more in situations where someone is standing on a stage”, such as a presentation or announcement at a Deaf Club. Another said that selecting a symmetrical 2H variant over a 1H variant happens in a more ‘formal’ context.
- *Mode (online v F2F)*: most participants believed that doubling is most prevalent in online videos, even though the feature is familiar from in-person contexts. Two older participants observed doubling as a ‘modern’ thing, commenting that the doubling they now see in online texts is not a ‘natural’ style of NZSL, one remarking: “At Deaf club you just sign naturally, like ‘thank you’ [one handed] or ‘please’ [one handed], you just sign naturally - you would use one hand for those signs, not much would be two handed. So I agree it’s more online posts where you would see the two-handed signs”. ‘Natural’ in this comment might be understood as either ‘conventional’ or ‘spontaneous’ or ‘unmarked’. Another group member expanded on the theme that doubling is a mode-related phenomenon: “I think you definitely see a lot of that online. You’re just signing and it comes out. Maybe there is less control over it because there are so many other demands at the same time with being filmed, and so you just sign like that without really thinking about it. I don’t think I see doubling in natural conversation at all. Well maybe just for ‘thank you’ [two handed], maybe. Not many others. Like you would never see ‘understand’ [two handed], I’ve never seen that. (...) So I think it’s definitely more in vlogs, when people might be feeling more nervous or they are thinking hard about the structure of what they will sign and they are overthinking and it just comes out.” The strong association made between doubling and online modality is objectively due to the fact that nowadays, most announcements and informative bulletins are encountered online, rather than in traditional contexts such as a Deaf Club meeting, as well as the fact that the number of such texts has exploded in recent years.
- *Production ease/phonetic context*: some participants noticed that double handed signs occur more in the company of other two-handed signs, for a ‘smoother transition’. One participant described production constraints as follows: “It might be connected to sign efficiency. So if the sign before or after the doubled sign is already two-handed, then the doubling may be because it is more efficient to carry on with both hands, rather than drop one, only to pick it back up soon after.” Another commented on an instance of chaining of doubled signs in the data clips: “Some people used like the same - like two hands - for both THANKYOU [two handed] and HUNGRY [two handed], and HELLO [two handed], it was a continuation”.
- *Semantic plurality*: Plurality was identified as a reason for doubling in relation to (i) interlocutors and (ii) reference in the discourse. Regarding plural referents, a participant said: “Maybe if you are talking about a large group of children, you might use 2 handed, and 1 handed if you’re only talking about a few children”.

#### 4. Discussion

Quantitative and qualitative findings confirm our prediction that handedness variation does distinguish genre in NZSL. Specifically, symmetrical doubling of 1H signs and weak prop are more frequent variants in the public address style used in online announcements and short informative bulletins in this corpus. WD, by contrast, is typical in conversational discourse and rare in presentation style (actually absent in that genre in the subset of 11 texts matched for signer). These results echo previous findings about the association of these phonological variants with discourse context (e.g. [Paligot and Meurant, 2016a](#); [Stone, 2011](#); [Sutton-Spence and Woll, 1999](#); [Zimmer, 1989](#)). Consistent with the results of our corpus analysis, some focus group participants observed that doubling is phonetically determined, in that one symmetrical (or 2H) sign can prompt the use of two hands in surrounding signs, which they described in terms of ‘smooth transition’, or ‘less effort’ to keep two hands active in the signing space.

While we found mode (online v F2F) to be a non-significant factor in conversational discourse, we did not compare the effect of F2F vs online mode on public presentation discourse since the corpus did not include comparable announcements in a F2F context, which now mainly occur in an online medium. However, focus group participants commented that doubling also occurs in F2F presentations, but less prolifically than in online texts. A contextual factor that prompts doubling in online texts is an imagined group audience, which is especially evident in doubled 1H signs that express direct address such as greeting (HELLO-all), closing (THANKYOU-all), inflected verbs such as ASK-you-all, INFORM-you-all, REMIND-you-all. An assumed group audience transfers from the context of public address in community contexts where multiple watchers are simultaneously present in front of the signer, whereas in reality the signer in an online post is viewed individually and asynchronously. As such, hand doubling appears to be a feature that has been re-mediated ([Bawarshi and Reiff, 2010](#)) from public speaking on stage into the modern genre of online public information sharing, which is likely to now be a vector for its dissemination into wider (and F2F) contexts. For example, anecdotally, we observe prolific use of doubling by NZSL

interpreters in public platforms. It is not possible to say in which direction these contexts of use (online texts by Deaf signers/interpreting) might influence style in the other, but likely in a reciprocal relationship.

In addition to confirming genre effects, quantitative analysis shows that the strongest factors determining handedness variation remain linguistic: assimilation to the handedness of surrounding signs, and grammatical category of the sign. These findings are consistent with previous studies showing strong effects for phonological conditioning. We also observed a chaining effect with strings of more than two doubled variants occurring. For these reasons, and because the effect for genre shown in Table 4 is significant but rather small, we are cautious about making any claims about emerging registers in NZSL. It is possible that future work may show that hand doubling is one of several factors which has come to be “enregistered” (Johnstone 2016), cueing receivers to interpret their use as semiotic signals of a distinct register or genre. But we do not feel our data justifies making such strong claims yet.

We found that doubling of low frequency signs is more likely. Caselli et al. (2022) note that in ASL, low frequency signs are articulated closer to the face than high frequency signs, apparently to optimise their perceptual salience. This perceptual constraint could be at play in more doubling of low frequency signs, to amplify their visibility. But similar to van der Kooij (2001) and Nishio (2009), our results do not provide support for Frishberg’s (1975) generalisation that 1H signs below neck level without contact are more likely to become symmetrical through weak prop; our data contained many counter-examples of doubled signs located in the head/face area, such as THANKYOU, UNDERSTAND, KNOW, INFORM, which suggest stylistic, semantic or pragmatic motivation. We note that Frishberg’s generalisations about restrictions on doubling were intended to account for diachronic change in lexical form (which our study does not address), rather than synchronic variation in usage.

WD showed no association with social factors. For doubling, social factors were also less pronounced, with gender and ethnicity not playing a significant role. This echoes previous results for sociolinguistic variation in NZSL, which has shown little effect of these factors. The NZSL community is not highly socially stratified so we would not expect these macro categories to play a role in this type of phonological variation. We did, though, find more doubling by older signers, contrary to Woodward and DeSantis’ (1977) finding that younger signers used more innovative variants than older signers. It may be the case that older NZSL signers have been exposed to ‘presentation’ style for longer than young signers and are more competent in this genre, and therefore exhibit more doubling. Similarly, Wilkinson (2013) suggests that increasing experience in monologue settings may prompt regular vloggers to use the emphatic particle SELF more over time, as an alternative to a diachronic explanation.

Metapragmatic commentary in focus groups indicates that doubling does interactional work to attract and engage a virtual online audience. Our informants also observe that amplifying parts of an utterance by symmetrical doubling not only intensifies semantic impact (hyperbolic effect, as per Stern (2019)), but can flag important points in a message, and increase overall perceptual clarity for viewers. In line with our quantitative results from the corpus, participants strongly associate doubling with the performative, public-facing genre of recorded online announcements. It was suggested that the performative pressure of filming a message for an unseen audience may unconsciously prompt doubling. These findings suggest that doubling may be part of a more general phenomenon of hyper-articulation in a broadcast genre of signing, along with features such as the expanded use of spatial reference described in TV presentation discourse (Simper-Allen and Mesch, 2019) to compensate for lack of shared (physical and mental) context with an audience, and an imperative to maximise clarity with the loss of three-dimensionality.

Earlier descriptions of symmetrical doubling as a feature of International Sign in conference contexts and two-handed sign production as a feature of ASL public/formal discourse lead us to speculate that the increasing use of this feature in NZSL is likely influenced by overseas style features which are now readily available to NZSL users on the internet. Recent studies showing lexical, phonological and morphological influence from ASL in NZSL (McKee et al., 2022; McKee and McKee, 2020), suggest the likelihood of stylistic elements also being borrowed from an established ‘public speaking’ genre in ASL.

## 5. Conclusion

Our findings form a complex picture, confirming previous accounts of weak drop and weak prop in sign languages generally being due to phonological effects. Phonological environment, along with grammatical category of signs, are the strongest explanatory factors for handedness variation in our data. The effects of social factors were less pronounced, with ethnicity and gender not playing a significant role at all, and region and age not clearly delineated.

Handedness variation as a stylistic feature in new media shows greater use of doubling and weak prop in public online announcements, with minimal occurrence of WD in this context. This suggests that this new (in NZSL) text type is subject to innovative phonological or articulatory features, in particular a trend towards more two-handed production of signs. This may be evidence that NZSL is responding to processes of re-mediation of features from traditional discourse contexts into a new genre and modality, as observed in spoken and written languages.

Metapragmatic insights from NZSL signers about this variation indicate that doubling is often pragmatically motivated, augmenting the visual signal in order to enhance audience attention and engagement, and is recognised as a stylistic feature of online public address. The literature has suggested a trend towards phonological reduction increasing the proportion of one-handed signs over time. While our study does not provide definitive evidence of diachronic change towards doubling or weak hand drop, the emergence of a genre effect suggests possible future effects. As this style of online public texts becomes

one that signers regularly engage with either actively or passively, we may see an effect on the overall proportion of two-handed signs in NZSL generally, and the incipient enregisterment of this feature as a 'broadcast' style.

Further research on handedness and other variable features of contemporary genres may illuminate the globalising effects of new media on stylistic innovation and change in signed languages.

### Declaration of competing interest

None.

### CRediT authorship contribution statement

**Rachel McKee:** Writing – Review & Editing, Writing – Original Draft, Project administration, Methodology, Investigation, Funding Acquisition, Formal Analysis, Data Curation, Conceptualization. **Mireille Vale:** Writing – Review & Editing, Writing – Original Draft, Project Administration, Methodology, Investigation, Funding Acquisition, Formal Analysis, Data Curation, Conceptualization. **George Major:** Writing – Review & Editing, Methodology, Funding Acquisition, Formal Analysis, Data Curation, Conceptualization. **Sara Pivac Alexander:** Methodology, Data Curation, Conceptualization. **Miriam Meyerhoff:** Writing – Original Draft, Methodology, Funding Acquisition, Formal Analysis, Conceptualization.

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