

# Towards Accommodating Gerunds within the Sign Language Lexicon

**Zaid Mohammed**

School of Informatics and Cybersecurity  
Technological University Dublin  
Ireland  
zaid.mohammed@adaptcentre.ie

**Irene Murtagh**

School of Informatics and Cybersecurity  
Technological University Dublin  
Ireland  
irene.murtagh@adaptcentre.ie

## Abstract

This work is part of ongoing research work that focuses on the linguistic analysis and computational description of five different Sign Languages (SLs), namely Irish Sign Language (ISL), Flemish Sign Language (VGT), Dutch Sign Language (NGT), Spanish Sign Language (LSE), and British Sign Language (BSL). This work will be leveraged to inform the development of sign language (SL) lexicon entries for a Sign Language Machine Translation (SLMT) system. In particular, this research focuses on ISL. We investigate the existence of constructions similar to or equivalent in functionality to gerunds in spoken language, in particular, English. The preliminary findings indicate that in order to interpret if gerund constructions do indeed exist within ISL, further analysis and investigation is necessary, in particular within the domain of aspect and aspectual marking in signed languages.

## 1 Introduction

Sign languages are articulated using the visual-gestural modality, unlike spoken languages, which use the auditory-vocal modality (Perlman et al., 2018). Sign languages make use of Manual Features (MFs) and Non-Manual Features (NMFs). MFs involve the use of handshapes and their location and movement, and the palm orientation, whereas NMFs make use of the head, eye gaze, facial expressions,

and body movement within gestural space (Leeson and Saeed 2012, p. 79).

Despite the significant technological advances in the computational processing of spoken languages, which is supported by extensive scientific research, signed languages have not received nearly as much attention. This issue has resulted in the exclusion of deaf and hard-of-hearing individuals and has further contributed to the marginalisation of a minority group that is already under-resourced due to limited access to language technologies and tools that can effectively facilitate communication (Murtagh et al., 2021). Furthermore, there is a lack of research with regard to gerund constructions in SLs. This research work will involve a comprehensive linguistic analysis of gerund constructions across five sign languages. This research work will provide insight into the role that gerunds play within SLs with regard to the expression of ongoing events and actions as well as the formation of complex sentences.

## 2 Motivation

This research is part of the SignON project, which is a project concerned with bridging the communication gap between deaf, hard-of-hearing, and hearing individuals across Europe. One of the larger aims of the SignON project is to develop an application that will facilitate the translation between signed and spoken languages using different forms (text, video, and audio). As part of the project objectives, researchers will collaborate to guarantee equity in the dissemination of information and digital content across European societies<sup>1</sup>.

This work will inform the development of SL lexicon entries within the SignON project. These

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<sup>1</sup><https://signon-project.eu/about-signon/the-signon-project/>

lexicon entries will be used within the Natural Language Processing (NLP) pipeline, in the development of a SLMT computational engine. This work is motivated by the lack of efficient SLMT, which is still in its early stages (Shterionov et al. 2022). Recent work within this domain includes the use of Role and Reference Grammar (RRG) and the Sign\_A framework to provide SL lexicon entries for an SLMT system. (Murtagh et al., 2022). This work focuses on the development of SL lexicon entries that are robust enough to accommodate SLs (ibid.).

Section 3 will provide a summary of our methodology, data, and tools that are used to facilitate the analysis.

### 3 Methodology

This initial phase of this research work deals with investigating the existence of gerunds within signed languages, in particular to this research, ISL.

#### 3.1 Data

The Signs of Ireland Corpus (SOI) is used within this research work. The SOI corpus consists of data that is collected from 40 male and female participants from the following part of the Republic of Ireland: Dublin, Cork, Galway, Waterford and Wexford. The participants engaged in two forms of stories: the frog story, which is used for cross-linguistic studies, and a personal story from the participant's life (Leeson et al., 2006).

#### 3.2 Viewing the corpus

ELAN (EUDICO Linguistic Annotator) is used to view the SOI Corpus. ELAN is a software application that facilitates creating annotations for video data. It was developed by the Max Planck Institute for Psycholinguistics, The Language Archive, Nijmegen, The Netherlands (<https://archive.mpi.nl/tla/elan>) (Wittenburg et al., 2006). The software provides multiple tiers that represent annotations of MFs and NMFs for the ISL sentences being articulated. The SOI corpus is annotated using lexical glossing, which is a method of expressing the meaning of signs using English text. Glosses, which are provided in block capitals, are used to reflect the meaning of a sign or multiple signs in a spoken language (Vermeerbergen, 2006). A manual annotation approach is used for the investigation of gerunds within the data. Section 4 provides an overview of gerunds as linguistic phenomena in English.

### 4 Gerunds as linguistic phenomena

Gerunds in spoken language, in particular spoken English, present themselves with the suffixation *-ing* at the end of a verb (Huddleston and Pullum 2016, p.

81). Example 1 provides an example of a gerund, where the verb *destroying* includes the suffixation *-ing* (ibid., p. 81).

#### Example 1

“Destroying the files was a serious mistake.”

Biber et al. (1999) provided an account of gerunds in English with many examples. Gerunds may be used as subjects (Example 2(a)), extra-posed subjects (Example 2(b)), subject complements (Example 2(c)), direct objects (Example 2(d)), prepositional objects (Example 2(e)), or complements of preposition (Example 2(f)) (ibid., pp. 201-202).

#### Example 2

- (a) Eating cakes is pleasant.
- (b) It can be pleasant eating cakes.
- (c) What I'm looking forward to is eating cakes.
- (d) I can't stop eating cakes.
- (e) I dreamt of eating cakes.
- (f) She takes pleasure in eating cakes.

However, additional forms of verbs that use the same suffixation: present participle and past progressive are used with *-ing*. Some verbal nouns and deverbal nouns use *-ing* as one of many forms for nominalisation purposes (Taher 2015). This issue makes the distinction of gerund forms from other forms that use *-ing* suffixation challenging due to the similarity in representation (ibid.).

Leeson and Saeed (2012) refer to constructions in ISL that are equivalent in functionality to gerunds in English. In Example 3(a), the sign PRESENT is used to form the meaning *presenting* in English, whereas in Example 3(b), the reduplication of the sign THINK is used to convey the meaning of *thinking*.

#### Example 3

- (a) HOW YOU (c INDEX f) FEEL FIRST PRESENT  
“How did you feel about presenting?”  
(Leeson and Saeed, 2012, p. 105)
- (b) INDEX+c CANNOT STOP THINK++  
“I cannot stop thinking [about it]”  
(Leeson and Saeed, 2012, p. 164)

### 5 Findings

The following examples provide a mapping of ISL translations to English language usage, however, before we can decipher how to define a gerund in terms of signed language and if these examples do indeed reflect instances of gerunds in ISL, we must apply further analysis and investigation.

### 5.1 Gerunds and classifier constructions

As shown in Example 4, the morpheme “LIFTS” within the construction JEEP-LIFTS-CAR conveys the nominal use of *lifting*.

#### Example 4

JEEP-HITS-UNDER-CAR JEEP-LIFTS-CAR  
‘The jeep hit the car, lifting it up’  
SOI Corpus Nicholas (22) personal stories (Wexford)

### 5.2 Gerunds and reduplication of the verb

In ISL, the reduplication of a verb sign may act similarly to verb inflection in spoken languages (Leeson and Saeed, 2012, p. 104). Findings provide instances, where the repetition of a sign can refer to pluralisation. In Example 5, the use of reduplication of the sign BEE serves to pluralise the sign BEE.

#### Example 5

LOT-OF BEE++ IN DRINK  
“Lots of bees in (my) drink.”  
SOI Corpus Mary (30) personal stories (Cork)

In Example 6(a), the reduplication of the verb sign MEET communicates *meeting*. In Example 6(b), the reduplication of the sign LICK communicates the action of *licking*.

#### Example 6

- (a) INDEX+c\* LIVE BEFORE\* LIVE  
RATHMINES INDEX+c\* GROW-UP  
ALWAYS MEET++ DEAF\*  
“Previously, I lived in Rathmines and grew up always meeting deaf.”  
SOI Corpus Geraldine (20) personal stories (Dublin)
- (b) CONTINUE+ COME-OVER LICK-DRINK  
LICK++++ INDEX+c DRINK  
“(The dog) came over again, licking my drink.”  
SOI Corpus Eilish (10) Personal Stories (Dublin)

### 5.3 Gerunds and the citation form of the verb

In Example 7, the sign PLAY is used to express the action of *playing*.

#### Example 7

CONTINUE BASKETBALL PLAY  
“Continue playing basketball.”  
SOI Corpus Caroline (15) Personal Stories (Dublin)

### 5.4 -ing suffix in sign language

Sign reduplication and classifier constructions appear to be significantly important with regard to the investigation of gerunds in SL. Example 8 shows some other uses of both. In Example 8(a), the reduplication of the sign RAIN marks an ongoing activity of the verb, accompanied by the sign NOW,

resulting in an articulation equivalent in linguistic terms, to the present participle English verb *raining*. Similarly in Example 8(b), the reduplication of the sign WANT marks an ongoing activity of the verb *want*, which it is linguistically equivalent to the present participle verbs *wanting* or *asking* in English. In Example 8(c), the reduplication of the sign EXPLAIN serves as past progressive *explaining* due to the mention of tense at the beginning of the utterance. In the case of classifier construction DOG-SITTING-UP-WITH-PAWS in Example 8(d), the sign SITTING serves as past progressive *sitting*.

#### Example 8

- (a) RECENT DRY\* RECENT DRY\* BUT  
RAIN++ NOW RAIN+++  
“Recently, it was dry but now it is raining.”  
SOI Corpus Nicholas (22) personal stories (Wexford)
- (b) WANT+++ ALL FOUR CHILDREN WANT  
++ MOTHER HELP-ME  
“The four children are asking their mother for help.”  
SOI Corpus Frankie (11) Personal Stories (Dublin)
- (c) MOTHER EXPLAIN++ LOW RATHMINES  
ROAD STRONG LIVE DEAF  
“My mother was explaining that the deaf lived in the lower road of Rathmines.”  
SOI Corpus Geraldine (20) Personal Stories (Dublin)
- (d) THAT NIGHT \*DOG DOG-SITTING-UP-  
WITH-PAWS WAIT  
“That night, the dog was sitting up with paws, waiting.”  
SOI Corpus Fiona (36) Frog story (Waterford)

## 6 Conclusions and future work

We have outlined here our preliminary research towards accommodating gerunds within the sign language lexicon. We have provided a mapping of ISL translations to English language usage. The preliminary findings indicate that to correctly interpret if gerund constructions do indeed exist within signed languages, further analysis and investigation is necessary, in particular within the domain of aspect and aspectual marking in signed languages and spoken languages.

There are many challenging obstacles with regard to the process of identification of these constructions within signed languages. Even if verb reduplication conveys the meaning of an inflected verb with *-ing* (in English), the context determines whether the construction is a present participle construction or

past progressive, due to the use of aspect or tense. With regard to SL, in some cases, reduplication refers to pluralisation and does not convey any other meaning (e.g. the repetition of the sign BEE in Example 5, in which it serves as plural (*bees*)).

Future work will focus on gathering more evidence with regard to gerunds within signed languages. Further investigation will be carried out in terms of the morphological characteristics of gerund constructions within signed languages, alongside an analysis of their contextual usage.

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