Are there just WordNets or also SignNets?

Ineke Schuurman
KU Leuven
Leuven, Belgium
`ineke.schuurman@ccl.kuleuven.be`

Thierry Declerck
DFKI GmbH, Saarland Informatics Campus
Saarbrücken, Germany
`declerck@dfki.de`

Caro Brosens and **Margot Janssens**
Vlaams GebarentaalCentrum
Antwerpen, Belgium
`caro.brosens,margot.janssens@vgtc.be`

Vincent Vandeghinste
Instituut voor de Nederlandse Taal
Leiden, The Netherlands
`vincent.vandeghinste@idvnt.nl`

Bram Vanroy
KU Leuven
Leuven, Belgium
`bram.vanroy@kuleuven.be`

Abstract

For Sign Languages (SLs), can we create a SignNet, like a WordNet for spoken languages: a network of semantic relations between constitutive elements of SLs? We first discuss approaches that link SL data to wordnets, or integrate such elements with some adaptations into the structure of WordNet. Then, we present requirements for a SignNet, which is built on SL data and then linked to WordNet.

1 Introduction

Wordnets are semantic networks for *in se* spoken natural languages, containing lexical semantics relations between the words (mainly for nouns, verbs, adjectives and adverbs) in these languages. Full wordnets are currently only available for spoken languages, encoded in written form. In many cases, there are links between distinct wordnets, often using Princeton WordNet (Fellbaum, 2005) as a pivot, using interlingual wordnet indices (Bond et al., 2016).

There is an increasing interest in offering automated translations between spoken and signed natural languages. This is demonstrated by two ongoing large European research projects: SignON[1] (Saggion et al., 2021; Shterionov et al., 2022) and EASIER[2] (McDonald et al., 2021). The topic of automated translations between Sign Languages (SLs) is also being addressed.

Research is also addressing the role that WordNet(s) can play (Bigeard et al., 2022), for instance how to include SL data in WordNet(s) and how the

shared synset IDs in the Open Multilingual Wordnet (OMW, (Bond and Foster, 2013)) infrastructure can help in cross-linking and aligning signs used in both German and Greek Sign Language. This extends related work on building ASLNet (Lualdi et al., 2019, 2021), which deals with Princeton WordNet (PWN) and American Sign Language (ASL), using the semantic structure offered by PWN to support the semantic organization of ASL signs.

Complementary to this, we investigate whether the development of a specific (lexical) semantic network for SL data is an option for establishing (cross-lingual) semantic relations between elements of SL data sets and whether it supports a better linking to wordnets related to spoken languages, instead of "merely" integrating SL data in WordNet(s). We call these SignNets. Constructing sign languages specific SignNet(s) may help to bridge between Sign Languages and spoken languages. (Lualdi et al., 2019) already express the need to encode SL specific phonological and lexical relations (going beyond purely PWN-based relations) between ASL signs. It may be worth considering extending this approach to a full SignNet.

A SignNet can help in the extended publication and visibility of (some) SL data, as we can consider all SLs as low resource languages, esp. when taking into account that the resources should be machine-readable to overcome some translation issues, esp. when using MT. So for example, a significant part of the corpus for the Flemish Sign Language (Vlaamse Gebarentaal, VGT) is not yet machine-readable, cf (Wille et al., 2022). In

---

[1] `https://signon-project.eu/`
[2] `https://www.project-easier.eu/`

the VGT dictionary[3] each sign comes with a few keywords, but esp. when translating from spoken (Northern) Dutch to VGT several words are lacking. The availability of hypernyms etc may also be useful. Making use of signnets and wordnets, esp when translating from spoken language to sign language, we can detect which words can be related to which signs.

A last, but important issue: a wordnet should ideally be accessible to users having the language under consideration as their mother tongue, cf the app for PWN 3.1.[4] For a language like VGT it should be accessible in that SL (their mother tongue), not just in a 'foreign' spoken language.

2 Wordnets and Sign Languages

Currently, there are no wordnet-like resources publicly available for SLs, which rely on their visual-manual modality to express meaning. Some papers on this topic, however, are available, like (Ebling et al., 2012), (Shoaib et al., 2014), (Lualdi et al., 2019), (Lualdi et al., 2021), and (Bigeard et al., 2022).

Thus, work on resources for Greek and German, spoken and signed, are well under way, while currently work on ASLNet seems to be more or less at a standstill. However, it seems that in none of these cases a full 'wordnet' for an SL (a SignNet?) is being built.

As mentioned above, *in se*, a wordnet is a large semantic network stored in a database. We aim at including in such a semantic network all types of data available for a specific SL, also signs (and images/videos showing them), with their phonological elements, like hand shapes, position, orientation, as well as the glosses,[5] their phonetic transcriptions (like HamNoSys (Hanke, 2004), cf. Fig. 3), examples of use (in both the SL concerned and the surrounding spoken language), definitions and identifiers of entries in corpora where some attestations of the signs can be found, etc. This would mean that SignNets are semantic networks on their own, applied to visual-gestural data, and containing links to wordnets, rather than being in-

tegrated in those. As such, we are framing SLs as natural languages in their own right, and not as an appendix to spoken language (spoken language with signs/gestures). The latter was more or less the case, although with pictographs, in (Vandeghinste and Schuurman, 2014) where picographs were linked to Cornetto[6] synsets in order to enable people with intellectual disabilities to communicate with others using an app.

2.1 Semantic Networks for Sign languages (SignNets)

A wordnet containing words in a specific spoken language, expressing the semantic relations between these, comes in a written format.

This is rather important, as one of the characteristics of SLs is that there is no generally accepted written form. This means that the WordNet format as such is not directly applicable, although often glosses are used as a kind of written representation format. The same holds for some phonetic transcription formats, like HamNoSys, SiGML[7] and Sign_A (Murtagh, 2019).

In an ideal world, deaf people should be able to use a SignNet using 1) video (automatic sign language recognition), 2) written input, for example in Dutch when consulting VGTNet[8], 3) glosses and keywords, 4) picture-based parameters (handshape, location, movement, and orientation) whether or not enriched with info concerning region, topic/-category and 5) transcribed format (like SiGML or Sign_A). The same would hold for dictionaries or other SL resources. As (Lualdi et al., 2021) points out for ASLNet: "The semantic relations encoded by a wordnet enable semantically-driven language acquisition, resulting in a powerful first-language (L1) and second-language (L2) pedagogical resource that will also contribute to ASL linguistics."

Our starting point while building a SignNet are the lexical resources available for the SL under consideration. These are likely to contain just signs (plus glosses) approved by the deaf community, plus some keywords in the relevant spoken language, Dutch for VGT. Another point is that, for example for VGT, signed corpora are scarce, and

---

[3]https://woordenboek.vlaamsegebarentaal.be/

[4]https://wordnet-rdf.princeton.edu/

[5]Not to be confused with Wordnet glosses: glosses in the SL community are a simple way to name a sign, so that one can refer to it. The design and use of such glosses are subject to conventions by the community (Ormel et al., 2010). Nevertheless, not all communities are using exactly the same approach.

[6]An older wordnet for Dutch

[7]Machine-readable conversion of HamNoSys, cf https://vh.cmp.uea.ac.uk/index.php/SiGML_Tools

[8]Currently, often only words in spoken language explicitly mentioned as keywords (or translations) can be used in the SL SignNet

not always machine-readable ([Wille et al., 2022]), so that starting with lexical resources is a valuable option. This means that we are using a *merge* approach, as SLs have other characteristics than a spoken language like English (reflected in PWN). We are dealing in this paper with VGT, but will also consider SL of the Netherlands (Nederlandse Gebarentaal, NGT) in the near future.[9] In our approach the glosses, and esp. the keywords associated with them, play a central role.

2.2 Glosses

A rather important point when working with SLs: signs often have a somewhat broad meaning, expressing concepts linked to a series of words in spoken language, not just the meaning of one specific word. So the glosses are used to overcome the lack of a natural written format for signs and tend to have a broader meaning than the name suggests, i.e. it is a label for a concept, and does not represent the corresponding word in the spoken language at hand. In fact, a number could have been used instead.

Figure [1] shows the result when searching within the Dutch WordNet: the outcome is a series of homonyms. However, searching within the VGT dataset using a gloss results in a series of a) regional variants and/or b) full synonyms, i.e. a synset is shown. While searching for BANK, several signs will be shown, all with the keywords *bank, bankier, financiële instelling* (bank, banker, financial institution). They are marked as being used in various parts of Flanders. In the regional variants the phonetics differ, but the signs represented are the same.

Synonyms or dialectal variants may occur when older signs originated in schools in different parts of Flanders, while there was not that much contact between them.

The choice of the gloss for naming a sign is in some sense arbitrary. The gloss POOR referring to the concept 'poor' (Dutch 'arm') in VGT is AR-MOEDE (a noun), in NGT it is BEHOEFTIG (an adjective), in both cases the gloss ARM is avoided, as in both languages it is used for the sign(s) referring to the limb. However, in the *Gebarenwoordenboek* for NGT, created by Nederlands Gebarencentrum (and not by Radboud University Nijmegen, who also maintain such a dictionary), the gloss for the concept 'poor' is ARM and that for the limb

ID	Written Form	Semantics
bank-n-1	bank	zitmeubel
bank-n-2	bank	geldverlenende instelling
bank-n-3	bank	zandbank
bank-n-4	bank	wolkenbank
bank-n-5	bank	bij het kaarten
bank-n-6	bank	bankgebouw
bank-n-7	bank	werkbank

Figure 1: *'bank'* in Dutch Wordnet (Cornetto demo)

'ARM ledemaat'.[10] In VGT at least 4 signs come with the gloss ARMOEDE, in the metadata coming with the signs the different origins of the signs are shown. In NGT, there are 2 signs to be found in their signbank, with the glosses BEHOEFTIG-A and BEHOEFTIG-B, the latter having a broader coverage than the first.

Figure 2: Pictographic aids: 'arm' and 'red'

2.3 Transcriptions

While there are systems to transcribe signs, these formats are not readily accessible for the general audience because of several reasons. One reason: the lack of formal education in and about SLs means that not many people are familiar with annotation systems like HamNoSys. And as most deaf people are functionally bilingual, meaning that they can communicate through their second language in written form, this greatly reduced the need for a widely known transcription system. Besides, signers are now able to benefit from all sorts of technological advances (video calls, video messages, ...) further reducing the need for writing down sign language in one of these formats. However, for Natural Language Processing (NLP) purposes a machine-readable written format (SiGML or Sign_A) is still needed. But these formats will only be used by a limited group of (deaf) people. Most people will want to consult a SignNet using recorded signs, spoken language in written format,

---

[9]This because VGT and NGT differ quite a lot, for example in using glosses, and the keywords associated with related glosses.

[10]An additional feature sometimes presented in the Gebarencentrum version of the dictionary are pictographs depicting the meaning of a sign, cf Figure [2]

handshape descriptions, just like they consult a sign language dictionary.

Examples in written form are shown in Figures 3, 4 and 5. Both SiGML and Sign_A are machine-readable.

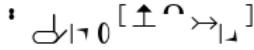Figure 3: HamNoSys, 'going-to'

```
<?xml version="1.0" encoding="iso-8859-1"?>
<!DOCTYPE sigml SYSTEM .../sigml.dtd>
<sigml>
<hns_sign gloss="DGS_going-to">
  <hamnosys_manual>
    <hamsymmpar/>
    <hamfinger2/>
    <hamthumboutmod/>
    <hamextfingeruo/>
    <hampalml/>
    <hamparbegin/>
    <hammoveo/>
    <hamarcu/>
    <hamreplace/>
    <hamextfingerdo/>
    <hamparend/>
  </hamnosys_manual>
</hns_sign>
</sigml>
```

Figure 4: SiGML, 'going-to'

```
Sign_A Manual Feature Description <MF>
<HAND><dh>"right"</dh><ndh>"left"</ndh></HAND>
<HS><HMMode>unique</HMMode><HSID><value>24</value></HSID>
<AM><BHEAD><rightCheek_i><EDti></EDti><EDtn></EDtn></rightCheek_i>
          <rightCheek_n><EDti></EDti><EDtn></EDtn></rightCheek_n>
          <TLti></TLti><TLtn></TLtn>
</BHEAD></AM>
<PO>
  <dh>
  <p1><p1_i><EDti></EDti><EDtn></EDtn></p1_i>
      <p1_n><EDti></EDti><EDtn></EDtn></p1_n>
      <TLti></TLti><TLtn></TLtn>
  </p1>
  </dh>

  <ndh>
  <p_Def><pDef_i><EDti></EDti><EDtn></EDtn></p_Def_i>
         <pDef_n><EDti></EDti><EDtn></EDtn></pDef_n>
         <TLti></TLti><TLtn></TLtn>
  </p_Def>
  </ndh>
</PO>
Sign_A Non Manual Feature Description <NMF>
<MOUTHING><NOUN_ONE_TO_ONE><NOUNIPA>"/g3:(r)l/"</></NOUN_ONE_TO_ONE></MOUTHIN
G>
```

Figure 5: 'girl' in Sign_A

In a user survey, the possibility to search from VGT to Dutch was reported to be of importance, (Brosens et al., 2022). In the current version of the VGT dictionary, users can select (a) handshape(s), location(s), region(s) and/or semantic category/categories to search for specific signs and their meanings. The meanings are currently only displayed through possible translations into Dutch, cf. Fig. 6. Each entry has a page detailing more information. At the bottom of this page regional variants (based on the glosses) as well as similar signs (i.e. phonologically related signs, based on the handshape and location) are displayed.
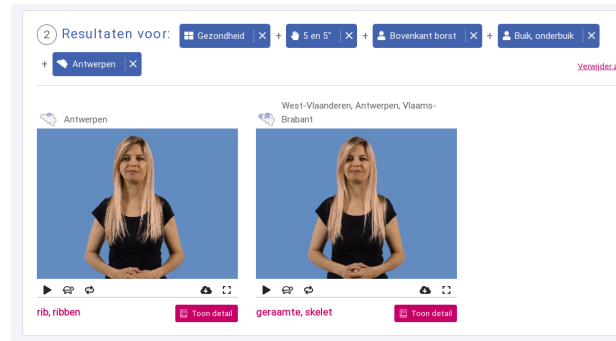
The glosses involved in Fig. 6 are RIBBEN (rib)

Figure 6: Using handshapes etc to find a sign

and SKELET (skeleton).[11] Neglecting the region, one more sign comes up, with gloss FYSIEK(-A) (physical), and not specifying the category results in a total of 11 signs. These are not all homophones. The current series of information on pictures available for VGT is not fine-grained enough to offer a more accurate subset of homophones, this would improve largely when for example pictures for 'movement' could be selected as well: is there a circular motion, a vertical or horizontal one, is it repeated, etc. In for example ASL some twenty movements are described (Stokoe et al., 1965).

The search function through handshape, location, movement, ... is not designed or meant to yield homonyms as results. It would be similar to looking for all words containing a schwa sound in English and expecting these to be homonyms. A far better way would be using signs as such (recorded by the user's camera, the recording being recognized as a specific sign in the SL by a sign language recognition tool).

But even though when using handshapes, location etc the user has to have a look at some (videos of) signs to find the one looked for, and find its meaning in spoken Dutch. An advantage is that this user does not need to be familiar with HamNoSys, Sign_A or the like, for example to use an interface in agreement with the one available for Princeton WordNet 3.1, cf https://wordnet-rdf.princeton.edu, but adapted for SLs.

Taking all of this into account, the best way to find SL *synonyms* and phonetic variants is to make use of the words in written language presented in the SL dictionary as keywords. For the time being, in most SLs *homonyms* are to be hard-coded (in VGT for example 'honger' and 'Hongarije',[12] or

---

[11] Rather RIBBEN-D and SKELET-B for these specific instantiations

[12] HONGER-A (hunger) and HONGARIJE-B (Hungary)

'geel' and 'donderdag'[13]) rather than (videos of) signs and/or transcriptions[14] can be used as input.

3 An Application under Construction

The glossing system described above is widely used by linguists. But there is this major difference between using words and glosses, the latter in fact representing a series of words (synset) from the beginning. And quite often representing a broader concept for gloss X than the one reflected in the synset resulting from the search for word X, sometimes also smaller!

A semantic network for SLs (SignNet) also presenting such data is to be set up more or less from scratch, taking advantage of the wordnet of a surrounding spoken language. For both VGT and NGT that would be ODWN.[15]

However, this might involve adaptations in the (spoken) wordnet, in our case ODWN, as well. In selecting the ODWN synsets to connect with a VGT gloss, the few words in spoken language (keywords) provided by the people behind the VGT dictionary[16] are really helpful.

3.1 Glosses representing a series of signs: consequences for wordnet/SignNet

Considering signs as the core of a SignNet does not at all mean that we will neglect the glosses. As mentioned above, they provide a very good link to resources available for surrounding spoken languages. Quite often, an SL synset is broader than that in the surrounding spoken language. The gloss HANGEN (hang) in VGT, corresponds to at least two synsets in ODWN. We found them making use of the keywords mentioned in the SL dictionaries. So the gloss HANGEN comes with four such keywords: *hangen, aanhangen, ophangen, aanhaken*. (hang, couple (on), hang (up), hook up/on).

These 4 verbs belong to at least 2 synsets: *aanhaken, haken, vasthaken* and *hangen, neerhangen, ophangen* which give the impression to be (semantically) closely related. In such cases we may have to adapt the current version of ODWN, for example by creating a new 'higher' synset, to which the other synsets are related (hyponyms). But ... before doing so, we will first present these to the people behind the SL dictionary at hand, and, when approved by them, in a later stage to representatives

of the deaf community. Only when they approve the proposal, it will be made public.[17]

It would be interesting to see how NGT handles signs with more or less the same meaning. They may even use another gloss (cf BEHOEFTIG-A and -B mentioned above). In the case mentioned above, all words involved are verbs. But that is not necessary, it can even be a mixture of verbs, nouns, adjectives: Gloss: AFBREKEN (pull down), possible keywords *afbreken,* **afbraak***, slopen* (pull down / demolish, **demolition**, demolish) i.e. two verbs, one noun.

In such a case we may have to create a 'derivational related form',[18] thus connecting the noun '*afbraak*' with the verb '*afbreken*'. In some wordnets, like PWN, such links are already available, but it is not yet a common characteristic. Other types of mixes are also possible, see (Vossen, 2002).[19]

For the time being, we've handled the keywords (and these were accepted by VGTC), we will look for their hypernyms, hyponyms, antonyms, ... mentioned in the wordnet and try to link them with signs (or rather their glosses/keywords) in our Sign-Net. Once more, the people behind the dictionary and the representatives are asked for their approval. This way a full SignNet is being constructed. In short: a SignNET contains glosses, coming with

- a synset: series of subglosses or constituting glosses (SIGN-A, SIGN-B, SIGN-D, etc),

- example sentences (signed and spoken), pictographs (like ARASAAC)[20] are linked to wordnet (Schwab et al., 2020),

- series of keywords (using surrounding spoken language),

- links with glosses expressing hypernyms, hyponyms, antonyms, ... etc,

- wordnet link (intelingual identifiers), thus relations with wordnets and other signnets can be made traceable

[13]GEEL-A (yellow) and DONDERDAG-B (Thursday)

[14]Not yet available for many SLs

[15]Replacing Cornetto, the older, not open version

[16]These keywords are approved by the deaf community

[17]For VGT and NGT, while accepting several elements out of the wordnet synset as new keywords, others may be rejected being considered as only usable in the Netherlands or Flanders (false friends)

[18]Terms in different syntactic categories that have the same root form and are semantically related

[19]"In WordNet, nouns, verbs and adjectives form separate sub-networks that are not interrelated. This strict separation between the parts of speech has been abandoned in EuroWord-Net." (p. 32) when claiming that the Dutch adjective *aardig* often should be linked with the verb 'to like' in English

[20]https://arasaac.org/)

Subglosses (SIGN-A etc.) come with

- video of the sign itself,

- transcription in SiGML, Sign_A, ...,

- homonyms,[21]

- description of handshapes, position, movement, location in picture-format,

- pictograph (like ARASAAC),

- category (family, nature, occupation, animal, education, etc ...),

- metadata like region, gender when available.[22]

4 Conclusion

Our pilot study made it clear to us that building real SignNets, comparable with wordnets for spoken languages, is possible, doing justice to the characteristics of the sign language under consideration. Mainly linking signs with surrounding wordnet synsets does so to a lesser extent. Another advantage is that for example an application comparable to that of Princeton WordNet 3.1, but for SLs, is accessible to a much larger set of users. So, we'll continue working on developing SignNets! Our signnets are in some respect an extension of the work done by (Lualdi et al., 2019), (Lualdi et al., 2021), and (Bigeard et al., 2022). Their results can *in se* be used as a first step towards a full signnet, and be extended with for example examples in the relevant SLs, recognition of video of a particular sign, etcetera.

Acknowledgements

---

[21] like HONGARIJE-B and HONGER-A; GEEL-A and DONDERDAG-B

[22] For Irish SL for example the gender of the persons using the specific variant of a sign

[23] All authors but Thierry Declerck

[24] Thierry Declerck and Ineke Schuurman

References

Sam Bigeard, Marc Schulder, Maria Kopf, Thomas Hanke, Kiki Vasilaki, Anna Vacalopoulou, Theodoros Goulas, Athanasia-Lida Dimou, Stavroula-Evita Fotinea, and Eleni Efthimiou. 2022. Introducing Sign Languages to a Multilingual Wordnet: Bootstrapping Corpora and Lexical Resources of Greek Sign Language and German Sign Language. In *Proceedings of the LREC2022 10th Workshop on the Representation and Processing of Sign Languages: Multilingual Sign Language Resources*, pages 9–15, Marseille, France. European Language Resources Association (ELRA).

Francis Bond and Ryan Foster. 2013. Linking and Extending an Open Multilingual Wordnet. In *Proceedings of the 51st Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*, pages 1352–1362, Sofia, Bulgaria. Association for Computational Linguistics.

Francis Bond, Piek Vossen, John McCrae, and Christiane Fellbaum. 2016. CILI: the Collaborative Interlingual Index. In *Proceedings of the 8th Global WordNet Conference (GWC)*, pages 50–57, Bucharest, Romania. Global Wordnet Association.

Caro Brosens, Margot Janssens, Sam Verstraete, Thijs Vandamme, and Hannes De Durpel. 2022. Moving towards a Functional Approach in the Flemish Sign Language Dictionary Making Process. In *Proceedings of the LREC2022 10th Workshop on the Representation and Processing of Sign Languages: Multilingual Sign Language Resources*, pages 24–28, Marseille, France. European Language Resources Association (ELRA).

Sarah Ebling, Katja Tissi, and Martin Volk. 2012. Semi-Automatic Annotation of Semantic Relations in a Swiss German Sign Language Lexicon. In *Proceedings of the LREC2012 5th Workshop on the Representation and Processing of Sign Languages: Interactions between Corpus and Lexicon*, pages 31–36, Istanbul, Turkey. European Language Resources Association (ELRA).

Christiane Fellbaum. 2005. WordNet and wordnets. In *Encyclopedia of Language and Linguistics*, pages 665–670, Oxford. Elsevier.

Thomas Hanke. 2004. HamNoSys – Representing Sign Language Data in Language Resources and Language Processing Contexts. In *Proceedings of the LREC2004 Workshop on the Representation and Processing of Sign Languages: From SignWriting to Image Processing. Information techniques and their implications for teaching, documentation and communication*, pages 1–6, Lisbon, Portugal. European Language Resources Association (ELRA).

Colin Lualdi, Jack Hudson, Christiane Fellbaum, and Noah Buchholz. 2019. Building ASLNet, a Wordnet for American Sign Language. In *Proceedings of the 10th Global Wordnet Conference*, pages 315–322, Wroclaw, Poland. Global Wordnet Association.

Colin Lualdi, Elaine Wright, Jack Hudson, Naomi Caselli, and Christiane Fellbaum. 2021. Implementing ASLNet V1.0: Progress and Plans. In *Proceedings of the 11th Global Wordnet Conference, GWC 2021, University of South Africa (UNISA), Potchefstroom, South Africa, January 18-21, 2021*, pages 63–72. Global Wordnet Association.

John C. McDonald, Rosalee Wolfe, Eleni Efthimiou, Evita Fontinea, Frankie Picron, Davy Van Landuyt, Tina Sioen, Annelies Braffort, Michael Filhol, Sarah Ebling, Thomas Hanke, and Verena Krausneker. 2021. The Myth of Signing Avatars. In *Proceedings 1st International Workshop on Automatic Translation for Signed and Spoken Languages (AT4SSL)*, pages 33–42. Association for Machine Translation in the Americas.

Irene E. Murtagh. 2019. *A Linguistically Motivated Computational Framework for Irish Sign Language*. PhD Thesis, Trinity College London, School of Linguistic Speech and Comm Sci.

Ellen Ormel, Onno Crasborn, Els van der Kooij, Lianne van Dijken, Ellen Yassine Nauta, Jens Forster, and Daniel Stein. 2010. Glossing a multi-purpose sign language corpus. In *Proceedings of the LREC2010 4th Workshop on the Representation and Processing of Sign Languages: Corpora and Sign Language Technologies*, pages 186–191, Valletta, Malta. European Language Resources Association (ELRA).

Horacio Saggion, Dimitar Shterionov, Gorka Labaka, Tim Van de Cruys, Vincent Vandeghinste, and Josep Blat. 2021. SignON: Bridging the gap between Sign and Spoken Languages. In *Proceedings of the Annual Conference of the Spanish Association for Natural Language Processing: Projects and Demonstrations (SEPLN-PD 2021) co-located with the Conference of the Spanish Society for Natural Language Processing (SEPLN 2021), Málaga, Spain, September, 2021*, volume 2968 of *CEUR Workshop Proceedings*, pages 21–24. CEUR-WS.org.

Didier Schwab, Pauline Trial, Céline Vaschalde, Loïc Vial, Emmanuelle Esperanca-Rodier, and Benjamin Lecouteux. 2020. Providing Semantic Knowledge to a Set of Pictograms for People with Disabilities: a Set of Links between WordNet and Arasaac: Arasaac-WN. In *Proceedings of the Twelfth Language Resources and Evaluation Conference*, pages 166–171, Marseille, France. European Language Resources Association.

U. Shoaib, N. Ahmad, P. Prinetto, and G. Tiotto. 2014. Integrating MultiWordNet with Italian Sign Language lexical resources. *Expert Systems with Applications*, 41(5):2300–2308.

Dimitar Shterionov, Mirella De Sisto, Vincent Vandeghinste, Aoife Brady, Mathieu De Coster, Lorraine Leeson, Josep Blat, Frankie Picron, Marcello Paolo Scipioni, Aditya Parikh, Louis ten Bosch, John O'Flaherty, Joni Dambre, and Jorn Rijckaert. 2022. Sign Language Translation: Ongoing Development, Challenges and Innovations in the SignON Project. In *Proceedings of the 23rd Annual Conference of the European Association for Machine Translation*, pages 325–326, Ghent, Belgium.

William C. Stokoe, Dorothy C. Casterline, and Carl G. Croneberg. 1965. *A dictionary of American sign language on linguistic principles*. Gallaudet research publication. Centennial series l. Gallaudet Press, Washington, D.C.

Vincent Vandeghinste and Ineke Schuurman. 2014. Linking pictographs to synsets: Sclera2cornetto. In *Proceedings of the Ninth International Conference on Language Resources and Evaluation (LREC'14)*, Reykjavik, Iceland. European Language Resources Association (ELRA).

Piek Vossen. 2002. WordNet, EuroWordNet and Global WordNet. *Revue Française de Linguistique Appliquée*, VII:27.

Beatrijs Wille, Inez Beukeleers, Mieke Van Herreweghe, and Myriam Vermeerbergen. 2022. Big Things Often Have Small Beginnings: A Review on the Development, Use and Value of Small and Big Corpora for Flemish Sign Language Linguistic Research. *Frontiers in Psychology*, 12.