

Towards an RDF Representation of the Infrastructure  
consisting in using WordNet(s) as a conceptual Interlingua  
between multilingual SignLanguage Datasets

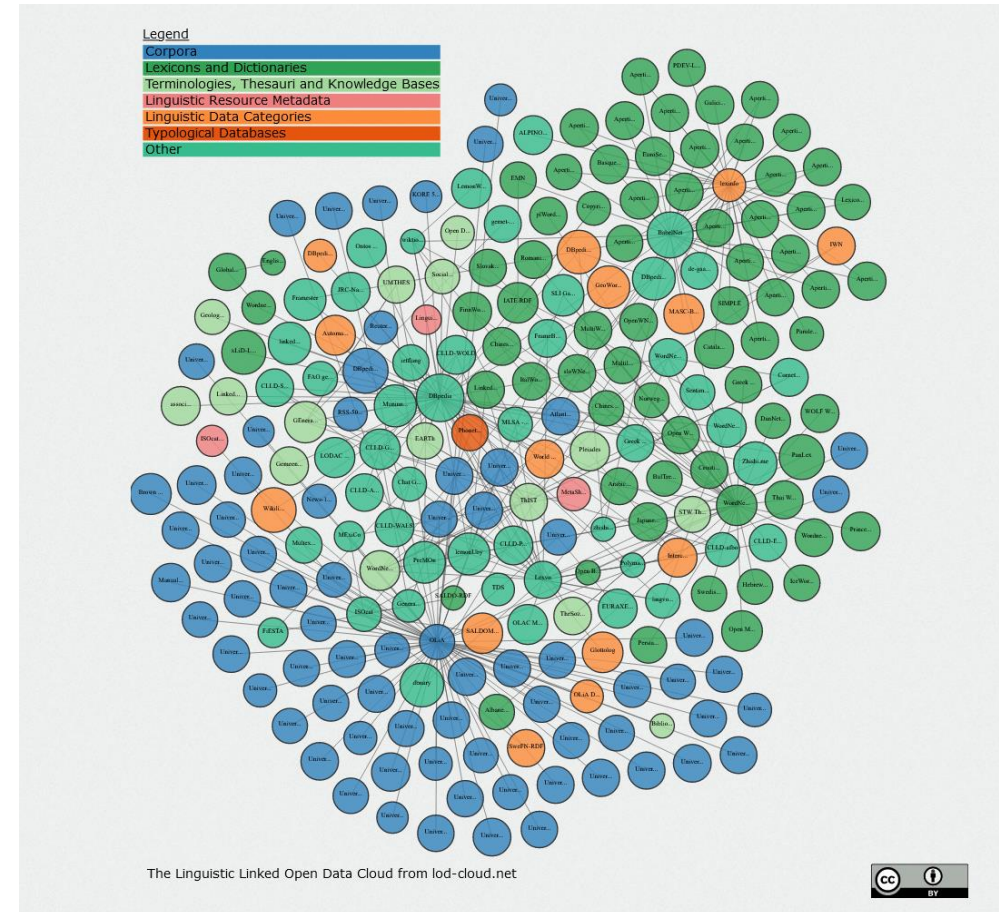
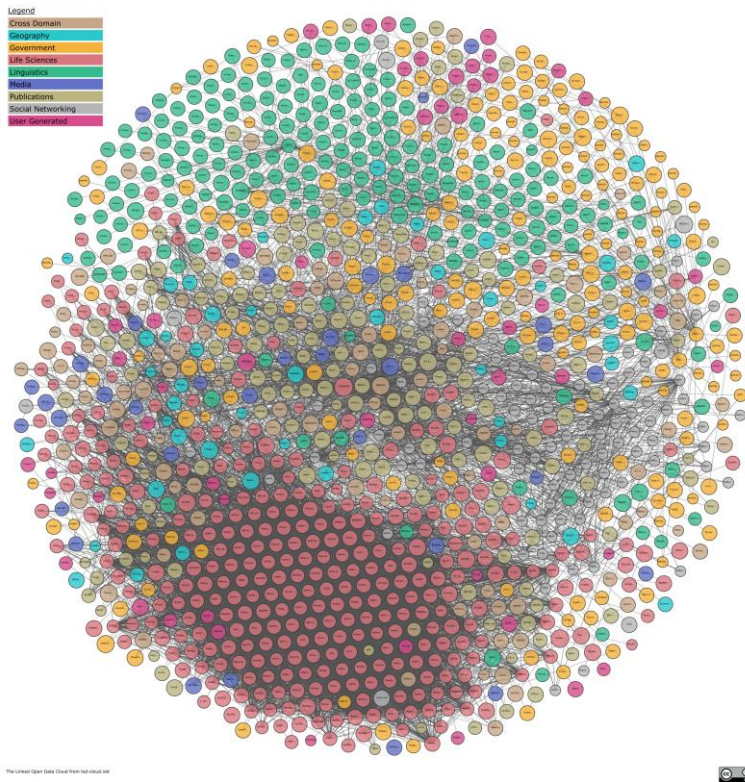
Thierry Declerck<sup>1</sup>, Thomas Troelsgård<sup>2</sup> and Sussi Olsen<sup>3</sup>

<sup>1</sup>German Research Center for Artificial Intelligence (DFKI GmbH)

<sup>2</sup>University College Copenhagen (KP)

<sup>3</sup>Centre for Language Technology, NorS, University of Copenhagen

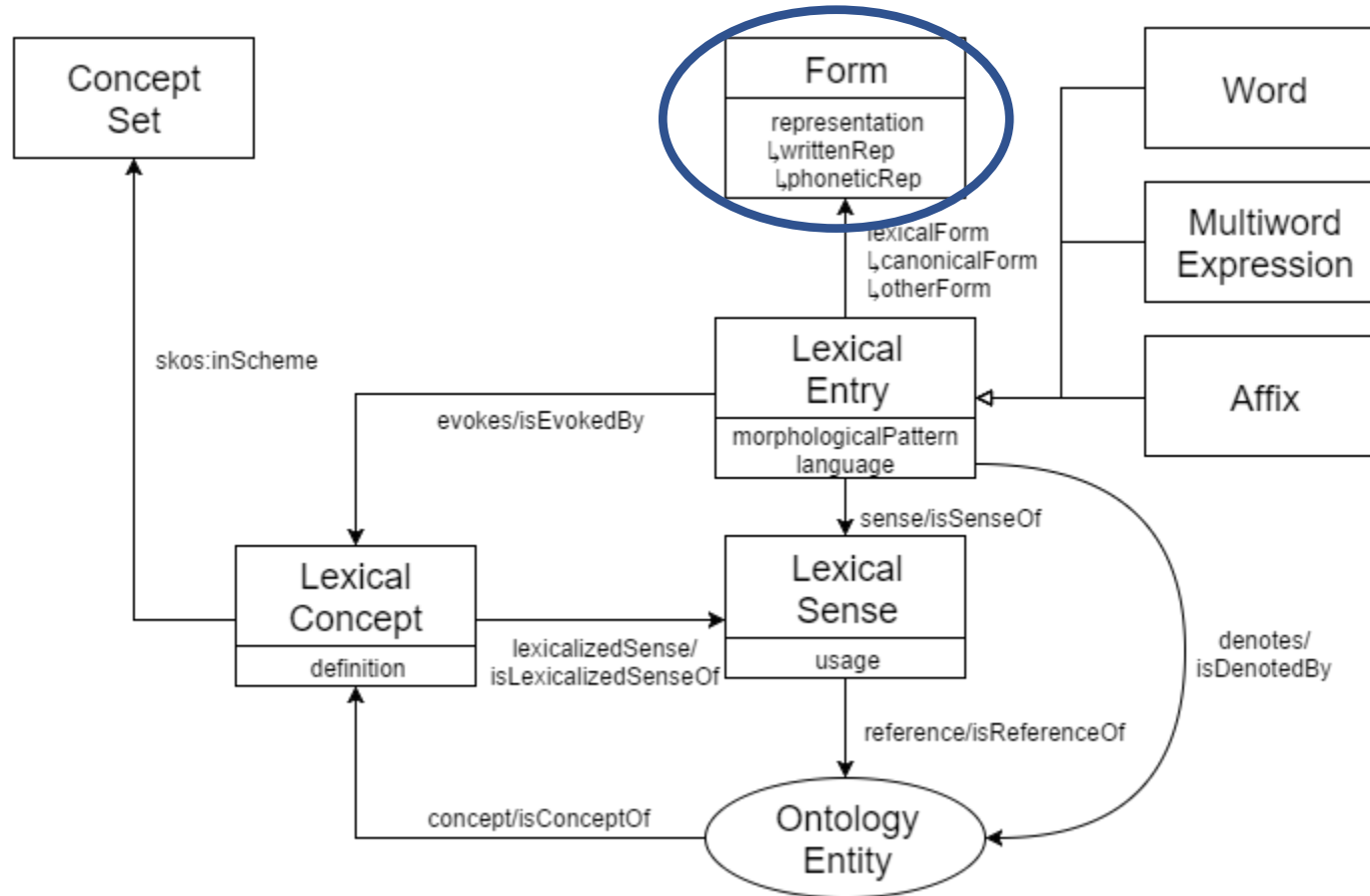
# Goal: Representing and Publishing Sign Language Data Sets in the Linguistic Linked Data (LLOD) Cloud, which is a subset of the Linked Data (LD) Cloud



# Current status of the relation between Linked Data and Sign Languages

- We could observe that Sign Language (SL) lexical data are not represented in the datasets included by now in the LLOD cloud.
- Also looking at the “Overview of Datasets for the Sign Languages of Europe” published by the “Easier” European project (<https://www.project-easier.eu/wp-content/uploads/sites/67/2021/08/EASIER-D6.1-Overview-of-Datasets-for-the-Sign-Languages-of-Europe.pdf>) we do not see any mention of a dataset being available in an Linked Data compliant format.

Checking the usability of Ontolex-Lemon for encoding Sign Language data – Ontolex-Lemon covers only writtenRep and phoneticRep. How to include the Representation of SLs?



# The Features of Sign Language Data we want to integrate in the LLOD cloud? An example from the American Sign Language

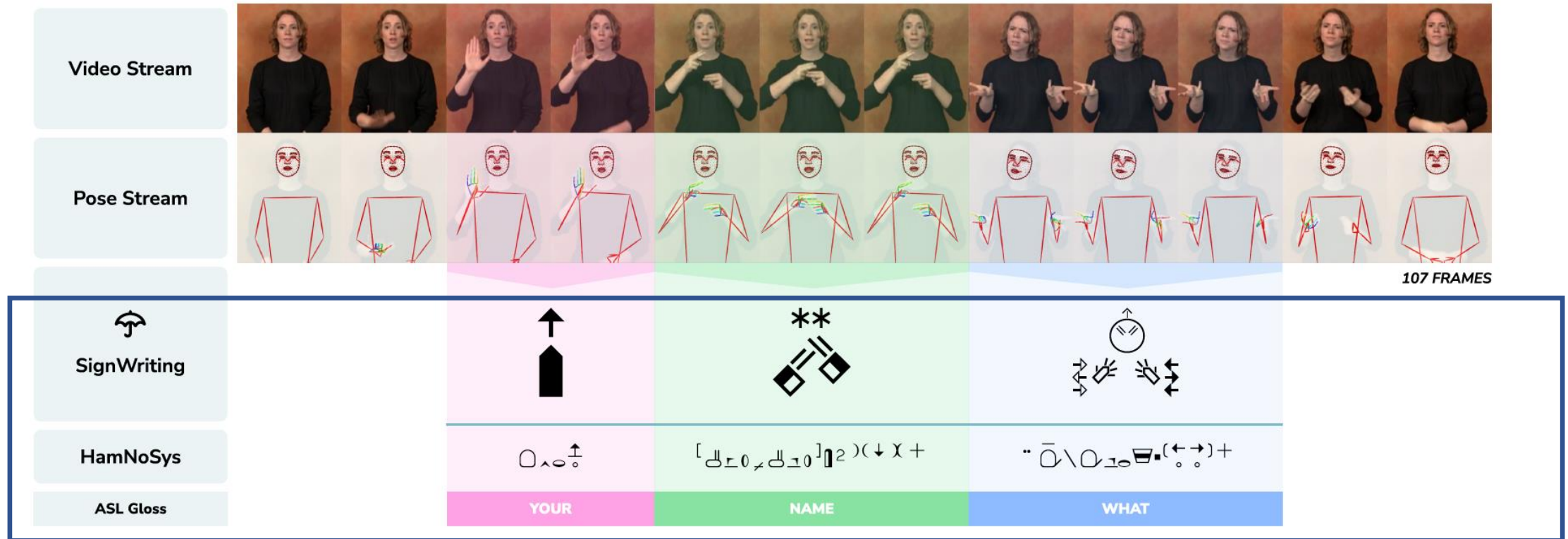


Figure 2: Various representations of American Sign Language. English translation: “What is your name?”

Taken from: Including Signed Languages in Natural Language Processing. Kayo Yin, Amit Moryossef, Julie Hochgesang, Yoav Goldberg, Malihe Alikhani. <https://arxiv.org/abs/2105.05222> (ACL-IJCNLP 2021)

# About the Phonology of Sign Languages

“[Sign languages](#) such as [American Sign Language](#) (ASL) are characterized by [phonological](#) processes analogous to, yet dissimilar from, those of oral [languages](#). Although there is a qualitative difference from oral languages in that sign-language [phonemes](#) are not based on sound, and are spatial in addition to being temporal, they fulfill the same role as phonemes in oral languages.

Basically, three types of signs are distinguished: one-handed signs, symmetric two-handed signs (i.e. signs in which both hands are active and perform the same or a similar action), and asymmetric two-handed signs (i.e. signs in which one hand is active [the 'dominant' or 'strong' hand] and one hand is held static [the 'non-dominant' or 'weak' hand]). The non-dominant hand in asymmetric signs often functions as the location of the sign. Almost all simple signs in ASL are monosyllabic.”

([https://en.wikipedia.org/wiki/American\\_Sign\\_Language\\_phonology](https://en.wikipedia.org/wiki/American_Sign_Language_phonology))

More details in specialized literature.

# A first Step for encoding the Phonology: A (first and tentative) Ontology of constitutive Elements of SLs

The screenshot displays the TopBraid Composer FE interface. On the left, a tree view shows the ontology structure, including classes like `lexinfo:TermElement`, `lexinfo:TermType`, `lexinfo:VerbFormMood`, `lexinfo:Voice`, `ontolex:Form`, `ontolex:LexicalEntry`, `ontolex:MultiwordExpression`, `owl:NamedIndividual`, `semiotics:Expression`, `semiotics:Meaning`, `skos:Collection`, `skos:Concept`, `skos:ConceptScheme`, `sldc:ConstructedAction`, `sldc:NotationsForSignLanguages`, `sldc:Sign`, `sldc:Duration`, `sldc:Fingerspelling`, `sldc:LexicalProperties`, `sldc:Phonology`, `sldc:Phonology_Manual`, `sldc:DominantHand`, `sldc:HandShape`, `sldc:NonActivatedFingers`, `sldc:SelectedFingers`, `sldc:ThumbContact`, `sldc:ThumbPosition`, `sldc:Location`, `sldc:Location_DGS_Horizontal`, `sldc:Location_DGS_Vertical`, `sldc:MajorLocation`, `sldc:MinorLocation`, `sldc:SecondMinorLocation`, `sldc:Movement`, `sldc:NonDominantHand`, `sldc:Orientation`, `sldc:TwoHandedSigns`, `sldc:Phonology_NonManual`, `sldc:Phonology_ToBeClassified`, and `sldc:SignLanguage`. The main window shows the `Class Form` for `sldc:Movement`, with annotations for `rdfs:label` and `skos:definition`. The `Class Axioms` section shows `rdfs:subClassOf` and `owl:equivalentClass` axioms. The bottom panel displays a table of instances.

[Resource]	rdfs:type	rdfs:label	rdfs:comment
sldc:ArticulatorInternal...	sldc:ArticulatorInternalMo...	"kinking changes in hands...	DGS
sldc:ArticulatorInternal...	sldc:ArticulatorInternalMo...	"Opening/Closing change...	DGS
sldc:ArticulatorInternal...	sldc:ArticulatorInternalMo...	"Rubbing changes in hand...	DGS
sldc:ArticulatorInternal...	sldc:ArticulatorInternalMo...	"Shift between straddling ...	DGS
sldc:ArticulatorInternal...	sldc:ArticulatorInternalMo...	"bending movement"	
sldc:ArticulatorInternal...	sldc:ArticulatorInternalMo...	"rotating movement"	
sldc:ArticulatorInternal...	sldc:ArticulatorInternalMo...	"shaking movement"	
sldc:BackAndForth	sldc:PathMovement	"back and forth"	
sldc:Bend	sldc:PathMovement_Shape	"bend"	
sldc:Circular	sldc:PathMovement_Shape	"circular"	
sldc:Curved	sldc:PathMovement_Shape	"curved"	
sldc:False	sldc:FlexionChange, sldc:...	"false"	
sldc:None	sldc:PathMovement	"none"	
sldc:Other	sldc:MajorLocation, sldc:...	"other"	
sldc:OtherAway	sldc:MajorLocation, sldc:...	"other away"	
sldc:Spiral	sldc:PathMovement_Shape	"spiral"	
sldc:Straight	sldc:PathMovement_Shape	"straight"	
sldc:True	sldc>Contact, sldc:Flexion...	"true"	
sldc:Waves	sldc:PathMovement_Shape	"waves"	
sldc:X-Shaped	sldc:PathMovement_Shape	"x-shaped"	
sldc:Z-Shaped	sldc:PathMovement_Shape	"z-shaped"	

See also Thierry Declerck Towards a new Ontology for Sign Languages. LREC 2022

# About the status of “Glosses” used for labelling Sign Language Data

- “Glosses” used in Sign Language resources are not originated in lexical entries of the spoken language or from specific vocabularies. More a kind of informal annotation of a performed sign:
  - “In ASL it is an English word or words that we use to name ASL signs so that we can talk about these signs. The word or words associated with that sign do not relay the signs meaning.” (Signs & their Glosses - Bellevue College)



# The “GLOSSING” pages of IDGS point to Corpora where the signs are occurring, but also to more detailed phonological and lexical information

**Pointing to more detailed information (transcription, phonology, and lexical)**

## Pointing to corpus attestations

### ABWEHR1

Frankfurt | dgskorpus\_fra\_06 | 31-45f Sie wollten mich mit Gewalt ausziehen, aber ich habe mich dagegen gewehrt.

r	AUF- PERSON1*	AUSZIEHEN- UNTERKÖRPER1A*	ICH1	ABWEHR1
l				
m	auf	ausziehen	ich	

Münster | dgskorpus\_mst\_16 | 61+m Da habe ich mich gewehrt.

r		ICH1*	ABWEHR1
l			
m		[MG]	[MG]

Münster | dgskorpus\_mst\_16 | 61+m Ich habe mich gewehrt und gewehrt.

r		ICH1	ABWEHR1
l			
m		[MG]	wehren wehren

Münster | dgskorpus\_mst\_16 | 61+m Ich habe mich gewehrt und an meiner Mutter festgehalten und gerufer „Mama, Mama.“

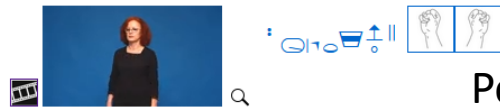
r		ABWEHR1	FESTHALTEN2**
l			
m		[MG]	mama mama






Pointing to more detailed information (transcription/notation, phonology, and lexical)

<https://www.sign-lang.uni-hamburg.de/galex/glossen/g13990.html>

← **SCHUTZ1A** →

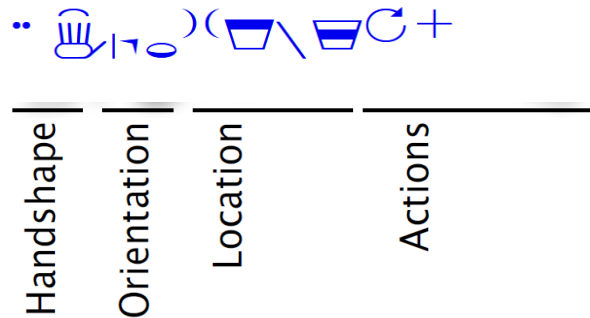


Pointing also to signs having a similar hand configuration

<b>BEDEUTUNGEN</b>	geschützt, Schutz, schützen
<b>BESCHREIBUNG</b>	Mögliche Assoziation: jemandem oder etwas eine Blockade entgegensetzen oder jemanden von sich wegschieben (stilisiert); Bildelemente mit möglichen Assoziationen: Bewegung: von sich weg; Handform: Kraft, Stärke, Gewalt, massiv, kompakt
<b>GEBÄRDENRAUMNUTZUNG</b>	<u>Varierbare Gebärde</u> : Ausgangspunkt: Person, die sich schützt; Bewegung ausgerichtet auf Gefahr, Person oder Sache, gegen die man sich schützt; andere Verwendung: Ausgangspunkt: Person, die eine andere Person oder Sache (Endpunkt) schützt.
<b>AUSFÜHRUNGSVARIANTEN</b>	 <a href="#">SCHUTZ1B</a>
<b>FORMÄHNLICH</b>	 <a href="#">BLEIBEN2</a>
<b>GEBÄRDENUMGEBUNG</b>	 <a href="#">SCHUTZ2A</a>  <a href="#">SCHUTZ2B</a>  <a href="#">SCHUTZ2C</a>
<b>VORKOMMEN</b>	Konventionell verwendet für „geschützt, Schutz, schützen“:  <a href="#">32: Anwenderschutz</a>  <a href="#">46: Atemschutzmaske</a>

# About the Status of Transcriptions

- We focus on HamNoSys („Hamburg Sign Language Notation System“), which is a phonetic transcription system.
- There is a conversion mechanism of HamNoSys to XML, resulting in a SiGML machine-readable format (example for the sign labelled with the gloss „BUSCH“):



```
(base) C:\Users\thde00\.spyder-py3\python_script\SignLanguage\HamNoSys2SiGML-master\Original>python HamNoSys2SiGML.py "?????????????" (Busch)
<?xml version="1.0" encoding="UTF-8"?>
<sigml>
  <hns_sign gloss="(Busch)">
    <hamnosys_nonmanual/>
    <hamnosys_manual>
      <hamsymmlr/>
      <hamfinger2345/>
      <hamfingerbendmod/>
      <hamthumboutmod/>
      <hamextfingeruo/>
      <hampalmd/>
      <hamclose/>
      <hamshoulders/>
      <hambetween/>
      <hamchest/>
      <hamcircleo/>
      <hamrepeatfromstart/>
    </hamnosys_manual>
  </hns_sign>
</sigml>
```

HamNoSys or ist SiGML transcription can be encoded as a value of ontalex:Form

# Linking values of ontolex:Form to instances of ontolex:LexicalConcept

- Current (very promising) work is dealing with linking SL data to WordNet data included in the Open Multilingual Wordnet infrastructure.
  - Contribution on NexusLinguarum (and the projects SignOn and Easier), in cooperation with the University of Hamburg, the Institute for Language and Speech Processing (Greece), and the Fran Ramovš Institute for the Slovene Language: offering a Linked Data compliant representation of this type of linking: ontolex:Form to ontolex:LexicalConcept (where WordNet data is encoded), especially for the many cases for which we are lacking a lexical entry or a lexical sense.

# The Linking of SL data and OMW (for English and Greek), as proposed in the EASIER project (<https://www.fdr.uni-hamburg.de/record/10169#.Y01WXExBzmE>)

[add new synset](#)

omw.01115162-n  
[omw link](#) [internal link](#)

lemmas:sell

def:the activity of persuading someone to buy

validated: 1  
confidence: 5  
GSL

omw.02242464-v  
[omw link](#) [internal link](#)

lemmas:sell

def:exchange or deliver for money or its equivalent

validated: 1  
confidence: 5

omw.00767635-v  
[omw link](#) [internal link](#)


lemmas:sell

def:persuade somebody to accept something


validated: 0

dgs9292 [ilex link](#)

## TO-DISTRIBUTE2^



•  $\sigma^2_{r_0} X[\rightarrow \rightarrow \rightarrow]$



frontal

45°

90°

from above

## TO-SELL1

Berlin | dgskorpus\_ber\_02 | 46-60m There is a clothes store in the capital of Tunisia, no, in the second largest city

r		DEAF1A*	STORE1*	TO-SELL1	CLOTHES1A*
l	\$INDEX1				
m			geschäft		

# The Linking between SL Data and OMW in an Excel File (for Greek and English) – Cross-Lingual Linking via WordNet IDs Conceptually, more precise than linking via Glosses

## The Greek data

970	gsl326,omw.00988028-v,manual accept
971	gsl1049,omw.00362103-n,manual accept
972	gsl1050,omw.00377364-n,manual accept
973	gsl1050,omw.07308563-n,manual accept
974	gsl2592,omw.05128519-n,manual accept

## The English data

6833	dgs67339,omw.00568430-n,auto accept
6834	dgs10875,omw.14449405-n,auto accept
6835	dgs10040,omw.00377364-n,manual accept
6836	dgs10481,omw.00377364-n,manual accept
6837	dgs9882,omw.04228054-n,auto accept
6838	dgs73480,omw.07349299-n,auto accept

(from <https://www.fdr.uni-hamburg.de/record/10169#.Y01WXExBzmE>)

## The entry 00377364-n in the Greek Wordnet

00377364-n      ell:lemma    έκρηξη  
00377364-n      ell:lemma    σκάσιμο  
00377364-n      ell:def      0            η ενέργεια του  
εκρήγνυται ή σκάει κάτι

## The entry 00377364-n in the English Wordnet

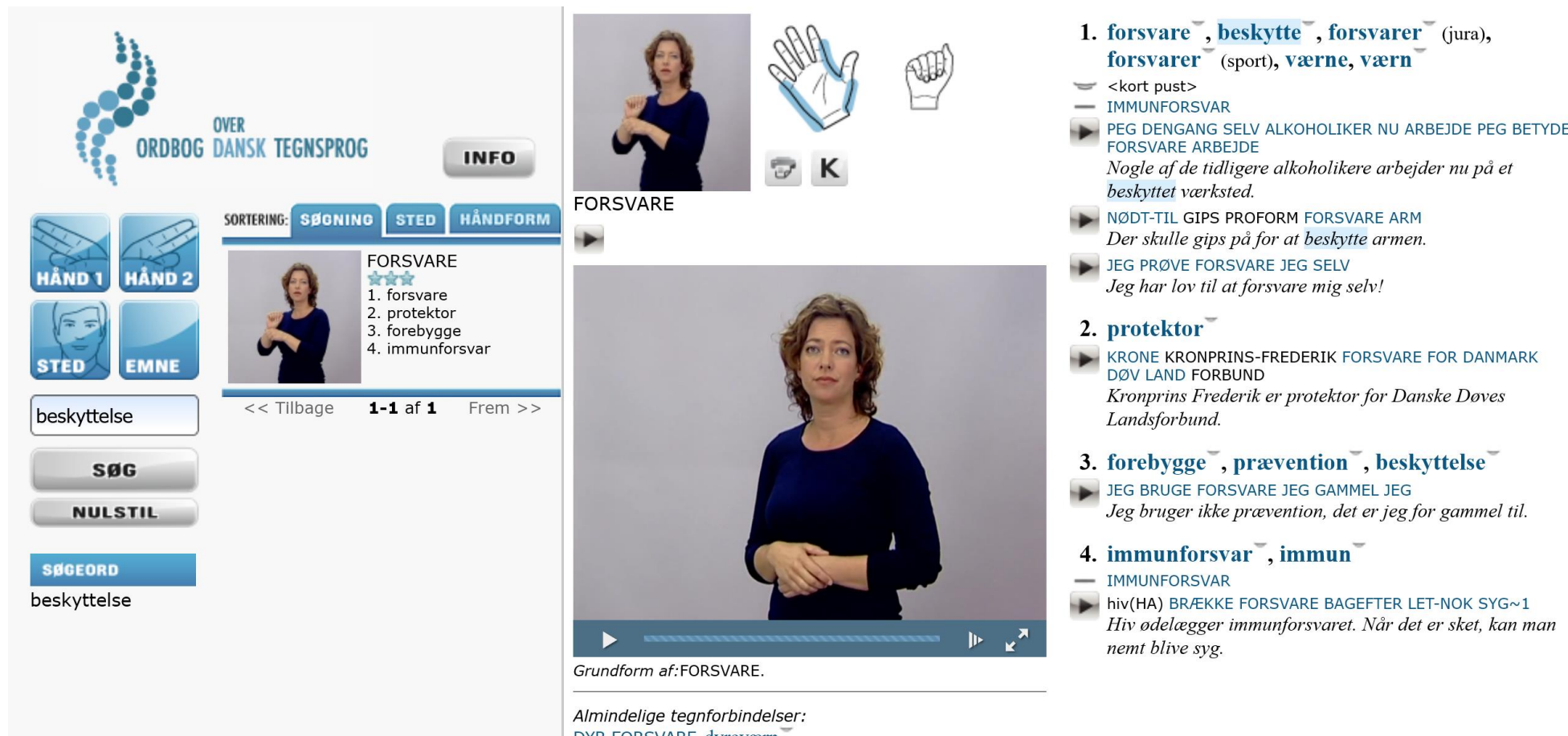
00377364-n      lemma    explosion  
00377364-n      lemma    burst

Another IDGS Resource: Dicta-Sign ([https://www.sign-lang.uni-hamburg.de/dicta-sign/portal/concepts/cs/cs\\_688.html](https://www.sign-lang.uni-hamburg.de/dicta-sign/portal/concepts/cs/cs_688.html)): 1000 concepts with Sign Realizations in 4 languages, using single Glosses and other videos

Navigation: [Back to overview](#) | [Zurück zur Übersicht](#) | [Retour au sommaire](#) | [Πίσω στην επισκόπηση](#)

<p>protect <span>BSL</span> </p> <p>protect(v)#1 · 〇 τ_ο 〇   +</p>	<p>schützen <span>DGS</span> </p> <p>SCHUTZ1A · 〇 τ_ο 〇  </p>
<p>protéger <span>LSF</span> </p> <p>PROTEGER · [ 〇_α_ο_ο_ο_ο ] [ 〇_1 (X_τ) 〇 ] ↓</p>	<p>ΠΡΟΣΤΑΤΕΥΩ <span>GSL</span> </p> <p>Compound</p> <p>ΠΡΟΣΤΑΤΕΥΩ · 〇_τ_0 〇 (X_2 〇) ; [ 〇_τ_ο_ο_ο_τ_ο ] ( [ 〇_τ_ο_τ_ο_τ_ο ] )</p>

# “Beskyttelse” in the Danish SL Portal



The screenshot shows the Danish Sign Language Portal interface. On the left, there is a search bar with the text "beskyttelse" and buttons for "SØG" and "NULSTIL". Below the search bar, there are buttons for "HÅND 1", "HÅND 2", "STED", and "EMNE". The main content area displays search results for "FORSVARE". The results are sorted by "SØGNING" and show a list of four items: 1. forsvare, 2. protektor, 3. forebygge, and 4. immunforsvar. A video player shows a sign language interpreter performing the sign for "FORSVARE". To the right of the video player, there are icons for "HÅND 1", "HÅND 2", "STED", and "EMNE". Below the video player, there is a section for "Grundform af: FORSVARE." and "Almindelige tegnforbindelser: DVB FORSVARE, dvbeværm".

OVER ORDBOG DANSK TEGNSPROG

INFO

SORTERING: SØGNING STED HÅNDFORM

HÅND 1 HÅND 2

STED EMNE

beskyttelse

SØG

NULSTIL

SØGEORD beskyttelse

FORSVARE

1. forsvare  
2. protektor  
3. forebygge  
4. immunforsvar

<< Tilbage 1-1 af 1 Frem >>

FORSVARE

Grundform af: FORSVARE.

Almindelige tegnforbindelser:  
DVB FORSVARE, dvbeværm

1. **forsvare**, **beskytte**, **forsvarer** (jura), **forsvarer** (sport), **værne**, **værn**  
<kort pust>  
IMMUNFORSVAR  
PEG DENGANG SELV ALKOHOLIKER NU ARBEJDE PEG BETYDE FORSVARE ARBEJDE  
*Nogle af de tidligere alkoholikere arbejder nu på et beskyttet værksted.*  
NØDT-TIL GIPS PROFORM FORSVARE ARM  
*Der skulle gips på for at beskytte armen.*  
JEG PRØVE FORSVARE JEG SELV  
*Jeg har lov til at forsvare mig selv!*
2. **protektor**  
KRONE KRONPRINS-FREDERIK FORSVARE FOR DANMARK DØV LAND FORBUND  
*Kronprins Frederik er protektor for Danske Doves Landsforbund.*
3. **forebygge**, **prævention**, **beskyttelse**  
JEG BRUGE FORSVARE JEG GAMMEL JEG  
*Jeg bruger ikke prævention, det er jeg for gammel til.*
4. **immunforsvar**, **immun**  
IMMUNFORSVAR  
hiv(HA) BRÆKKE FORSVARE BAGEFTER LET-NOK SYG~1  
*Hiv ødelægger immunforsvaret. Når det er sket, kan man nemt blive syg.*



# Transcriptions of Danish SL

FORSVARE•VAR

????????????????

```
<sigml><hns_sign  
gloss='FORSVARE'><hamnosys_manual><hamsymmmlr/><hamfist/><ha  
mparbegin/><hamextfingeru/><hampalmd/><hamplus/><hamextfinge  
rr/><hampalmr/><hamparend/><hamparbegin/><hammoveu/><hamt  
humbside/><hamtouch/><hamplus/><hamnomotion/><hamparend/><  
hamrepeatfromstart/></hamnosys_manual></hns_sign></sigml>
```

[https://www.tegnsprog.dk/video/t/t\\_2162.mp4](https://www.tegnsprog.dk/video/t/t_2162.mp4)

# DanNet – PWN core (taken from <https://github.com/omwn/omw-data/blob/main/wns/dan/wn-data-dan.tab>)

4534	13244109-n	lemma	besiddelse
4535	13244109-n	lemma	eje
4536	13244109-n	lemma	ejendom
4537	05091194-n	lemma	proportion
4538	07161429-n	lemma	forslag
4539	14489699-n	lemma	velstand
4540	01128193-v	lemma	beskytte
4541	01128193-v	lemma	forsvare
4542	01128193-v	lemma	værne
4543	00817680-n	lemma	beskyttelse
4544	00817680-n	lemma	forsorg
4545	00817680-n	lemma	forsvar
4546	00817680-n	lemma	værn
4547	14539960-n	lemma	ly
4548	14539960-n	lemma	skjul

ODT-ID 3844:

<https://www.tegnsprog.dk/#%7Csoeg%7C'tekst'beskyttelse%7Cresultat%7C1%7Ctrestjerner%7C1%7Ctegn%7C837>

Signs/Videos/Glosses of Signs, Transcriptions of Signs  
In other Sign Languages, like English, French, German,  
Greek, etc..

# Our RDF/OntoLex-Lemon Encoding of the conceptual Information

The screenshot displays a software interface for editing an RDF/OntoLex-Lemon file named 'sl-23-10.ttl'. The interface is divided into several panels:

- Classes:** A list of classes on the left, including `frac:Corpus`, `geo:SpatialThing`, `lexicog:FormRestriction`, `lexicog:LexicographicComponent`, `lexicog:UsageExample`, `ontolex:Form`, `ontolex:LexicalEntry`, `owl:NamedIndividual`, `semiotics:Expression`, `semiotics:Meaning`, `skos:Collection`, `skos:Concept`, `skos:ConceptScheme`, `sl:GLOSS`, `sl:SignVideos`, `synsem:OntoMap`, `synsem:SyntacticArgument`, and `synsem:SyntacticFrame`.
- Annotations:** A section in the central editor showing the following annotations:
  - `rdfs:label` with values: "Schutz" (@de), "beskyttelse" (@da), "protection" (@fr), "protection" (@en), and "προστασία" (@el).
  - `skos:definition` with the value: "παρεχόμενη φροντίδα σε κάποιον ώστε να προφυλάσσεται από υπαρκτούς ή διάφορους πιθανούς κινδύνους" (@el).
- Other Properties:** A section in the central editor showing the following properties:
  - `sl:hasWnLemma` with values: "beskyttelse" (@da), "forsorg" (@da), "forsvar" (@da), "protection" (@en), "protection" (@fr), "værn" (@da), and "προστασία" (@el).
- Properties:** A list of properties on the right, including `dgs:hasGLOSS`, `dgs:hasOMW-Link`, `dgs:hasSubType`, `dgs:hasVideo`, `geo:location`, `lexicog:describes`, `lexicog:restrictedTo`, `lexicog:usageExample`, `lime:conceptualDataset`, `lime:entry`, `lime:lexiconDataset`, `lime:linguisticCatalog`, `lime:referenceDataset`, `lime:resourceType`, `ontolex:concept`, `ontolex:evokes`, `ontolex:isConceptOf`, `ontolex:isDenotedBy`, `ontolex:isEvokedBy`, `ontolex:isLexicalizedSenseOf`, `ontolex:isReferenceOf`, and `ontolex:isSenseOf`.

# Our RDF/OntoLex-Lemon Encoding of the SL Glosses

The screenshot displays a software interface for editing an RDF resource. The central panel, titled "Resource Form", shows the following details:

- Name:** dts:GLOSS\_dts-1\_2162
- Annotations:**
  - rdfs:label**
    - "FORSVARE" {@da}
    - "PROTEGER" {@fr}
    - "SCHUTZ1A^" {@de}
    - "protect(v)#1" {@en}
    - "ΠΡΟΣΤΑΤΕΥΩ" {@el}
- Other Properties:**
  - rdf:type**: sl:GLOSS
  - owl:topDataProperty**
- Incoming References:**
  - dgs:hasGLOSS**: dts:SignVideos\_dts-t\_2162.mp4

The left sidebar shows a class hierarchy with "sl:GLOSS (8)" selected. The right sidebar lists various properties, including "dgs:hasGLOSS", "dgs:hasOMW-Link", "dgs:hasSubType", "dgs:hasVideo", "geo:location", "lexicog:describes", "lexicog:restrictedTo", "lexicog:usageExempl", "lime:conceptualData", "lime:entry", "lime:lexiconDataset", "lime:linguisticCatalog", "lime:referenceDataset", "lime:resourceType", "ontolex:concept", "ontolex:evokes", "ontolex:isConceptOf", "ontolex:isDenotedBy", "ontolex:isEvokedBy", "ontolex:isLexicalized", and "ontolex:isReferenceC".

# Our RDF/OntoLex-Lemon Encoding of the Locations of the SL Videos

The screenshot displays a software interface for editing an RDF resource. The central panel, titled "Resource Form", shows the following details:

- Name:** dts:SignVideos\_dts-t\_2162.mp4
- Annotations:** rdfs:label "Videos representing a sign"
- Other Properties:**
  - dgs:hasGLOSS: dts:GLOSS\_dts-1\_2162
  - sl:hasVideoAdress: https://www.tegnsprog.dk/video/t/t\_2162.mp4
  - rdf:type: sl:SignVideos
  - owl:topDataProperty
- Incoming References:** ← dgs:hasVideo: dts:Form\_1\_2162

The left sidebar lists various classes, with "sl:SignVideos (6)" selected. The right sidebar lists properties, including "dgs:hasGLOSS", "dgs:hasOMW-Link", "dgs:hasSubType", "dgs:hasVideo", "geo:location", "lexicog:describes", "lexicog:restrictedTo", "lexicog:usageExample", "lime:conceptualDataset", "lime:entry", "lime:lexiconDataset", "lime:linguisticCatalog", "lime:referenceDataset", "lime:resourceType", "ontolex:concept", "ontolex:evokes", "ontolex:isConceptOf", "ontolex:isDenotedBy", "ontolex:isEvokedBy", and "ontolex:isReferenceOf".

# Conclusions

- Promising on-going work with an exciting cross-disciplinary cooperation!
- The linking of SLs data to Wordnet seems to be an optimal anchor point for linking SL Data to spoken language data.
- Integrating a number of disparate SL, conceptual and lexical resources under one “umbrella”, realising a dense linking of this distinct information sources.
- Current work in applying the approach across Nordic Sign Languages (Danish, Swedish, Icelandic for the time being)

Thanks for your Attention!