

MY DGS – ANNIS: ANNIS and the Public DGS Corpus

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Abstract

In 2018 the DGS-Korpus project published the first full release of the Public DGS Corpus. The data have already been published in two different ways to fulfil the needs of different user groups, and we have now published the third portal *MY DGS – ANNIS* using the ANNIS browser-based corpus software. ANNIS is a corpus query tool for visualization and querying of multi-layer corpus data. It has its own query language, AQL, and is accessed from a web browser without requiring a login. It allows more complex queries and visualizations than those provided by the existing research portal. We introduce ANNIS and its query language AQL, describe the structure of *MY DGS – ANNIS*, and give some example queries. The use cases with queries over multiple annotation tiers and metadata illustrate the research potential of this powerful tool and show how students and researchers can explore the Public DGS Corpus.

Keywords: German Sign Language (DGS), corpus query and visualization tools, ANNIS

1. Introduction

The DGS Corpus is a part of the DGS-Korpus project, which is a long-term project to create both a corpus and dictionary of German Sign Language (Prillwitz et al., 2008). The elicitation setting for the DGS Corpus involves two participants interacting in different ways with each other and a moderator leading the session.¹ In order to fulfil the needs of a variety of different users (Jahn et al., 2018), the data are published in different formats:

MY DGS (meine-dgs.de) – a community portal for the Deaf community and others interested in DGS, which offers video recordings of selected dialogues with optional German subtitles, and

MY DGS – annotated (ling.meine-dgs.de) – a research portal in English and German for the international scientific community, which offers an annotated corpus of DGS for linguistic research.

These resources were released and continue to be improved and extended during the life time of the DGS-Korpus project. With release 2 in September 2019 the Public DGS Corpus contained a subset of 50 hours of

the DGS Corpus, release 3² (Hanke et al., 2020) followed in July 2020, and release 4 is in preparation.

The *MY DGS – annotated* web interface provides a list of transcripts, an index of sign types, and an index of keywords that allow the Public DGS Corpus to be accessed by topic. Each transcript consists of its video recording with time-aligned annotations and translations. All of these pages are searchable through built-in browser-based text search, but it is not possible to perform more advanced searches. The main purpose of *MY DGS – annotated* is to offer an interesting subset of the DGS Corpus data that can be used for various research options. Online transcript views and KWIC concordances of the tokens in the types list³ entries make it possible for a researcher to browse the data before deciding to download videos and annotation files.

Although we will continue to improve the usage options of *MY DGS – annotated*, for example by introducing a text search function for translations, we were aware that this cannot replace a corpus search tool that allows for combined searches also including metadata. Therefore, we have created a third freely available option:

MY DGS – ANNIS (annis.meine-dgs.de) – a second additional research portal which allows complex queries of the annotated Public DGS Corpus⁴, searching either in English or German annotations or both.

¹About 560 hours of near-natural signing were collected from 330 participants 2010–2012; 376 hours of videos were translated into German, about 113 hours time-aligned; 92.5 hours of aligned elicitation tasks were lemmatized resulting in nearly 615,000 tokens. The total number of tokens of the DGS corpus is more than 668,000, the Public DGS Corpus has more than 374,800 tokens. For references to all relevant publications please refer to the data statement of the Public DGS Corpus (Schulder et al., 2021).

²<https://doi.org/10.25592/dgs.corpus-3.0>

³https://www.sign-lang.uni-hamburg.de/meinedgs/ling/types_en.html

⁴Jokes are not available in *MY DGS – ANNIS* because they have no annotations and therefore cannot be searched. They are available in *MY DGS – annotated* where all content of the Public DGS Corpus can be accessed in its entirety.

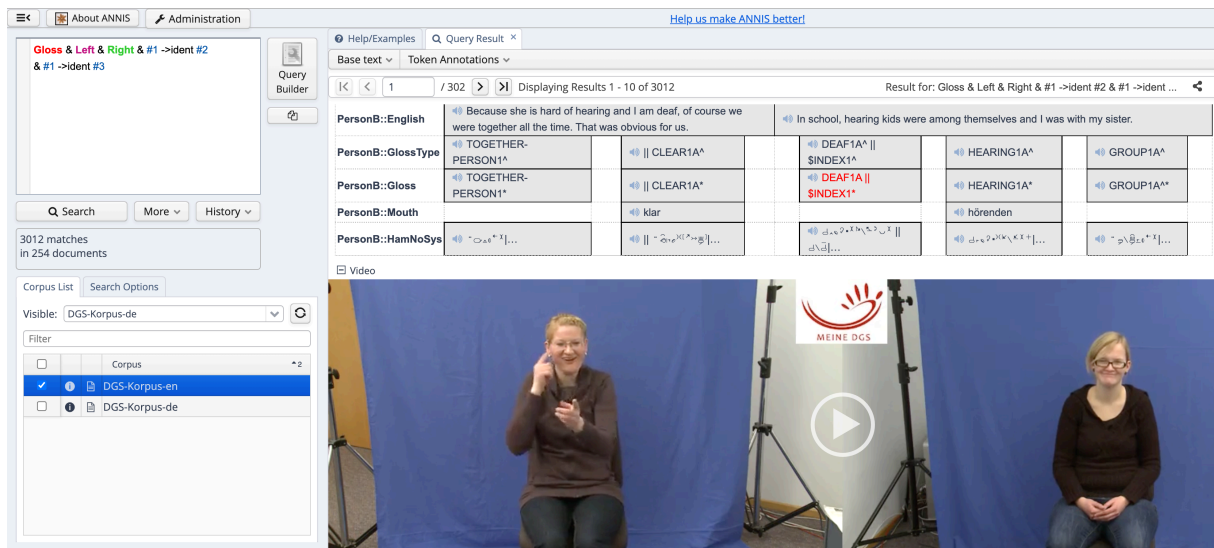


Figure 1: ANNIS display showing query results for glosses involving articulation of different signs with each hand (Query 10).

ANNIS (Krause and Zeldes, 2016) is a web browser-based search and visualization architecture for complex multi-layer linguistic corpora with diverse types of annotation. It allows the display of a corpus with multiple annotation tiers and optional linked audio or video files, as shown in Figure 1. In *MY DGS – ANNIS* the videos with the frontal perspective of the participants are displayed side by side as in the “Video AB” file in *MY DGS – annotated*.⁵ Queries can be carried out using the ANNIS Query Language (AQL), which we introduce in Section 3, and the query results shown in Figure 1 are discussed in Section 4.1.

What makes *MY DGS – ANNIS* attractive is the fact that DGS data can now be searched online in a user interface that is already known to researchers working with corpora and that allows queries

- over more than one transcript,
- over more than one annotation tier,
- combining annotations with metadata (13 regions, 4 age groups, participant’s code and gender),
- for form features (using HamNoSys notation of types’ forms),
- with customized range of left and right neighbours (tokens), and
- with specified distance between annotations in the same tier.

ANNIS is not meant to be another content-related access point. Users will need to be somewhat familiar

⁵In *MY DGS – annotated* there is an additional “Video Total” perspective showing participants from their side with the moderator between them.

with the Public DGS Corpus content, its metadata, and the annotation conventions used.

In the following sections we give some background information on ANNIS (Section 2) and AQL (Section 3), followed by a description of how we transformed the data (Section 4). We then explain in more detail the advantages of exploring the Public DGS Corpus with ANNIS, and make suggestions by presenting some research use cases (Section 5).

2. ANNIS

ANNIS (Krause and Zeldes, 2016) is a browser-based tool developed at Humboldt-Universität zu Berlin, Georgetown University and Potsdam University, which allows complex queries to be carried out on corpora with multiple annotation tiers. The data may be structured as required by any particular corpus, and there are no constraints or theory-based requirements. Query results can be visualized in a number of different styles, and linked audio and/or video files can also be displayed. ANNIS is a Java software programme which can be run on a server so that free access is available to all via a web browser (ANNIS Server), or as a standalone version on an individual machine without outside access (ANNIS Desktop)⁶.

Many corpora are already available online through ANNIS, from a very wide variety of domains, with many different annotations; large collections are available for example from korpling.german.hu-berlin.de/annis3 and corpling.uis.georgetown.edu/annis. The majority of these corpora are text-based, but there are also some containing video, including the Berlin Map Task corpus BeMaTac (Sauer and Lüdeling, 2016).

⁶<https://corpus-tools.org/annis/download.html>

3. ANNIS Query Language

The ANNIS Query Language (AQL) is based on the concept of searching for annotation attributes and relations between them. There are a number of search operators which can be combined to form complex queries. The query operators allow searches involving:

- text, including regular expressions using the Rust library regex format
- annotations
- the hierarchical structure of the tiers
- pointing relations between nodes
- distances between nodes in the same tier
- corpus metadata

Below, we will introduce the query operators most relevant for the examples given in this paper; a full guide to AQL is available online⁷. All of the explanatory examples given in Sections 2 and 4 refer to the English version of the corpus, and each use case example in Section 5 specifies whether it refers to the English or German version of the corpus.

3.1. Annotation Text Queries

Any annotations which contain text can be searched either as exact strings using quotation marks or as regular expressions using forward slashes (/). Both may also be negated using the operator "!". For example, in Query 1 we search for all glosses which exactly match the string "TRAIN2A", in Query 2 for all glosses beginning with the string "TRAIN" and in Query 3 for all English translations which do not contain the string "train" anywhere in them.

- (1) Gloss="TRAIN2A"
- (2) Gloss=/TRAIN.*/
- (3) English!=/*.train.*/

The operators and (&) and or (|) can be used to combine any number of search elements within queries.

3.2. Queries with the Distance Operator

The AQL dot (.) operator can be used to search for preceding or following tokens within the same tier. In corpora such as ours where there are multiple tiers, the tier on which tokens are consecutive can be specified. In Query 4 we first specify two search elements, one a gloss starting with TRAIN and the other a gloss containing arbitrary text. We then specify that the first element (referenced as #1) should directly precede the second element (referenced as #2) in the Gloss tier. It is possible to use a shortcut for this query by placing the distance operator between the two search elements, as

shown in Query 5. If desired, we can also specify a distance, and search for example for two glosses starting with TRAIN which occur between one and 5 tokens apart, shown in Query 6.

- (4) Gloss=/TRAIN.*/ & Gloss=/.*/ & #1.Gloss #2
- (5) Gloss=/TRAIN.*/ .Gloss Gloss
- (6) Gloss=/TRAIN.*/ .Gloss,1,5 Gloss=/TRAIN.*/

3.3. Query Links between Tiers

It is also possible within ANNIS for there to be links between tokens from different tiers, and AQL queries can use these links. The links are specified using the AQL operator "->" followed by the name of the link. In *MY DGS – ANNIS* we have created an "ident" link which links tokens belonging to the same participant. Query 7 combines Queries 2 and 3 and searches for a gloss starting with TRAIN which has an "ident" link to an English translation which does not contain the word "train". Query 8 uses a shortcut to express the same query. We explain in Section 4.2 how we use links in *MY DGS – ANNIS* and why they are important.

- (7) Gloss=/TRAIN.*/ & English!=/*.train.*/ & #1 ->ident #2
- (8) Gloss=/TRAIN.*/ ->ident English!=/*.train.*/

3.4. Metadata Queries

Metadata can be included in queries using the AQL "@*" operator. Query 9 will return results for glosses starting with TRAIN only from participants recorded in Schleswig-Holstein (SH).

- (9) Gloss=/TRAIN.*/ @* RegionCode="SH"

Further explanations and examples of these queries with *MY DGS – ANNIS* are provided in the following sections.

4. Transforming the Public DGS Corpus Data for ANNIS

In order to convert the DGS Corpus data into the ANNIS format, we used Pepper, which is a software platform that allows linguistic data to be converted from one format to another (Zipser and Romary, 2010).⁸ Pepper uses the interchange format Salt⁹ as an abstract theory-independent interchange format, so we wrote a Pepper module to transform the DGS Corpus data into the Salt format, which can then be output as ANNIS data.

4.1. Annotation Tiers

The DGS Corpus uses a type hierarchy and double glossing (Konrad et al., 2020), where types and subtypes are linked to each other by a parent-child relation. Individual gloss tokens in the annotations may refer either to a type or a subtype.

⁷<https://korpling.github.io/ANNIS/4.6/user-guide/aql>

⁸<https://corpus-tools.org/pepper>

⁹<https://corpus-tools.org/salt>

We created a separate ANNIS corpus for English and for German, each of which contains the following annotation tiers for each participant¹⁰:

Gloss – subtypes or types used to lemmatize tokens (in English or German)

GlossType – parent types (in English or German)

HamNoSys – type citation forms in HamNoSys (phonetic notation system of signs (Hanke, 2004))

Mouth – mouthings (referring to German words and therefore only in German in both ANNIS DGS corpora) or mouth gestures (coded simply as “[MG]”)

Translation – for each utterance (in English or German)

Right and Left – tokens which note whether a sign was carried out with the right or left hand. These tiers are not displayed in query results but are used to perform queries referring to a single hand, as described below.

Signs in DGS may be one- or two-handed, and there are also complex sign constructions where each hand articulates a different sign. Rather than providing one gloss tier for each hand, we have a single tier for all the glosses for one participant, so when complex signs occur, we combine the two glosses into a single token, with the two glosses separated by “||”. This allows us to perform AQL queries involving distance between tokens, where we include all of the tokens belonging to a participant, regardless of which hand they used. We also have a tier containing tokens which note whether a sign was carried out with the right or left hand. In this way, we can search for example for all tokens signed with the left hand, while still allowing all sign tokens from one participant to be present in the same tier.

Query 10 uses the links between the Gloss tiers and the “Right” and “Left” tiers to find all occasions in which a participant has articulated a different sign with each hand.

- (10) Gloss & Left & Right & #1 ->ident #2
& #1 ->ident #3

The query results are shown in Figure 1. In this case we have selected the English version of the corpus, and are viewing the video of the first of the 3012 results returned for Query 10. We can see the annotation tiers for the current signer (PersonB): English, GlossType, Gloss, Mouth and HamNoSys. The tiers for PersonA are not visible because they are not currently signing. The token which corresponds to the search just carried out is highlighted in red (in this case a (double) token

¹⁰In addition, there is a translation tier for the moderators’ utterances when they say something relevant to the general flow of conversation. There are however no Gloss, GlossType or Mouth annotations for the moderators.

DEAF1A || \$INDEX1* in the Gloss tier) and some context is shown on either side. We can also play video by clicking on a token from any tier to play just a short segment, or by using the play button to play for as long as desired.

Once a query has been performed, it is also possible within ANNIS to see a frequency analysis of the results, as described in Section 5.1 and shown in Figure 3.

4.2. Links between Annotation Tiers

Because almost every transcript of the DGS Corpus involves two participants, we cannot rely on the timeline when running AQL queries which involve more than one tier. When both participants sign simultaneously, annotations for one participant will overlap in time with annotations for their interlocutor. We therefore created “ident” links within the ANNIS corpus between tokens pertaining to a single participant in different tiers which temporally overlap, so that queries involving more than one tier will only return results where the tiers relate to the same participant (see Section 3.3).

The need for “ident” links between tiers is illustrated by the following two queries which specify an English translation containing the word “not” and a gloss which denotes a headshake¹¹. Query 11 uses temporal alignment to search for translations which include tokens of the gloss (AQL operator “_i_”), whereas Query 12 uses the links between participant tiers (our implemented link operator “->ident”).

- (11) Gloss=^\$GEST-NM-SHAKE-HEAD.*/
& English =/.* not .*/ & #2 _i_ #1
(12) Gloss=^\$GEST-NM-SHAKE-HEAD.*/
& English =/.* not .*/ & #1 ->ident #2

Query 11 returns 104 results including some where the translation temporally coincides with the the gloss, but the translation belongs to one participant and the gloss to the other. An example is shown in Figure 2, where the translation “No that’s not right. You’re right” (highlighted in purple) belongs to PersonA while the gloss \$GEST-NM-SHAKE-HEAD1^ (highlighted in red) belongs to PersonB. Query 12 returns 84 results, where the translation temporally includes the target gloss token, and additionally the token and the translation belong to the same participant. If we had not included the participant links, the query results for this case would therefore have included almost 20% of false results.

4.3. Metadata

Each corpus also contains searchable metadata pertaining to the transcript (recording region and date, transcript task) and the participants (age group, gender). As described in Section 3.4, AQL queries can also include any of the corpus metadata.

¹¹A nonmanual gesture identifying utterances without relevant manual activity but only headshaking to express negation.

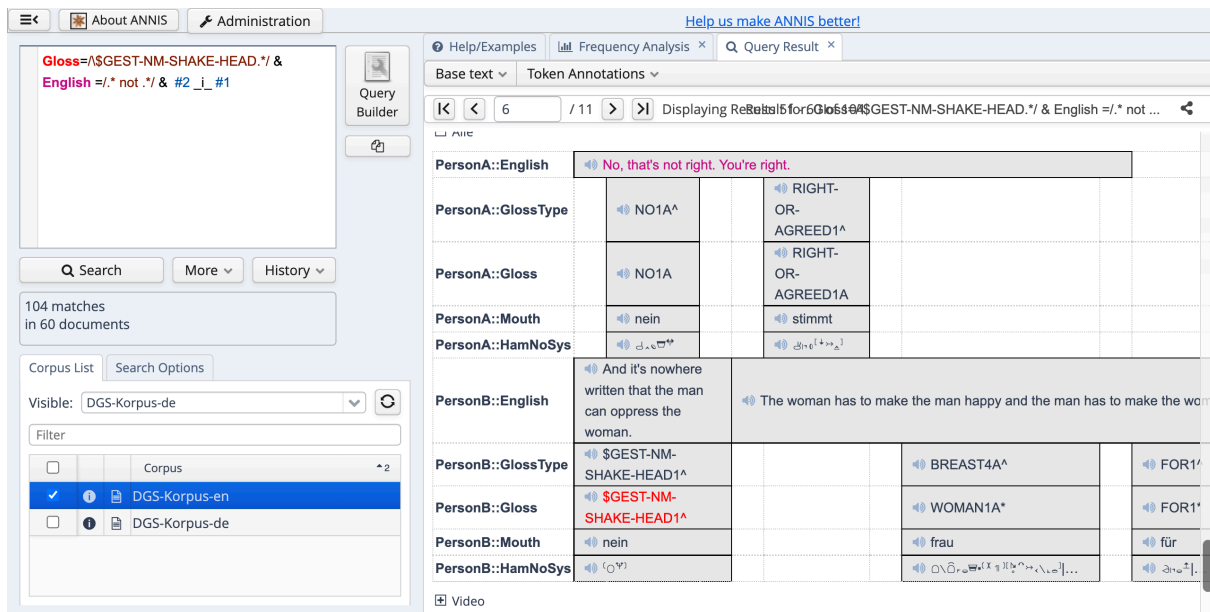


Figure 2: ANNIS display showing result of AQL query which uses temporal overlap and finds a translation from PersonA overlapping with a Gloss from PersonB (Query 11).

5. Research Use Cases with ANNIS

As described in Sections 3 and 4, ANNIS allows queries to be made over and within the different annotation tiers and metadata. The following sections contain some examples of research queries.

5.1. Lexical Negation in DGS

One could be interested in how negation is expressed in DGS with a focus on manual (lexical) signs. To identify these signs (or rather the glosses which represent them) one could search the German version of the corpus for German negation words like “nicht”, “nein”, or “kein” in the German translations and filter out relevant glosses within these sequences. For example, the AQL statement in Query 13 searches for “kein”, “keine”, “keines”, “keiner”, “keinem”, and “keinen” in German translations and all glosses from the same participant which occur during the time covered by the translation:

- (13) `Deutsch =/.* kein(e[srnm])? .* /
& Gloss & #2 ->ident #1`

Within ANNIS, the glosses included in these utterances can be displayed using the “Frequency Analysis” tool, which displays a gloss list sorted by frequency of tokens. This frequency analysis can be saved as a CSV file and further processed in a spreadsheet. Singling out unique gloss names shows that in the Public DGS Corpus, several gloss names appear that are highly relevant for expressing negation, such as KEIN (NONE), NEIN (NO), NICHT (NOT), NICHTS (NOTHING), NIEMALS (NEVER), NIEMAND (NOBODY), NIRGENDWO (NOWHERE), but also combinations with -NICHT (NOT-), KEIN-, KEINE- (NO-) and some others like the previously mentioned ges-

ture \$GEST-NM-KOPFSCHÜTTELN (\$GEST-NM-SHAKE-HEAD). These glosses can be used for further queries like the one shown in Query 14:

- (14) `Gloss=/. *KEIN.* / ->ident Mundbild`

The query returns 1128 matches for tokens of both participants lemmatized by glosses that contain KEIN, highlighting the matched gloss and coarticulated mouthing in the ANNIS query results. The frequency analysis in ANNIS reports 227 different gloss-mouthing combinations. Fifty percent of the tokens are accompanied by a mouth gesture rather than a mouthing. In 41% the annotated mouthing starts with “kein”, and in some cases the mouthing is extended (e.g. “keine Ahnung” (no idea)) or simultaneously expresses a further meaning component (“Erfahrung”; cf. Ebbinghaus (1998, 596) giving similar examples of this kind of “syntagmatic dimension” which the coarticulation of manual signs and mouthed words can take).

Knowing that in some sign languages negation is expressed by a morphemic pattern showing a characteristic alpha-movement, in the terminology of Zeshan (2006, 49-54) “irregular negatives”, one could try to find these forms by searching for mouthings that contain at least two words of which the second is “nicht”, for example “kann nicht”, which are coarticulated with a manual sign that is deviant from the citation form. Tokens with form deviation, which in the case of alpha negation is a different movement pattern, are singled out in the Public DGS Corpus by an asterisk (*) at the end of the gloss e.g. KANN1*. The AQL statement in Query 15 returns 925 matches resulting in a frequency list of 347 sign-mouthing combinations like KANN1*/kann nicht (124 tokens) or

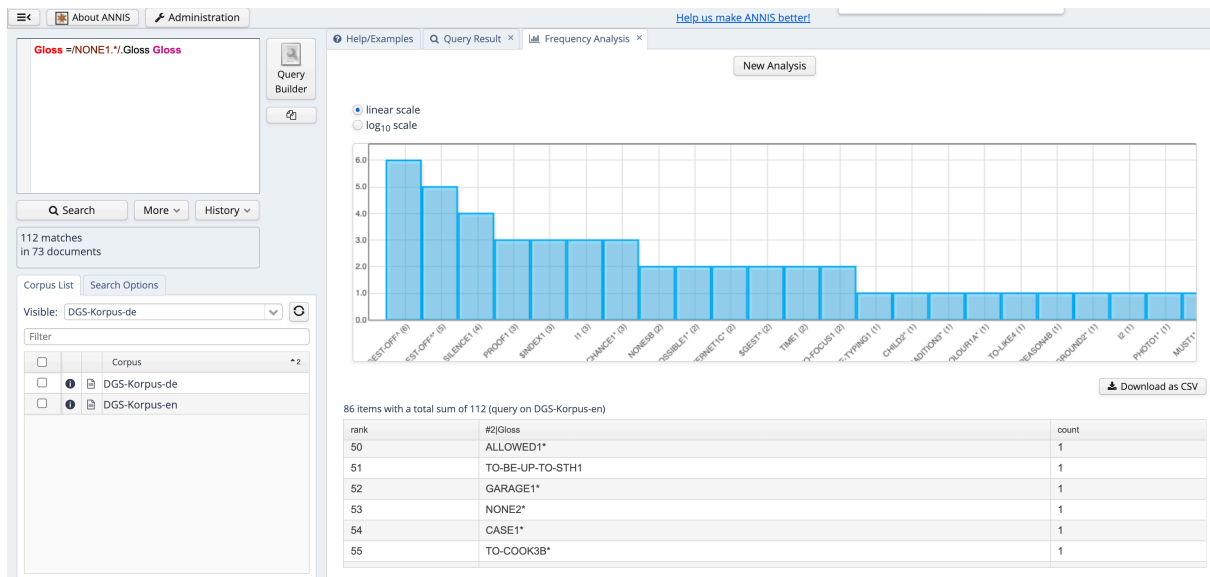


Figure 3: ANNIS display of frequency analysis for AQL query searching for Gloss tokens which follow a Gloss token NONE1 (Query 16)

BRAUCHEN1*/braucht|en nicht (41 tokens).¹²

(15) `Mundbild=/.*[a-z] nicht.* / & Gloss=/.*/ & #2 ->ident #1`

With *MY DGS – ANNIS* we can also test a hypothesis made by Papaspyrou et al. (2008, 179). The authors state that NONE1¹³ can only refer to nouns. Since the Public DGS Corpus is not part-of-speech tagged, a straightforward query searching for NONE1 tokens followed by a noun can not be run. However, we can search the English version of the corpus for the right-hand neighbours of NONE1 and have a closer look at the results. The AQL statement in Query 16 returns 112 matches.

(16) `Gloss =/NONE1*/.Gloss Gloss`

Figure 3 shows the frequency analysis of the matches. Going through the frequency list of the right neighbour glosses, one finds glosses like ALLOWED1, CAN2A, TO-LIKE4, MUST1, GOOD1, RIGHT-OR-CORRECT1B, NONE2, and TO-COOK3B. Each of these combinations of NONE1 followed by one of these tokens are included in the same translation tag belonging to the same utterance. With a refined search like the one shown in Query 17 one can analyse the tokens in question.

(17) `Gloss=/(NONE1*/.Gloss
Gloss=/(ALLOWED|CAN|TO-LIKE).*/`

Since the examples thus found contain a number of words whose part of speech is not noun, this suggests that the hypothesis should be modified.

¹²For a more comprehensive description of how negation is annotated in the DGS Corpus see Loos and Konrad (2022).

¹³https://www.sign-lang.uni-hamburg.de/meinedgs/types/type16242_en.html

5.2. Metaphorical Use of Signs

As the type forms in the Public DGS Corpus are notated in HamNoSys, one can search for form features and access all the tokens that are matched directly to that type or to one of its subtypes. To analyse the use of the brain = cognition metaphor the AQL statement in Query 18 on the English version of the corpus returns all tokens whose type has a location at the forehead region (as specified by the HamNoSys character ρ):

(18) `GlossType & HamNoSys=/.*ρ.* / &
Gloss & #3 ->ident #1 & #3 ->ident #2`

The frequency list generated from this query contains over 1000 entries. Normalizing the list in a spreadsheet and sorting by type gloss reveals more than 3,500 tokens of four lexical or phonological type variants all glossed by TO-KNOW-OR-KNOWLEDGE, 148 tokens of the type TO-COMPREHEND1¹⁴, and 10 tokens of types glossed EXPERT. But even if the type name seems to indicate a non-metaphorical use like BRAIN, one has to look for the subtypes' gloss names as they indicate conventionalized uses of the sign like MENTALLY2¹⁵, a subtype of BRAIN1A with repeated movement. Interested in how metaphorical uses of signs vary between age groups, one can search for a type name like EXPERT including the metadata AgeGroup and run a frequency analysis. Of course, this could also be done for region or even for signs of a single participant as they are coded by an anonymized shortname.

¹⁴https://www.sign-lang.uni-hamburg.de/meinedgs/types/type15301_en.html

¹⁵https://www.sign-lang.uni-hamburg.de/meinedgs/types/type13914_en.html#type26535

6. Conclusion

We presented *MY DGS – ANNIS*, a new portal which complements the existing portals available for the Public DGS Corpus by providing a freely accessible web interface which allows researchers to directly search the corpus online without the need to register, download data, or install new programs. We provide access for corpus-based research that allows complex searches to be made across the different annotation tiers and metadata information available in the Public DGS Corpus. Since the ANNIS interface is already familiar to corpus researchers, we hope that *MY DGS – ANNIS* will stimulate corpus-based research in DGS, and encourage crosslinguistic studies.

Some knowledge of the ANNIS Query Language and the DGS Corpus annotations is necessary to interact with *MY DGS – ANNIS*. There is detailed online documentation for the ANNIS software interface and query language¹⁶, and in addition to the simple queries automatically generated for our corpora by the ANNIS software, we will provide a number of more complex example queries in the Help/Examples section of the interface. These will illustrate the use of AQL operators with the various annotation tiers, and researchers can then use these examples as a basis to search for the information in which they are interested.

7. Acknowledgements

This publication has been produced in the context of the joint research funding of the German Federal Government and Federal States in the Academies' Programme, with funding from the Federal Ministry of Education and Research and the Free and Hanseatic City of Hamburg. The Academies' Programme is coordinated by the Union of the Academies of Sciences and Humanities.

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¹⁶<https://korpling.github.io/ANNIS/4.6/user-guide/interface/index.html>