Representing Multimodality in Terminology Resources

Federica Vezzani
Department of Linguistic and Literary Studies, University of Padua
Via Elisabetta Vendramini, 13, 35137 Padova, Italy
federica.vezzani@unipd.it

Abstract

This paper addresses the lack of a multimodal approach to specialized knowledge representation in terminology work. In particular, we introduce a new Multimodal Terminological Metamodel (MTM) for the design of terminology resources which introduces an explicit modality layer, enabling uniform modelling of different language modalities within domain-specific and concept-oriented resources. The metamodel is formalised via an entity-relationship schema and a systematic contrast with the baseline framework – the Terminological Markup Framework (TMF; ISO-16642 (2017)) – to specify revised entities, relations, and cardinalities. As case study, we instantiate the MTM for the signed modality by defining a minimal data-category module with level-placement constraints, and we provide a lightweight, TBX-inspired XML serialisation that packages modality-specific terminological data in a consistent structure. Together, these components deliver a reproducible specification for designing and exchanging multimodal terminology resources.

Keywords: terminology work, terminology science, multimodality, language modalities

1. Introduction

Terminology work deals with building domain-specific and concept-oriented resources which collect “forms of [verbal] representation” (Picht, 2011) of specialized knowledge (ISO-1087, 2019). Historically, the field has accessed these representations through a specific language modality – namely, the written modality – since terminological analysis is mainly based on the study of terms, as linguistic designations of specialized concepts, as they occur in expert-authored documents (Thoiron and Béjoint, 2010).

However, knowledge can be verbalized and represented across multiple language modalities. According to ISO-21636-1 (2024), a language modality is “a language variety specific to a given medium or channel used for communication by the speaker”. In addition to the written modality, the international standard (aimed at providing a comprehensive framework for language varieties) recognizes spoken, signed, whistled, drummed, and haptic modalities, each of which may – individually or in combination – characterize a language-use event.

Each of these modalities can serve as the basic modality for specific individual languages. ISO-639 (2023) specifies that the basic modality is the language modality in which an individual language is most commonly used, in which it develops, and from which any other modalities of that language (if any) are derived. For most natural languages, the basic modality is spoken; the written modality is derived from it (Chafe and Tannen, 1987), in the sense that writing represents properties of oral language use (including non-alphabetic systems). For individual sign languages, the basic modality is signed; when these languages are written or otherwise graphically represented, the written modality is derived from the signed modality – that is, it represents properties of visual-spatial language use (Capirci et al., 2022).

This systemic view of language modalities highlights a representational space that extends beyond writing. Yet these insights have not been operationalized in terminology theory or resource-design practice, leaving a structural gap in the multimodal representation of specialized knowledge.[1]

Against this backdrop, this paper aims at proposing a framework for the design and implementation of multimodal terminology resources. In particular, our contributions are twofold:

1. We introduce a Multimodal Terminological Metamodel (MTM) that extends the Terminological Markup Framework (TMF) (ISO-16642, 2017) – to our knowledge, the only existing metamodel specifically developed for the design of terminology resources – by adding an explicit modality layer that enables multiple forms of knowledge representation to be mod-

[1] To our knowledge, the only explicit call for integrating non-textual material within concept-oriented resources in terminology studies has mainly come from the LexiCon research group: `http://lexicon.ugr.es`. Their work highlights the value of adding images for certain objects – especially in environmental domains – showing that combining textual and visual information supports understanding (León-Araúz et al., 2013; Cabezas-García and Reimerink, 2022). However, these proposals primarily address the graphical depiction of entities or processes (e.g., an image of a beech forest), rather than the representation of designations when these are conveyed through visual-gestural acts (e.g., signs for sign languages) and should therefore be modelled as first-class designations within a terminology resource.

Proceedings of the Fifteenth Language Resources and Evaluation Conference (LREC 2026), pages 1320–1330
11–16 May 2026. ©ELRA Language Resources Association (ELRA), 2026

eled uniformly within terminology resources.

2. We present a case study focusing on the signed modality, providing a compact data model and a generic-XML serialization inspired by the TermBase eXchange (TBX) format (ISO-30042, 2019), thereby illustrating how the MTM can be instantiated for visuo-gestural languages.

The present contribution is primarily conceptual in nature: rather than evaluating an implemented system, we propose a formally specified extension of an existing ISO-based metamodel. The adequacy of the proposal is therefore assessed in terms of structural coherence, compatibility with TMF principles, and its capacity to model multimodal designations without disrupting established hierarchies.

The remainder of the paper is structured as follows. Section 2 introduces the MTM conceptualization via an entity-relationship schema and compares it with the state-of-the-art TMF metamodel. Section 3 specifies a minimal set of data categories for representing the signed modality, and Section 4 illustrates the corresponding XML serialization. Drawing on this specific case study, Section 5 surveys related work on modeling linguistic data for sign language resources. Finally, Section 6 presents concluding remarks and outlines future directions.

2. Multimodal Terminological Metamodel: Conceptualization

We conceptualize the Multimodal Terminological Metamodel (MTM) by taking the Terminological Markup Framework (TMF) (ISO-16642, 2017) as the baseline and extending it. TMF specification was designed to ensure interoperability across terminological applications and adopts a nested hierarchical structure (Drewer and Schmitz, 2017; Vezzani and Di Nunzio, 2020; Ralli and Tamás, 2025). Its core principle is that a single concept – represented by exactly one concept entry – can be verbalized in n[2] languages, each captured in a distinct language section. For each language, there may be n terms – each in its own term section – that designate the concept at the top of the hierarchy. In practical terms, TMF distinguishes three levels, which we briefly recall to frame our extension:

- The concept level provides administrative and language-independent information, such as the subject field and sub-subject field to which the concept belongs.
- The language level includes language-dependent information, such as the natural-language definition of the concept, together with sources and external cross-references.
- The term level records the term used to designate the concept, together with its linguistic properties, such as part of speech, gender, number, or usage notes.

[2] Here n denotes an arbitrary number at each level and does not imply numerical equivalence across levels.

Building the MTM involves two essential steps. First, we add a modality layer to explicitly account for multimodal communication channels. Second, we redefine "term" as "designation", generalizing the notion to include both linguistic and non-linguistic forms of representation of concepts. These two points are detailed in Section 2.2.

To present the new metamodel alongside the original TMF, we adopt the entity-relationship (ER) model. Introduced by Chen (1976), the ER model is a widely used conceptual tool for designing relational databases and is well suited to clearly expressing the structure of a resource. It enables a precise description of the objects of interest via an ER schema whose basic elements are:

1. Entities, representing objects that share common properties.
2. Relationships, defining the logical link between those entities.
3. Cardinalities, indicating the minimum and maximum number of objects that can participate in each relationship.

Figure 1 compares the ER schema of the TMF metamodel with the ER schema of the proposed MTM. In ER notation, entities appear as rectangles and relationships as diamonds. Cardinalities are shown on the segments connecting entities and relationships; each pair specifies the minimum and maximum number of instances of the adjacent entity that may be involved in that relationship. This visual comparison clarifies where the MTM follows the state-of-the-art TMF and where it extends it.

The next sections proceed in two steps. First, in section 2.1, we describe the ER schema of the existing TMF metamodel, following the schema presented in Vezzani et al. (2025). Then, in section 2.2, we introduce the MTM in a strictly comparable manner, highlighting the areas where the model is extended (colored elements at the right of Figure 1).

2.1. TMF: ER schema

2.1.1. TMF Entities – Definition

For the TMF metamodel, the entities in the ER schema are defined as follows:

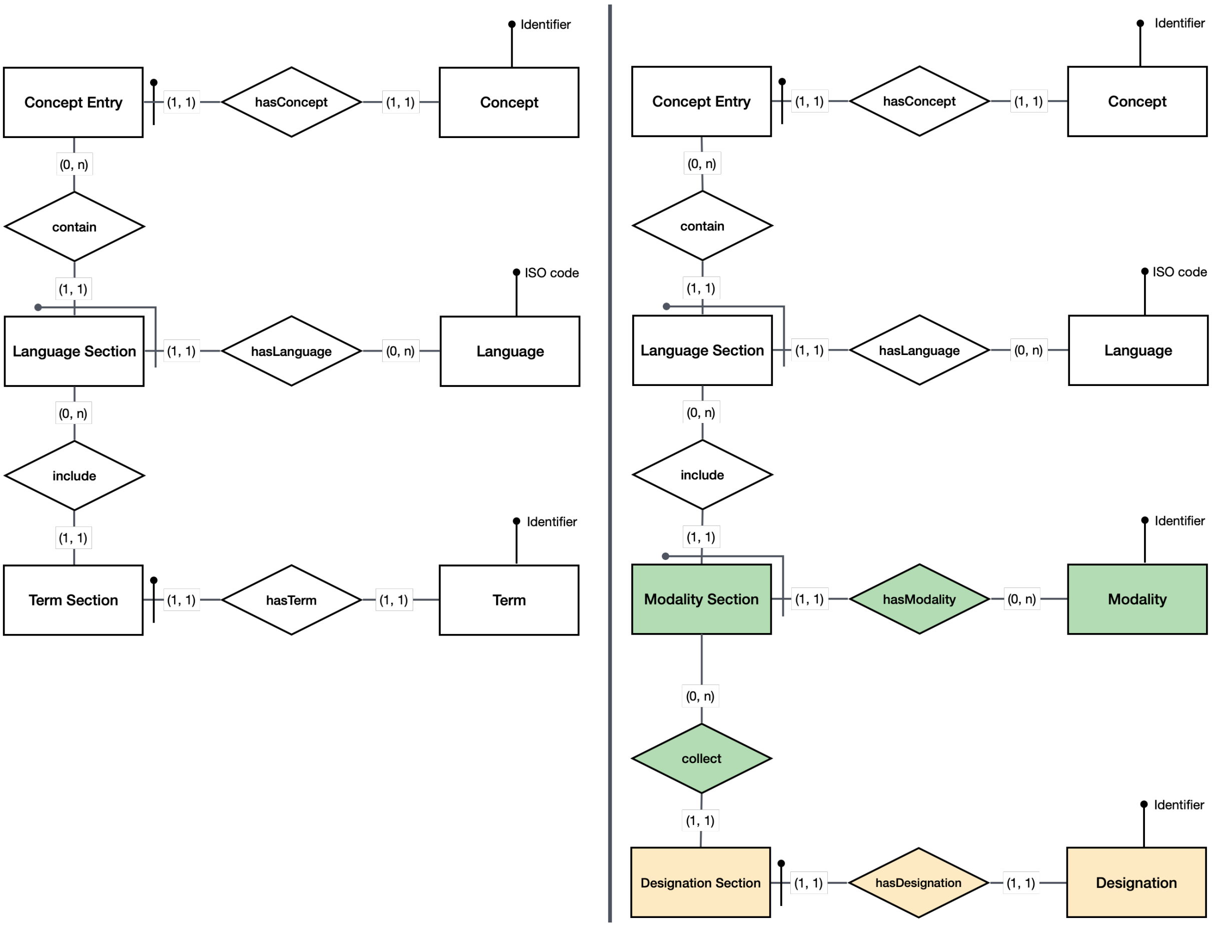

Figure 1: Comparison between the ER schema of the original TMF metamodel (left) and the ER schema of the proposed MTM (right).

- "Concept Entry": "part of a terminological data collection which contains the terminological data related to one concept" (ISO-16642, 2017).

- "Language Section": "part of a terminological data collection containing information related to one language" (ISO-16642, 2017).

- "Term Section": "part of a language section containing information about a term" (ISO-16642, 2017).

- "Concept": "unit of knowledge created by a unique combination of characteristics" (ISO-1087, 2019).

- "Language": "system of sounds, characters, symbols used for communication" (ISO-1087, 2019).

- "Term": "designation that represents a general concept by linguistic means" (ISO-1087, 2019).

2.1.2. TMF Entities – Relationships and Cardinalities

Building on the definitions above, we now detail the relationships among TMF entities and their cardinalities. The ER schema of the original TMF (at the left of Figure 1) can be read as follows:

- The entity "Concept Entry" is associated with, and identified by, the related "Concept" through the relationship 'hasConcept', with cardinality (1, 1). A concept entry contains zero, one or more language sections instances (cardinality (0, n)).

- The entity "Language Section" is identified by the pair "Concept Entry" and "Language" through the relationships 'contain' and 'hasLanguage' (both with cardinality (1, 1)). A language section is associated with the "Term Section" entity and may include multiple term sections (cardinality (0, n)).

- The entity "Term Section" is identified by the "Term" itself via the relationship 'hasTerm' with cardinality (1, 1) and belongs to exactly one “Language Section” (cardinality (1, 1)).

- The entity “Concept” has its own identifier and must be associated with exactly one “Concept Entry” through the relationship ‘hasConcept’ (cardinality (1, 1)).
- The entity “Language”, identified by its ISO code, is associated with the entity “Language Section” through the relationships ‘hasLanguage’. In particular, one language can be used in any number of language sections (cardinality (0, n)).
- The entity “Term” is identified by its own identifier and must be associated with only one “Term Section" (cardinality (1, 1)).

To illustrate this structure with a simple example, consider a concept such as *cancer*. In TMF, this concept is represented by a single concept entry, which may contain, for instance, an English language section and a French language section. Within the English language section, different term sections may encode designations such as *cancer* and *carcinoma*, each treated as a term directly linked to that language, without any intermediate differentiation of communicative modality.

2.2. MTM: ER schema

2.2.1. MTM Entities – Definition

Building on the TMF schema, the MTM metamodel introduces two new entities – “Modality Section” and “Modality” – and replaces “Term Section” and “Term” with “Designation Section” and “Designation”, respectively. The entities are defined as follows (where no source is indicated, the definitions are provided by the authors):

- “Modality Section”: part of a language section containing information about a specific language modality.
- “Modality”: “certain medium or channel used for communication by the speaker” (ISO-21636-1, 2024).
- “Designation Section”: part of a modality section containing information about a specific designation which can be linguistic or non-linguistic.
- “Designation”: “representation of a concept by a sign which denotes it in a domain or subject” (ISO-1087, 2019).

These changes make the metamodel explicitly multimodal while preserving TMF’s hierarchical structure. “Modality Section” localizes modality-specific information within each language, and “Modality” supplies a clear, standardized characterization of the communicative channel. Replacing “Term” with “Designation” generalizes the representation to include both linguistic and non-linguistic forms of specialized knowledge representation, allowing multimodal resources to be described uniformly without altering the underlying structural hierarchy.

2.2.2. MTM Entities – Relationships and Cardinalities

Building on the definitions above, the ER schema of the MTM (right in Figure 1) can be read as follows:

- The entity “Concept Entry” remains unchanged with respect to TMF schema.
- The entity “Language Section” acts as a container for all the modality sections of a concept entry for a given language, as well as information pertaining to the concept in that language. This entity is identified by the pair “Concept Entry” and “Language” through the relationships ‘contain’ and ‘hasLanguage’ (both with cardinality (1, 1)). A language section is associated with the “Modality Section” entity and may include multiple modality sections (cardinality (0, n)).
- The entity “Modality Section” acts as a container for all the designation sections for a specific modality, within a given language and for a given concept.[3] This entity is identified by the pair “Modality” and “Language Section” through the relationships ‘include’ and ‘hasModality’ (both with cardinality (1, 1)). A modality section may include multiple designation sections (cardinality (0, n)).
- The entity “Designation Section”, contains exactly one designation and the information about that designation. In particular, it is identified by the “Designation” itself via the relationships ‘hasDesignation’ with cardinality (1, 1) and belongs to exactly one modality section (cardinality (1, 1)).
- The entity “Concept” remains unchanged with respect to TMF schema.
- The entity “Language” remains unchanged with respect to TMF schema.
- The entity “Modality” is identified by its own code and is associated with the entity “Modality

[3] If necessary, the information related to the basic modality can be expressed here by a property of this entity.

Section" through the relationships 'hasModality'. In particular, one modality can be used in any modality section (cardinality (0, n)).

- The entity "Designation" is identified by its own identifier and must be associated with only one designation section (cardinality (1, 1)).

Returning to the previous example, the same concept *cancer* in the MTM would still be represented by a single concept entry and a language section, for instance, for English; however, within that language section, separate modality sections could be introduced – for example, one for the written modality and one for the spoken modality. In the case of a sign language such as Auslan (the Australian Sign Language), the language section would contain a modality section for the signed modality (as basic modality), within which video-based designations are modeled explicitly. This additional layer makes the communicative channel structurally visible in the resource.

3. Data Categories Definition

As specified in ISO-16642 (2017), the development of Terminological Data Collections (TDCs) entails two abstraction levels. The first is the metamodel, previously outlined, which is independent of any particular implementation or software. The second is the data model level, which introduces data categories (DCs) – defined as "class of data items that are closely related from a formal or semantic point of view" (ISO-30042, 2019) – required to represent a given TDC. Typical data categories include /subject field/, /note/, /definition/, etc., conventionally indicated between forward slashes (/). For terminology work, Termweb[4] serves as the reference DC repository, offering a comprehensive inventory of DCs and their specifications.

The choice of DCs for a specific resource naturally depends on the project and its objectives. For instance, Termweb currently lists around 3,000 DCs spanning domains such as lexicography, terminology, translation, interpreting, and sign language. The purpose here is not to provide an exhaustive catalogue of DCs across language modalities,[5] but rather to illustrate, through selected examples, how they can be modeled within the MTM framework and how they are distributed across the MTM levels.

[4] https://datcatinfo.net

[5] In this regard, see, for example, Declerck (2022), described also in Section 5 , who proposes an ontology for sign language DCs, comprising 260 ontology elements grouped into five top-level classes (Sign Language Data Category): (1) ConstructedAction, (2) NotationsForSignLanguages, (3) Sign, (4) SignLanguage, and (5) SpokenLanguage.

As defined above, the MTM is sufficiently abstract and general to accommodate terminological data for any language modality. In what follows, we focus on a specific use case: the signed modality, as the basic modality of individual sign languages.

To this end, we examined, as an illustrative example, terminological data from the Medical Signbank for Auslan.[6] The resource is terminological in scope – targeting a specific domain (medical) – yet it was not developed within a strict terminology framework, i.e., outside the tradition of terminology science as a research field and standard terminology work. Figure 2 presents three entries from the Signbank corresponding to the concepts "abdomen",[7] "cancer",[8] and "mammogram".[9]

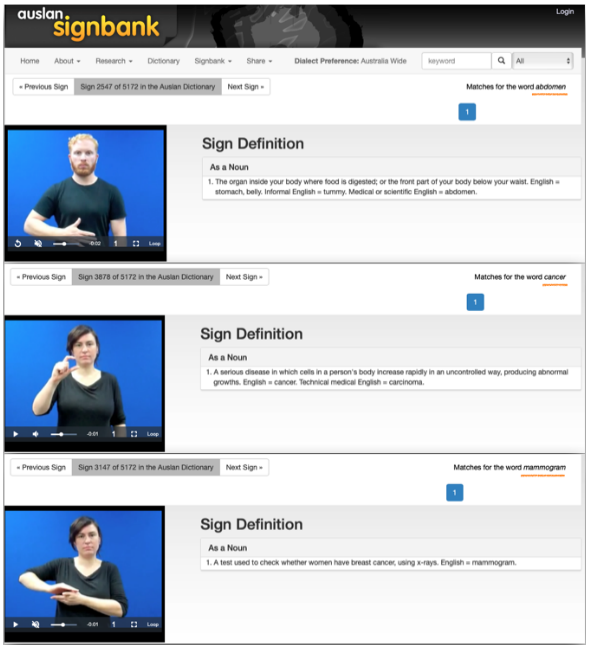

Figure 2: Example entries from the Medical Signbank for Auslan ("abdomen", "cancer", "mammogram").

For these three illustrative entries, the information provided includes: (1) video, (2) definition, (3) part of speech, (4) term (i.e., the written form of the English equivalent for the sign), and (5) where available, register variation – namely, the informal English term and the specialized English term.

To broaden the range of information types, we examined further domain-specific sign language re-

[6] The resource is accessible here: https://auslan.org.au/about/medicalsignbank/. For a more detailed description of the project, see Section 5.

[7] https://auslan.org.au/dictionary/words/abdomen-1.html

[8] https://auslan.org.au/dictionary/words/cancer-1.html

[9] https://auslan.org.au/dictionary/words/mammogram-1.html

DC name	PID	DC definition	Value(s)	MTM level(s)
/subject field/	http://datcatinfo.termweb.eu/datcat/DC-0489	A field of special knowledge.	free text/controlled picklist	concept level
/term/	http://datcatinfo.termweb.eu/datcat/DC-0508	A designation representing the concept of the terminological entry, generally by linguistic means	byte stream/free text	designation level
/video/	http://datcatinfo.termweb.eu/datcat/DC-0533	Recorded visual images used to represent or illustrate terminological or conceptual information.	byte stream	concept level, designation level
/definition/	http://datcatinfo.termweb.eu/datcat/DC-0168	A representation of a concept by an expression that describes it and differentiates it from related concepts.	byte stream/free text	modality level
/part of speech/	http://datcatinfo.termweb.eu/datcat/DC-0396	A category assigned to a word based on its grammatical and semantic properties.	controlled picklist	designation level
/register/	http://datcatinfo.termweb.eu/datcat/DC-1988	Classification indicating the relative level of language individually assigned to a lexeme or term or to a text type.	free text/controlled picklist	designation level

Table 1: Set of DCs with PIDs, definitions, allowed values, and the MTM levels.

sources (described in Section 5): (1) Sign'Maths,[10] which provides French Sign Language (LSF) signs for the mathematical domain; (2) the British Sign Language (BSL) Glossary,[11] covering STEM areas such as astronomy, biology, and chemistry; and (3) the Irish Sign Language (ISL) Glossary,[12] which offers signs for parliamentary terminology. These resources preserve the same core information classes and, in some cases – e.g., the last – add a video with the signed definition in ISL.

The above information classes are then mapped to their corresponding data categories in Termweb,[13] and for each category we specify constraints on its placement within the MTM – i.e., whether it should be attached at the concept, language, modality, or designation level.

Table 1 summarizes the resulting DC module and the associated level constraints. In particular:

- /subject field/ – Attached at the concept level, as it characterizes the specialized knowledge rather than a particular linguistic realization; implementable as free text or a controlled picklist.
- /term/ → /designation/ – In the MTM, /term/ should be superseded by /designation/ and placed at the designation level. Because /designation/ is not currently in Termweb, a new DC would be required. Values may be a byte stream (for video, images, or graphical sign-notation such as HamNoSys[14] (Hanke, 2004)) or a string (orthographic forms, glosses).
- /video/ – Attached at the concept level when the content is language-agnostic (e.g., a depiction of an object), and at the designation level when it records a linguistic verbalization of the concept. The same would go for a possible DC for /image/.
- /definition/ – Attached at the modality level so that a single concept can have definitions across different modalities; values may be string or byte stream.
- /part of speech/ – Attached at the designation level, since it is a morphosyntactic property of a specific designation in a given language/-modality; implemented as a picklist.
- /register/ – Treated as an attribute of /designation/ to capture register variation (e.g., specialized vs. non-specialized) at the designation level; implementable as a free text or a controlled picklist.

4. Serialization Example

In this section, we describe a generic XML-based serialization that instantiates the MTM introduced

[10] https://signmaths.univ-tlse3.fr/

[11] https://www.ssc.education.ed.ac.uk/BSL/

[12] https://www.oireachtas.ie/en/how-parliament-is-run/houses-of-the-oireachtas-service/equality-diversity-and-inclusion/isl-glossary/

[13] The mapping to Termweb data categories was conducted manually by consulting the Termweb repository and selecting the closest matching DCs based on their formal definitions and intended scope.

[14] https://www.sign-lang.uni-hamburg.de/dgs-korpus/files/inhalt_pdf/HamNoSys_2018.pdf

above and the DCs outlined previously. While not a TBX-based implementation, the example in Figure 3 is TBX-inspired in structure and intent (ISO-30042, 2019): it mirrors MTM's layered organization – concept → language → modality → designation – and shows how multimodal information can be packaged for exchange independently of any specific software stack.

At the top level, <termBank> stores metadata in <Header> and the terminological content in <text>. Each <conceptEntry> aggregates all information pertaining to a single concept; in the example, the concept is situated in the medical domain via <descrip type="subjectField">medicine</descrip>, and includes both textual and signed forms of knowledge representation.

The language dimension is introduced by <langSec>, while <modalSec> specifies the communicative channel – for example, written for English and signed for Auslan. The attribute basic="true" marks whether that modality is the basic one for that language. For example, the signed modality for Auslan (asf, which is the ISO-639 (2023) code for Australian Sign Language) is the language's basic modality, consistent with ISO-21636-1 (2024). Conversely, for written modalities in spoken-language contexts we explicitly mark basic="false", since for most natural languages the basic modality is spoken (ISO-639, 2023).

Designations are encapsulated by <designSec>, each containing exactly one <designation> and any associated descriptors.

In this structure, DCs are attached to the appropriate MTM level: for instance, /part of speech/ and /register/ appear with the designation, whereas /subject field/ remains at the concept level. Multimodality is accommodated by allowing different value types within designations: for written language, the designation is free text; for Auslan, it is referenced as video media (<mediaRef>) and can be complemented by a graphical transcription (e.g., HamNoSys – not represented in the schema).

Overall, the serialization shows how MTM's constraints translate into a concrete, implementation-agnostic XML that remains compatible with ISO-aligned DCs while making room for modality-specific evidence.

5. Related Work

As discussed in Section 1, terminology science and practice have so far largely overlooked the multimodal dimension in the representation, organization, and transfer of specialized knowledge. This is reflected in the lack of both theoretical studies and practical implementations addressing the modeling of different language modalities within terminology resources – a gap that motivates the present work.

By contrast, related areas such as lexicology and lexicography, which focus on general-language resources, have devoted substantial attention to the representation of the signed modality, which is here our case study. In the field of sign language lexicography, numerous projects have investigated how to document and describe signs and their linguistic properties (McKee and Vale, 2017). A recent survey by Sprugnoli (2025) provides a comprehensive overview of current online sign language dictionaries, analyzing their main characteristics and proposing a comparative framework for their description and evaluation.

Several initiatives have also explored multimodal resource development for general-language purposes. The LREC Workshop Series on the Representation and Processing of Sign Languages[15] – held regularly since 2004 – has become a major venue for presenting advances in sign language corpora, annotation tools, and modeling strategies for visuo-gestural linguistic data. These efforts, however, have primarily focused on corpus-based and lexicographic perspectives rather than on terminology-oriented frameworks.

From a modeling standpoint, this lack of multimodal consideration extends to both *de jure* standards – such as TMF (ISO-16642, 2017) and TBX (ISO-30042, 2019) – and to *de facto* standards in the Linguistic Linked Open Data (LLOD)[16] ecosystem, developed under the W3C community framework.[17] As noted by Gromann et al. (2024), sign languages have received very limited attention within LLOD. One of the few exceptions is Declerck (2022)'s preliminary ontology for representing constitutive elements of sign languages (available at `https://github.com/Declerck/sl-onto`). This model emerged from efforts to represent multimodal lexical data in the OntoLex-Lemon framework, with the goal of integrating sign language data into the LLOD cloud.

Beyond these modeling initiatives, a number of domain-specific projects and deriving resources – though not conceived within the field of terminology science – demonstrate the practical relevance of multimodal representation in specialized contexts.[18] Dalle et al. (2024) present the Sign'Maths resource, devoted to creating mathematical signs in LSF through a collaborative and iterative process. Their approach involves bilingual teachers and Deaf experts who jointly explore concepts, assess existing signs, and, when necessary, coin new ones that align with both mathematical definitions

[15] `https://www.sign-lang.uni-hamburg.de/lrec-ws/workshops.html`

[16] `https://linguistic-lod.org`

[17] `https://www.w3.org`

[18] Links to access the mentioned resources are already provided in Section 3.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<termBank xml:lang="en">
  <Header>
    <fileDesc>
      <sourceDesc>
        <p>Example of a generic XML-based serialization</p>
      </sourceDesc>
    </fileDesc>
  </Header>
  <text>
    <body>
      <conceptEntry id="fictious_id">
        <descrip type="subjectField">medicine</descrip>
        <media type="video">
          <mediaRef xlink:href="http://example.org/media/cancer-overview.mp4"/>
        </media>

        <langSec xml:lang="en">
          <modalSec modality="written" basic="false" dcRef_modality="ISO 21636-1:2024">
            <descrip type="definition">
              A disease caused by uncontrolled division of abnormal cells.
            </descrip>

            <designSec>
              <designation>cancer</designation>
              <descrip type="part of speech">noun</descrip>
            </designSec>

            <designSec>
              <designation>carcinoma</designation>
              <descrip type="part of speech">noun</descrip>
              <descrip type="register">specialised</descrip>
            </designSec>
          </modalSec>
        </langSec>

        <langSec xml:lang="asf">
          <modalSec modality="signed" basic="true" dcRef_modality="ISO 21636-1:2024">
            <descrip type="definition">
              <media type="video">
                <externalRef xlink:href="https://auslan.org.au/dictionary/words/cancer-1.html"/>
                <mediaRef xlink:href="http://example.org/media/auslan-cancer-definition.mp4"/>
              </media>
            </descrip>

            <designSec>
              <designation>
                <media type="video">
                  <externalRef xlink:href="https://auslan.org.au/dictionary/words/cancer-1.html"/>
                  <mediaRef xlink:href="http://example.org/media/auslan-cancer-sign.mp4"/>
                </media>
              </designation>
              <descrip type="part of speech">noun</descrip>
              <descrip type="register">specialised</descrip>
            </designSec>
          </modalSec>
        </langSec>
      </conceptEntry>
    </body>
  </text>
</termBank>
```

Figure 3: Generic XML-based serialization for *cancer*.

and phonological constraints of LSF.

Similarly, O'Neill et al. (2019) describe the British Sign Language Glossary Project, which develops specialized BSL vocabulary for scientific fields. The project follows a co-creation methodology involving Deaf scientists, interpreters, and educators. Its workflow includes identifying key scientific terms, analyzing conceptual content, evaluating existing signs, proposing and validating new signs, and publishing them online with definitions and videos. The process leverages visual iconicity, derivation, and composition to ensure clarity and usability in context.

Comparable participatory methodologies underpin the Medical Signbank project in Australia (Johnston and Napier, 2010), aimed at developing and standardizing Auslan medical terminology through collaboration among linguists, interpreters, healthcare professionals, and Deaf community members. The resource provides an interactive online dictionary featuring videos of medical terms and invites contributions from users to expand and refine the lexicon.

Finally, Grant and O'Leary (2023) describe the creation of an ISL Parliamentary Glossary, developed after the ISL Act, published in 2017, recognized ISL as an official language of Ireland. The project involved interpreters and Deaf students in coining approximately 80 new signs for parliamentary terminology, validated through extensive community consultation. The resulting glossary, published by the Houses of the Oireachtas, is designed as an evolving, open-access resource to enhance civic participation and reduce terminological gaps in political discourse.

Taken together, these initiatives illustrate the growing recognition of multimodality – particularly the signed modality – as an integral component of linguistic representation. However, they also reveal the lack of unified frameworks or standards for integrating such modalities within terminology resources, underscoring the need for a multimodal terminological metamodel such as the one proposed in this work.

From a practical perspective, the absence of a modality-aware metamodel means that terminology resources cannot systematically encode whether a designation is written, spoken, or signed, nor can they enforce consistent constraints across modalities. The MTM proposed here addresses this limitation by making modality an explicit structural dimension, thereby enabling interoperable modeling of multimodal data within standardized terminology workflows.

6. Conclusion and Future Work

This paper has proposed the Multimodal Terminological Metamodel (MTM), a conceptual and structural extension of the Terminological Markup Framework (TMF) that introduces an explicit modality layer to enable the uniform representation of multimodal designations within terminology resources. Through the case study on the signed modality, we have illustrated how the MTM can model visuo-gestural designations alongside written forms, thus bridging a long-standing gap in the representation of specialized knowledge.

Beyond its technical contribution, the MTM promotes a more modality-aware approach to terminology work by recognizing that specialized knowledge may be expressed and accessed through multiple communicative channels. Treating modality as an explicit structural dimension ensures that no form of designation is implicitly privileged at the modeling level. In this sense, the MTM contributes to a more inclusive and media-neutral terminology infrastructure. In this respect, it aligns with broader efforts to make language resources more accessible, equitable, and representative of diverse linguistic communities.

The introduction of an explicit modality layer also has implications for existing monomodal terminology resources, which currently represent the majority of implementations. Rather than merely adding structural depth, the MTM reconfigures the hierarchy to make the communicative channel an explicit modeling dimension. In monomodal contexts, this results in the systematic instantiation of a modality section even when only one modality is present. While this introduces an additional structural layer, it enhances conceptual clarity and future extensibility, enabling resources to accommodate multimodal data without redesign. From a technical standpoint, the impact on data size, storage, and processing depends on the number of modalities represented; the model scales proportionally to the granularity of representation chosen. Thus, the MTM does not aim to minimize structural complexity per se, but to render modality structurally visible in a controlled and interoperable manner, aligning terminology resources with contemporary multimodal communication practices.

Future work will focus on testing the MTM across additional domains and modalities, refining the associated data categories, and exploring interoperability with LOD frameworks to promote the integration of multimodal terminological data within the wider language resources ecosystem.

A further development concerns the formalization of a controlled vocabulary for modality values within terminology data category repositories. While ISO-21636-1 (2024) provides a conceptual classification of language modalities, its integration into DC repositories such as Termweb would benefit from a dedicated extension specifying modality as a standardized data category with a controlled set of permissible values. Such an extension would strengthen interoperability and ensure consistent modeling across implementations of the MTM.

Finally, future work will also include empirical validation through the implementation of MTM-compliant termbases and comparative analysis with alternative modeling strategies.

7. Acknowledgements

This work is partially supported by the HEREDITARY Project, as part of the European Union's Horizon Europe research and innovation programme under grant agreement No GA 101137074, and it is part of the initiatives of the Center for Studies in Computational Terminology (CENTRICO) of the University of Padua and in the research directions of the Italian Common Language Resources and Technology Infrastructure CLARIN-IT.

8. Bibliographical References

Melania Cabezas-García and Arianne Reimerink. 2022. Cultural context and multimodal knowledge representation: Seeing the forest for the trees. *Frontiers in Psychology*, 13:824932.

Olga Capirci, Chiara Bonsignori, and Alessio Di Renzo. 2022. Signed languages: A triangular semiotic dimension. *Frontiers in Psychology*, 12:802911.

Wallace Chafe and Deborah Tannen. 1987. The relation between written and spoken language. *Annual review of anthropology*, 16:383–407.

Peter Pin-Shan Chen. 1976. The entity-relationship model—toward a unified view of data. *ACM Trans. Database Syst.*, 1(1):9–36.

Juliette Dalle, Claire Dartyge, and Sophy Nattes. 2024. Enseignement des mathématiques en langue des signes française: création d'un corpus technique spécifique en lsf. *La main de Thôt: théories, enjeux et pratiques de la traduction*, (11):1–23.

Thierry Declerck. 2022. Towards a new ontology for sign languages. In *Proceedings of the Thirteenth Language Resources and Evaluation Conference*, pages 3977–3983, Marseille, France. European Language Resources Association.

Petra Drewer and Klaus-Dirk Schmitz. 2017. *Terminologiemanagement: Grundlagen-Methoden-Werkzeuge*. Springer-Verlag.

Ciara Grant and Caroline O'Leary. 2023. Irish sign language (isl) access in the houses of the oireachtas: The creation of an isl glossary of parliamentary terminology. In *Proceedings of the 6th WASLI Conference 2023: Shaping our world for a better future*, pages 74–99. World Association of Sign Language Interpreters (WASLI).

Dagmar Gromann, Elena-Simona Apostol, Christian Chiarcos, Marco Cremaschi, Jorge Gracia, Katerina Gkirtzou, Chaya Liebeskind, Liudmila Mockiene, Michael Rosner, Ineke Schuurman, et al. 2024. Multilinguality and llod: A survey across linguistic description levels. *Semantic Web*, 15(5):1915–1958.

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).

ISO-1087. 2019. Terminology work and terminology science – Vocabulary. Standard, International Organization for Standardization, Geneva, CH.

ISO-16642. 2017. Computer applications in terminology – Terminological markup framework. Standard, International Organization for Standardization, Geneva, CH.

ISO-21636-1. 2024. Language coding – A framework for language varieties. Part 1: Vocabulary. Standard, International Organization for Standardization, Geneva, CH.

ISO-30042. 2019. Management of terminology resources – TermBase eXchange (TBX). Standard, International Organization for Standardization, Geneva, CH.

ISO-639. 2023. Code for individual languages and language groups. Standard, International Organization for Standardization, Geneva, CH.

Trevor Johnston and Jemina Napier. 2010. Medical signbank: Bringing deaf people and linguists together in the process of language development. *Sign Language Studies*, 10(2):258–275.

Pilar León-Araúz, Arianne Reimerink, and Pamela Faber. 2013. Multidimensional and multimodal information in ecolexicon. In *Computational Linguistics: Applications*, pages 143–161. Springer.

Rachel McKee and Mireille Vale. 2017. *Sign language lexicography*, pages 1–22. Springer Berlin Heidelberg, Berlin, Heidelberg.

Rachel O'Neill, Gary Quinn, and Audrey Cameron. 2019. Learning the lingo: How deaf scientists create new technical terminology in british sign language. *Physiology News*, 115:26–28.

Heribert Picht. 2011. The science of terminology: History and evolution. *Terminologija*, (18):6–26.

Natascia Ralli and Dóra Mária Tamás. 2025. How to create and manage terminology resources: a practical guide from two termbases. *Journal of Digital Terminology and Lexicography*, 1(JDTL-Volume 1, issue 1):61–82.

Rachele Sprugnoli. 2025. Current trends in online sign language dictionaries. *International Journal of Lexicography*, 38(2):99–113.

Philippe Thoiron and Henri Béjoint. 2010. La terminologie, une question de termes? *Meta – Journal des traducteurs/Translators' Journal*, 55(1):105–118.

Federica Vezzani and Giorgio Maria Di Nunzio. 2020. Methodology for the standardization of terminological resources: design of TriMED database to support multi-register medical communication. *Terminology. International Journal of Theoretical and Applied Issues in Specialized Communication*, 26(2):266–298.

Federica Vezzani, Giorgio Maria Di Nunzio, Ana Salgado, and Rute Costa. 2025. When LMF and TMF meet: Towards a unified markup framework (UMF). *Terminology | International Journal of Theoretical and Applied Issues in Specialized Communication*, 31(1):72–109.