Representing Terminological Chains for Well-Formed Neologisms*

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Abstract

This work investigates the role of terminological chains in the coining of neologisms and the importance of their representation in databases, particularly when working multilingually. Different languages construct terminological chains in various ways, posing challenges for specialized translators. While coining chained neologisms can be a viable translation strategy, major evaluation methods may classify them as terminological errors. Properly representing terminological chains in multilingual databases can resolve this issue and provide additional benefits, such as identifying gaps that need to be addressed and facilitating the creation of transparent neologisms that support these chains.

Keywords
Neologism, terminological chain, terminological gap, knowledge graph, multilingual database, translation strategies, terminological errors.

1. Introduction

In this paper, terminological chains will first be defined based on the concepts of term consistency and text continuity. Then, the challenges translators face in transferring these textual properties into the target text using appropriate translation strategies will be outlined, one of which being the coining of new terms. Examples from specialized texts and translations in the language combinations German-Italian will be provided to support the discussion.

Multilingual terminology work, particularly for translation purposes, facilitates the detection of terminological gaps in the target language [1,2]. This work will show how multilingual knowledge graphs not only make the relationships between concepts but also the connections between the designations of the related concepts evident. When terms are intentionally coined by translators or systematically planned by field experts and terminologists to fill terminological gaps, ensuring formal consistency within the conceptual system—and thus accurately reflecting the connections between related concepts—enhances term transparency and improves the clarity of specialized texts and translations through what is referred to as terminological chains.

The advantages of visualizing terminological chains not just in texts but also within multilingual knowledge graphs and related multilingual datasheets become clear: (1) gaps in the chain with respect to other languages become evident; (2) the coining of well-formed terms with a higher likelihood of stability is favored; (3) compliance with the [client's] database during translation evaluation is not disattended.

2. Terminological chains

Terminological chains can be seen as a subset of lexical chains in specialized texts. They are a direct consequence of, or a strategy to ensure, an important aspect of textuality [3] – coherence – to which

the more specific aspects of specialized textuality, namely text continuity and term consistency, belong.

2.1. Text cohesion and continuity

Text cohesion refers to the internal relationships of linguistic elements within a text, which are overtly linked through lexical devices across sentence boundaries [4–6]. A coherent text must be unitary, progressive, and continuous (information is logically connected, often through connective words or reasoning) [7]. While logical and enunciative continuity are marginal in specialized translation, referential continuity is central to technical texts. It requires ensuring that the same concepts and terms are consistently used and logically connected throughout. Since a term represents a concept, its form is crucial for establishing these connections.

2.2. Term consistency

Term consistency means using a single designation for a concept across all occurrences within a document or a domain. In specialized translation, a distinction must be made between intralingual and interlingual term consistency. The former is considered a key principle of technical writing [8,9] while the latter serves as a quality criterion in major evaluation methods for terminological errors in translation. Nonetheless text-linguistic approaches to terminology, emphasize that term variants may reflect different perspectives on the same concept. Rather then diminishing clarity, this can add functional depth to the text [10-11].

Given this, translators must assess whether term inconsistency serves a purpose or merely leads to confusion - both within the source and target languages, as well as interlinguistically (see the concept of 'indeterminacy' according to [12-13]). Multilingual terminology databases cannot overlook this aspect, not least to assist translators and ensure the reliability of specialized translation evaluation systems.

2.3. Referential continuity through terminological chains

As introduced in section 2.1 referential continuity includes sequences of expressions that refer to the same referent or connected referents across sentence boundaries. In technical texts, these strategies can be described to as terminological chains, which form patterns belonging to the same coreference chains or clusters. Such patterns create a degree of redundancy in the text, enhancing transparency. Terminological chains can be analyzed to study patterns of term equivalence between languages.

2.3.1. Examples of terminological chains

Different languages construct terminological chains in different ways, presenting translators with the challenge of balancing terminological consistency and textual continuity when using these chains.

The following extract from a manual contains lexical items that form a terminological chain centered on the concept of "airtightness", specifically concerning the airtightness of buildings, containers, and building elements. The text features frequent repetitions and cohesive links related to this central concept, gradually introducing new, related concepts and relationships. Items of the same chain have been highlighted in bold, with the English translation in square bracket.

> Die Trennung von Raum- und Außenklima ist die **Luftdichtheitsebene [*level of airtightnes*s]**. Mit der **Luftdichtheitsebene [*level of airtightnes*s]** werden undefinierte **Luft**strömungen [*air flows*]vermieden. (...) Bei verputzten Leibungen ist ein vollständiges Abdichten bzw. Abkleben der Montageanker nicht erforderlich, da sich mit dem Einputzen eine geschlossene **luftdichte Ebene [*airtight level*]** ergibt. (...) Der Baukörperanschluss muss raumseitig umlaufend **luftdicht ausgeführt werden [*must be made airtight*]** (Ebene 1). (...) Die Anforderungen an die **Luftdichtheit [*airtightnes*s]** von Bauteil- und Bauteilanschlussfugen und deren Nachweismöglichkeit werden in DIN 4108-2 näher erläutert. Es wird im Besonderen auf Anschlussfugen von Fenstern und Außentüren sowie auf Konstruktionsfugen bei Rollladenkästen als typische Schwachstellen hingewiesen und die **luftdichte** Ausführung

[*making airtight*] dieser Fugen bzw. Konstruktionen gefordert. Eine im Labor nach DIN EN 12114 ermittelte **Luftdurchlässigkeit [*air permeability*]**von a < 0,1 m³/[h m (daPa)2/3] wird als praktisch **luftdicht [*airtight*]** angesehen. Für Rollladenkästen kann der Nachweis der **Luftdichtheit [*airtightness*]** nach ift-Richtlinie AB-02/1, **Luftdichtheit [*airtightnes**s*] von Rollladenkästen, Anforderung und Prüfung, anhand konstruktiver Merkmale oder durch Prüfung geführt werden. **Luftdurchlässige [*air permeable*]** Bauteil- und Bauteilanschlussfugen müssen deshalb vermieden werden. (…) Bänder mit BG R-Klassifizierung sind speziell für die raumseitige Abdichtung vorgesehen und dichten die Fuge **luftdicht** ab (a < 0,1 m³/[h m (daPa)2/3]). (…) In Verbindung mit einer **Luftdichtheitsüberprüfung [*airtightnes**s test*] des errichteten Gebäudes und Einhaltung der unten genannten Grenzwerte kann in Deutschland einen günstigerer Ansatz für die Berechnung der Lüftungswärmeverluste bei der Energiebilanzierung vor. (…) Beim Herstellen der **Luftdichtheitsschicht [*level of airtightness*]** ist auf eine sorgfältige Planung, Ausschreibung, Ausführung und Abstimmung der Arbeiten aller am Bau Beteiligten zu achten. (…) Eine **luftdichte [*airtight*]** Anschlussfuge ist also neben dem Wärme- und Feuchteschutz auch für den Schallschutz eine Grundvoraussetzung. Dichtsysteme, wie Dichtstoffe dichten den Anschluss auch akustisch (**luftdicht = akustisch dicht**) [*airtight = acoustic tight*]. Bis zur Ausgabe 2018 der DIN 4109 wurden die Mindestanforderungen an die **Luftschalldämmung [*airsound insulation*]** von Außenwandbauteilen in sieben Lärmpegelbereiche mit maßgeblichen Außenlärmpegeln eingeteilt.

Extract 1: RAL-Gütegemeinschaft Fenster und Haustüren e.V. 2024 *Leitfaden: Zur Planung und Ausführung der Montage von Fenstern und Haustüren für Neubau und Renovierung.* ift Akademie, 2024

The extract begins with a redundant introduction around the concept of *airtightness*. Subsequently, related expressions such as *Luftdichtheitsebene* [level of airtightness] are introduced and repeated frequently, along with the corresponding derived adjective and adverb. Following this initial redundancy, the term *Luftdurchlässigkeit* [air permeability] is introduced, providing a contrast that further clarifies the conceptual framework. Maintaining the same cohesive pattern, the adjective *luftdurchlässig* [air permeable] is then used as a logical counterpart. The phrase *Luftdichtheitsebene* [level of airtightness] is repeated so frequently that the noun *Ebene* [level] eventually functions as a substitution for the full compound. Similarly, the term *Dichtheit* [tightness] is used as a reduced form of airtightness, which is effective due to the clarity established earlier in the text.

Further down the chain, the well-formed neologism *Luftdichtheitsüberprüfung* [airtightness test] is enabled by the continuity of the terminological chain. There is no trace of this specific compound in parallel texts from the same domain, whereas the English loan *blower-door method* has become standard. The terminological continuity established in this text is so strong that the neologism fits naturally into the context. A similar case occurs with the neologism *Luftschalldämmung* [airborne sound insulation], which refers to acoustic insulation achieved through airtightness, and the associated adjective *akustisch dicht* [acoustically tight]. Comprehension is supported by frequent repetition and the high redundancy of chained terms. There is also an instance of term variation or inconsistency with the compound *Luftdichtheitsschicht* [level of airtightness] used instead of *Luftdichtheitsebene.* This variation appears unmotivated and should therefore not be reproduced with an Italian term variant.

Some of the terms from this extract that are chained through derivation are listed in Table 1 for the sake of clarity, and provided with a possible equivalent in Italian.

Table 1: German chained terms through derivation extracted from a text.

German	Italian	Italian chained Neologisms
Luftdichtheit [*air tightness*]	tenuta all'aria [*tightness to the air*]	
luftdicht [*air tight*]	ermetico (¬TC)(TG²) [*air tight*][*liquid tight*]	#a tenuta d'aria [*air tight*]
Luftdurchlässigkeit [*air permeability*]	permeabilità all'aria [*permeability to the air*]	
luftdurchlässig [*air permeable*]	(TG¹)	#permeabile all'aria [*air permeable*]

Failing to produce terminological chains in the target text may lead to confusion, as in the case of *ermetico* (¬TC), which serves as subordinate concept for both air and liquid tightness as well as

unspecific term for the two hyponyms. *Teiläquivalenz* [14] or *corrispondenza parziale* [15] [partial correspondence] can also be regarded as terminological gap [2], similar to TG[1] which occurs when the target language fails to designate a concept and leaves a gap. On the other hand, coining a neologism for both adjectives *luftdicht* and *luftdurchlässig* based on their related substantives would ensure transparency. Moreover, a stable chain between the substantive and the adjective would improve clarity, even if a contraction occurs for reason of brevity (i.e. *permeabile*).

Another way of ensuring terminological chains in German, is by maintaining regularity in compounds, for example with the same head *Schutz* [protection] (see Table 1). Chained compounds extracted from the manual have been listed and aligned in Table 2

Table 2: Examples of German chained compounds extracted from a text.

GER	ITA	chained neologisms (ITA)
Wärmeschutz	isolamento termico	
[*heat protection*]	[*thermal insulation*]	
Lärmschutz	isolamento acustico	
[*sound protection*]	[*acoustic insulation*]	
Brandschutz	sicurezza antincendio (TG[2])	#isolamento ignifugo
[*fire protection*]	[*fire safety*]	[*fire insulation*]
Feuchteschutz	protezione contro l'umidità (¬TC)	#isolamento igrometrico
[*humidity protection*]	[*protection against humidity*]	[*humidity insulation*]
Kälteschutz	(TG[1])	#isolamento criogenico
[*cold protection*]		[*cold insulation*]
Kälte-,Wärme-, Lärmschutz	coibentazione (¬TC)	

The terminological chain in Italian breaks down after the first two terms. Unrelated concepts, such as *sicurezza*, or terminological gaps [TG[1]] disrupt its continuity. The fact that the degree of standardization in this field is very low, results in terms like *protezione contro l'umidità* being not chained (¬TC) and therefore unstable. The term *sicurezza antincendio* is ambiguous and often used inconsistently without clear motivation.
While the relation between single terms like *isolamento acustico* and *protezione contro l'umidità* may be hinted by the definition of the domain and the tabular form, this correlation fails to be evident when unchained terms occur at a distance of sentences. A parallelism in the term structure favor the recognition of a conceptual adjacency.

3. Representation of terminological chains in terminology databases

Terminological chains are one manifestation of the complex relationship between concept and term. A term may encompass a set of properties characterizing its content (the more this holds true, the more transparent the term is) and a set of formal elements that constitute its form (16, 17]. Since terminological databases are typically structured to prioritize the concept over the form of a designation, and although the degree of term transparency could, in principle, be included as additional information in a datasheet, the challenge lies in representing transparency conveyed by the coexistence of multiple terms rather than a single one. The core issue is how to display a property that is inherently text-related within a system that inherently does not represent textual phenomena. One approach to accounting for this textual phenomenon is to use knowledge graphs to represent chains formed by the formal properties of terms.

While knowledge graphs in databases are known for facilitating the understanding of concepts through a network of relationships, the actual terms within them are typically used as labels for the described concepts. However, beyond merely displaying terms, they may also support comprehension through the formal aspects of these designations. Once conceptual relationships are established, connections at the level of form can also be made explicit.

The terminological chain in Table 2, for example, develops within the same conceptual level, sharing the subordinate concept *Gebäudehülle* (Figure 1) with a *HAS_property* relationship. The

breaking of the chain due to a TG[1] is indicated by the absence of an Italian equivalent (*Feuchteschutz*), while partial equivalence necessitates the creation of an additional node (TG[2]) (*sicurezza antincendio*). Non-chained equivalents are neither marked by color in knowledge graphs nor linked to chained terms in the datasheet (Figure 1).
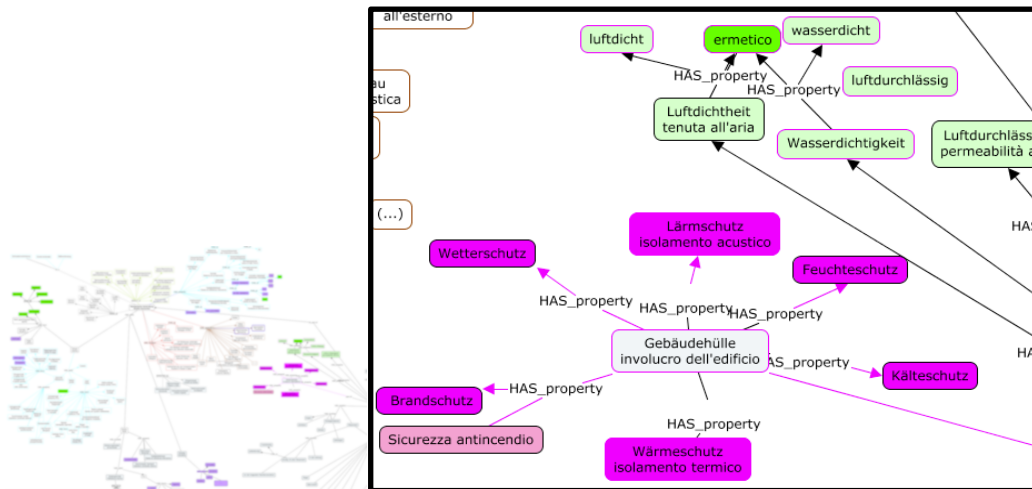

Figure 1: Example of terminological gaps and chains in knowledge graph

In the knowledge graphs, chained terms—indicated by color in Figure 1—are annotated and can be clustered and extracted in a multilingual glossary for translation purposes in a way similar to Table 1 and 2. The corresponding datasheet can include a field for chained terms, where formally related designations are listed and ideally linked to both the knowledge graph and chained equivalents in the other language when chained term is missing (Figure 2).

Figure 2: Example of terminological gaps and chains in database

This allows for the visualization and analysis of term networks that emerge from co-occurrence patterns, derivational relationships, or structural analogies, thereby providing a means to model text-based phenomena within concept-centered terminological systems.

Including this evidence in terminology databases favors the coining of well-formed neologisms by (1) facilitating the detection of terminological gaps and chains; (2) serving terminological principles for coining neologism that fill TG[1,2] or substitute unclear non-chained term; (3) ensuring that evaluation methods for terminological errors do not fail.

3.1 Detection of terminological gaps and chains

A TG refers to the absence of a specific term or concept in one language compared to another (TG1) or discrepancies in how knowledge is structured across languages (TG2) [2]. Identifying TGs requires a multilingual approach and a well-defined knowledge representation. Similarly, analyzing terminological chains can reveal the need for neologisms in another language. For example, the alignment of *isolamento igrometrico* with other types of insulation becomes evident through comparison with German, where the fact that humidity is considered a relevant threat to the *Gebäudehülle* as much as heat, cold, and sound propagation is expressed through the form of terms.

3.2 Neologisms as translation strategies for terminological chains

While terminological chains were used in the source text as a strategy for effective technical writing, translators must develop translation strategies to ensure the same level of transparency in the target text. Three translation strategies for transferring terminological chains have been identified: (1) Compensation: Adding information at the term level or within larger units of analysis. For example, adding *all'aria* after the term *ermeticità* enhancing clarity or using *coibentazione* and specifying the concept of "cold, warm, and sound insulation" elsewhere in the near context; (2) New (chained) term instead of an unchained term. For example, using *a tenuta d'aria* instead of *ermetico* to establish a chain with the Italian noun for airtightness. (3) New (chained) term for a terminological gap. For example, *isolamento igrometrico*.

Both strategy (2) and (3) include the coining of new terms. When new terms are created intentionally and in a planned manner or during translation, terminological principles are applied [18], including the principle of economy, language-system adequacy, transparency and consistency with the conceptual system. By detecting and representing terminological chains, most of these principles are supported. Transparency, for example, comes not always and only from the actual term but also from the surrounding terms (hence the chained terms). Alignment amongst languages is also considered a favouring principles for ensuring stability over time [19]. Moreover, well-formed terms that integrate seamlessly into specialized discourse facilitate acceptance and do not trigger "neological intuition" [20], which could lead to resistance or skepticism toward translation choices, especially in languages less accustomed to top-down normalization.

3.3 Evaluation of terminological errors

In translation evaluation, errors are categorized based on severity, with terminological errors being a key category. Various classification models exist [21-24], all recognizing terminology errors as the use of incorrect terms, inconsistent terminology, or non-compliance with standardized resources. However, none explicitly address terminological chains.

Different translation strategies yield varying results. Compensation at the term or text level does not trigger terminological errors if additional information is added without altering standardized terms, though it may cause misalignment in automated evaluation methods like BLEU [25]. Enforcing chained or derived terms with neologisms can lead to inconsistency with standardized termbases, if these do not account for terminological chains. Neologisms used to accommodate source term inconsistencies may introduce errors, while their impact on filling terminological gaps depends on how gaps are represented in terminology databases.

4. Conclusion

Knowledge graphs in terminology databases make relationships among concepts evident and clear. However, since concepts in graphs are inevitably represented through their lexical forms, they can also highlight relationships among term forms, supporting the clarification of meaning. In fact, transparency of meaning is also conveyed by the way designations relate to other designations. In specialized text linguistics, this is referred to as terminological chains. From a multilingual perspective, this is described as alignment among languages.

Since multilingual knowledge graphs help identify terminological gaps and chains, it is worthwhile to make these formal connections explicit to support the coining of well-formed neologisms through transparency, contextual adequacy, and alignment with related terms. This is particularly relevant in languages such as Italian, which are not accustomed to prescriptivism in terminology use and are particularly resistant to spontaneously coining new terms [26]. Chained terms are more likely to integrate seamlessly into the domain's terminology and ensure stability over time. From a translational perspective, including chained terms in databases can help prevent terminological errors during translation evaluation by accounting for terminological chains in the target language.

Declaration on Generative AI

The author has employed Generative AI tools for checking compliance to guidelines in references.

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