

Polysemy in Translation Studies: A Systematic Review of Publication Trends, Methodological Approaches and Research Themes

Dengke Pan

Faculty of Modern Languages and Communication,
Universiti Putra Malaysia, Selangor, Malaysia

Syed Nurulakla Syed Abdullah (Corresponding author)

Faculty of Modern Languages and Communication,
Universiti Putra Malaysia, Selangor, Malaysia

Muhammad Alif Redzuan Abdullah

Faculty of Modern Languages and Communication,
Universiti Putra Malaysia, Selangor, Malaysia

Linlin Yu

School of Foreign Languages,
Henan University of Animal Husbandry and Economy
No. 6, Longzihu North Road, Zhengdong New District, Zhengzhou, China

Received: August 1, 2025 Accepted: August 16, 2025 Published: August 18, 2025

doi:10.5296/ijelev13i2.23099 URL: <https://doi.org/10.5296/ijelev13i2.23099>

Abstract

Polysemy, characterized by a single word possessing multiple related meanings, poses significant challenges in translation, particularly when meanings lack direct equivalents in the target language. This study systematically reviews research on polysemy in translation studies, analyzing high-quality journal articles published up to July 31, 2025, sourced from the Web of

Science (WoS) and Scopus databases. Employing a structured coding and analysis framework, this review examines publication trends, methodological approaches, and research themes through a systematic literature review utilizing content analysis. Following the PRISMA guidelines, 36 articles were selected for analysis. The findings reveal: (1) Empirical research predominantly focuses on polysemy across various translation domains, with data collection and analysis methods demonstrating increasing diversification. (2) There is a notable gap in exploring polysemy translation within culturally specific and stylistically complex texts, necessitating further investigation into intricate contextual applications. (3) Future research should prioritize domain-specific syntheses and address multilingual translation requirements. This review contributes to translation studies by offering a comprehensive understanding of polysemy research, fostering greater attention to diverse linguistic contexts and promoting interdisciplinary collaboration.

Keywords: polysemy, translation, publication trend, methodological approach, research theme

1. Introduction

Polysemy, even within specialized domains, remains a prevalent phenomenon, frequently addressed in terminology literature (Bouveret, 1998; Adelstein & Cabré, 2002; Frassi, 2022). L'Homme (2024) asserts that polysemy constitutes a common challenge frequently encountered by terminologists. For instance, the word "run" exhibits distinct meanings across contexts, such as "run a half marathon," "run some water," "run on gasoline," "run a shop," "run late," "run away from responsibilities," "run in the family," and "run for President." The complexity of semantic relations and meaning manifestation in translation studies has attracted significant scholarly attention, as evidenced by works from Hawkins (2017), Corbett and Li (2021), and Zhou et al. (2022). This aligns with Al-Saudi's (2023) investigation into the challenges stemming from insufficient understanding of the source language, which often leads to deviations in meaning and semantic loss in English translations (Abdul-Raof, 2004; Al-Qinai, 2011).

Recent research has increasingly explored sense relations and meaning identification; however, polysemy, particularly from a translational perspective, remains underexplored (Al-Saudi, 2023). To address this gap, numerous studies have investigated the handling of polysemous words within translation studies. Nevertheless, the complexity of interpreting polysemy, devising effective translation strategies, and addressing associated challenges often creates difficulties for translators seeking reliable references. These complexities hinder translators and scholars from synthesizing prior research, staying abreast of current trends, and adopting robust methodologies for polysemy-focused translation studies. Consequently, there is a pressing need to systematically elucidate the landscape of translation research concerning polysemy.

A systematic literature review provides an objective, transparent, and comprehensive approach to synthesizing existing knowledge surrounding a research question (Tsafnat et al., 2014). Despite the expanding body of research on polysemy in translation, no prior study has systematically mapped its research trajectories across diverse domains, including law, literature,

machine translation, and language processing. This gap impedes interdisciplinary advancement and the development of cohesive translation strategies. To achieve a thorough understanding of polysemy research, this study conducts a systematic review to examine current research foci and identify future directions in translation studies. Notably, Al-Saudi (2023) highlights that meaning negotiation between languages frequently encounters challenges due to significant linguistic and cultural disparities. These challenges underscore the complexities translators face across varied contexts. Therefore, this review synthesizes empirical studies on polysemy in translation, drawing from international literature published up to July 31, 2025, guided by the following research questions:

- 1) What is the publication trend of polysemy research in translation studies?
- 2) What methodological characteristics are evident in related translation studies?
- 3) What research themes are focused on in related translation studies?

2. Methodology

To systematically identify translation studies on polysemy, this study adheres to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines proposed by Page et al. (2021). The methodology comprises three sections: search strategy, selection criteria, and data coding and analysis.

2.1 Search Strategy

This study encompasses all research on the translation of polysemy published up to July 31, 2025. Given the scarcity of systematic reviews on polysemy in translation studies, comprehensive data collection is essential to facilitate in-depth exploration and analysis in this field.

Potential studies were retrieved from the Scopus and WoS electronic bibliographic databases. Scopus is recognized as a comprehensive resource, encompassing a wide range of peer-reviewed social science journals (Steinhardt et al., 2017). The selection of both WoS and Scopus is justified by their complementary strengths, addressing individual database limitations (Burnham, 2006), and their status as leading bibliographic databases containing high-quality, peer-reviewed journal articles curated through rigorous selection processes (Pranckutė, 2021). In terms of its discussion, polysemy, as defined in the Encyclopedia of Language & Linguistics (Second Edition, 2006), denotes a linguistic phenomenon wherein words possess multiple meanings beyond their literal interpretation. Polysemy behaves similarly to semantic diversity, and the polysemous words tend to be more semantically diverse (Rodd, Gaskell, & Marslen-Wilson, 2002). Also, polysemy akin to semantic flexibility is often found in full natural languages (Raukko, 2003). Accordingly, the search strategy incorporated synonyms for polysemy, including “multiple meaning,” “semantic diversity,” and “semantic flexibility.” The search strings for title, abstract, and author keywords were as follows:

Search string for Scopus:

TITLE-ABS-KEY(("polysemy" OR "multiple meaning*" OR "semantic diversity" OR "semantic flexibility") AND translation))

Search string for WoS:

TS= (("polysemy" OR "multiple meaning*" OR "semantic diversity" OR "semantic flexibility") AND translation))

2.2 Selection Criteria

The screening process was designed to identify literature for inclusion in the review, streamlining the number of documents to ensure manageability for reviewers (Okoli, 2015). The inclusion and exclusion criteria have been set in alignment with the scope of the research question (Table 1).

Table 1: Inclusion and exclusion criteria

No.	Criteria	Inclusion	Exclusion	Justification
1	Language	English	All languages except English	To ensure accurate comprehension and representation of articles in a global academic context
2	Scope	Peer-reviewed academic journal articles	Review, book chapter, conference proceedings, editorial, short survey, other no peer-reviewed and unpublished articles	Journal articles are generated more consistently than other sources such as chapters and reports
3	Length	Full-text papers accessible for retrieval	Articles containing only abstracts or limited sections	To facilitate comprehensive evaluation, ensure complete data extraction, and avoid bias from missing information
4	Content	Papers with complete information elements	Articles lacking abstracts, author information, keywords, references, or other essential components	To ensure comprehensive data analysis, maintain consistency, and enhance the reliability and validity of findings
5	Focus	Studies centrally addressing polysemy in translation	Articles that peripherally mention polysemy or translation or address them minimally	To prioritize in-depth, relevant analyses that elucidate the impact of polysemy on translation

Given the restrictions of the scope, language, and document type, 483 records were retrieved from the WoS (90 records) and Scopus (393 records) databases. Of these, a total of 75 duplicates were filtered and removed manually to ensure quality. The remaining 408 records were screened by checking the titles, keywords, and abstracts based on the inclusion and exclusion criteria. The abstracts that are not detailed enough to appraise have been retained for full-text assessment. After that, 408 were read in full text. Altogether, 372 articles were excluded based on the selection criteria by carefully reading the full texts. For instance, "translation" in Finkbeiner et al.'s (2004) research is just used as a backdrop against what kind

of a role polysemy plays in masked semantic and translation priming; in fact, the whole passage only focuses on semantic categorization. Likewise, some studies focus on word formation translation rather than the study of word meaning translation (Pak et al., 2023; Zaw & Alpatova, 2023); some have begun to explore the translation of meaning, but have not addressed the study of polysemy (Bolduc, 2022); and the discussion of polysemous words in some articles is only a minor part rather than the main focus (Araghi & Palangkaraya, 2024). Overall, 36 articles were included in the final study. The data extracting and appraising process is outlined in Figure 1.

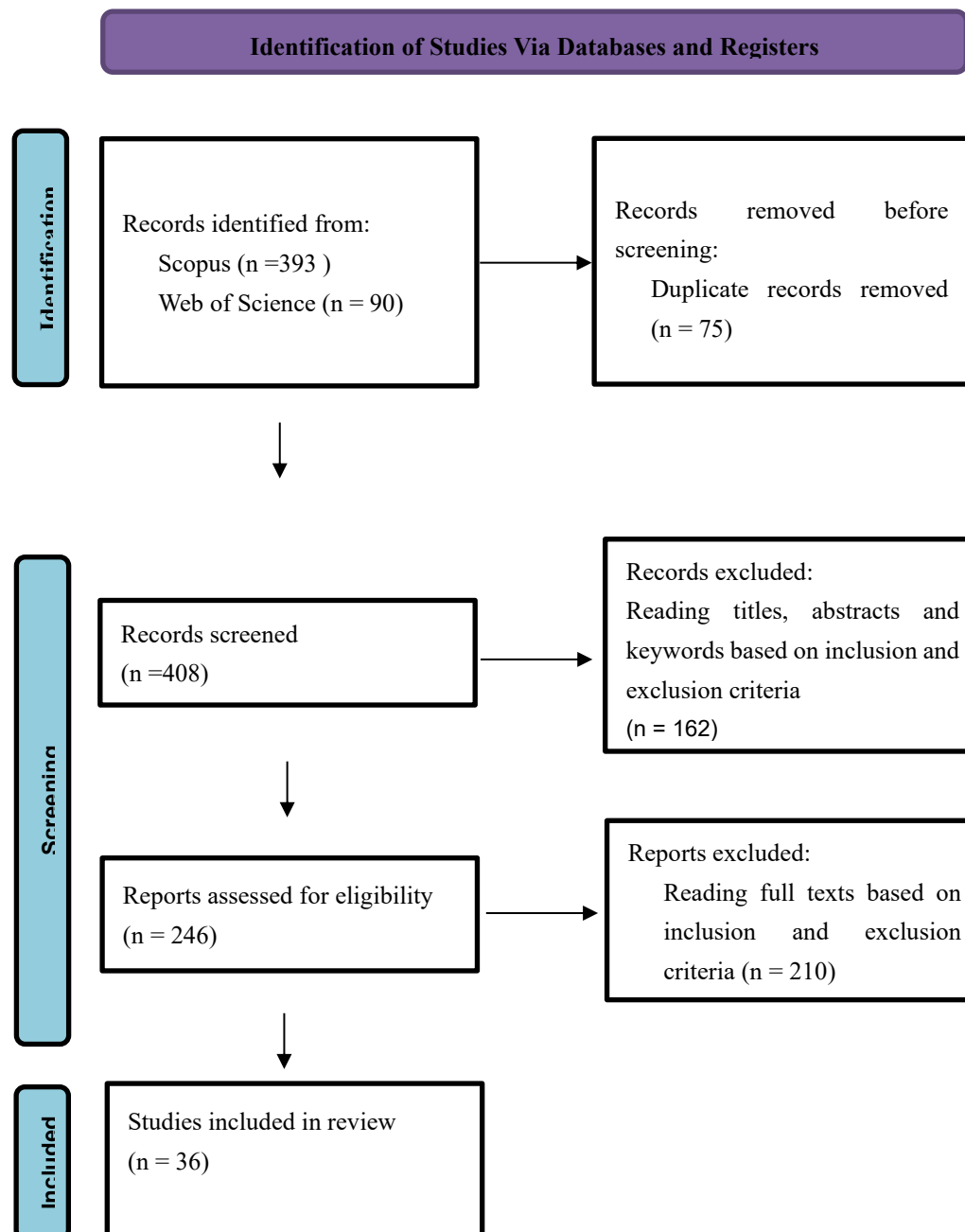


Figure 1. Flow chart of study inclusion process adapted from the PRISMA 2020 diagram

2.3 Literature Coding

Four researchers formed two independent teams to perform a content analysis of the literature. As illustrated in Figure 2, the first phase involved the development of the preliminary coding framework. Guided by the three research questions, the researchers referred to the coding system and analysis framework used in systematic literature reviews (Macaro et al., 2012; Lin & Lan, 2015) to construct the initial coding framework.

The second phase involved trial coding. Each team independently conducted a back-to-back trial coding based on the preliminary coding framework, selecting 10 identical SJR Q1 and Q2 journal articles from the candidate journals. After the trial coding, the inter-rater reliability (IRR) between the two researchers within the same team was above 0.92. Subsequently, the research teams then held a discussion meeting to unify the coding results and refine the coding framework.

The third phase comprised formal coding. Each team independently coded the 36 selected articles, following the same process as in the second phase. After the coding, a discussion meeting was held, resulting in the final coding and analysis framework (as shown in Figure 3), and the coding data was compiled and unified

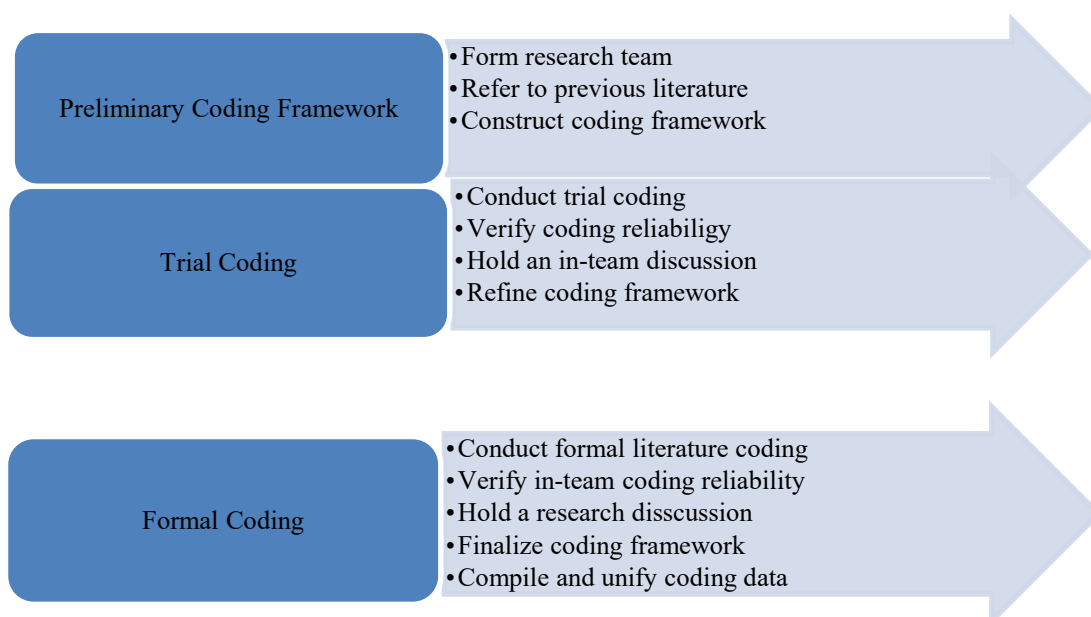


Figure 2. Data coding and analysis process

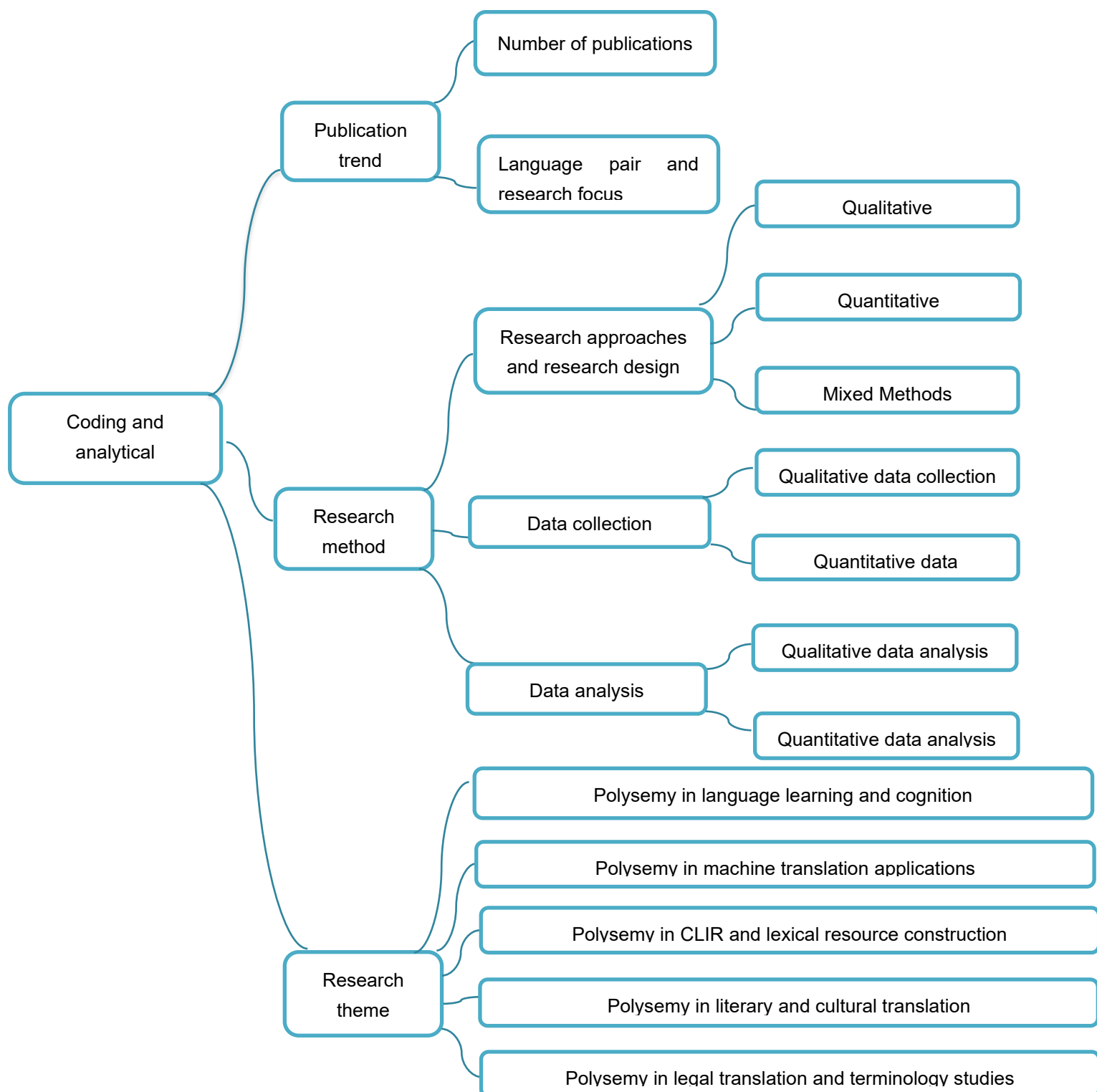


Figure 3. Coding and analysis framework for systematic literature review

3. Results and Discussion

3.1 Publication Trend

3.1.1 Number of Publications

From 1979 to 2025, as illustrated in Figure 4, the publication trend of articles on polysemy in translation studies exhibits a fluctuating pattern. During the early years (e.g., 1979, 1996, 1999, and 2001), publication output was minimal, with only one article per year. A slight increase occurred in 2007 and 2008, with two articles published annually. A modest peak was observed in 2014, with three articles, though this upward trend was not sustained, and subsequent years saw a return to lower publication numbers. The most notable peak occurred in 2017, with five articles published. From 2019 to 2025, publication numbers fluctuated modestly, typically ranging between one and three articles per year, with an average of approximately one article annually from 2023 to 2025.

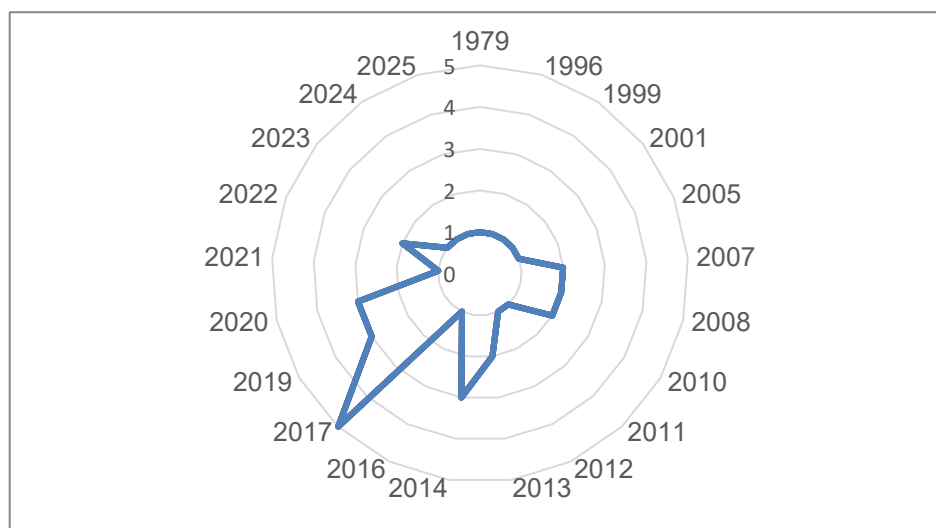


Figure 4. Number of publications from 1979 to 2025

These fluctuations can be attributed to multiple factors, including shifts in academic priorities, evolving researcher interests, advancements in research methodologies and theoretical frameworks, and the emergence of novel findings at the intersection of translation studies and related disciplines. The peak in 2017 likely resulted from methodological and analytical advancements in polysemy research, which heightened scholarly interest. Moving forward, the publication trend in this field may witness a gradual increase, driven by interdisciplinary approaches and data-driven methodologies.

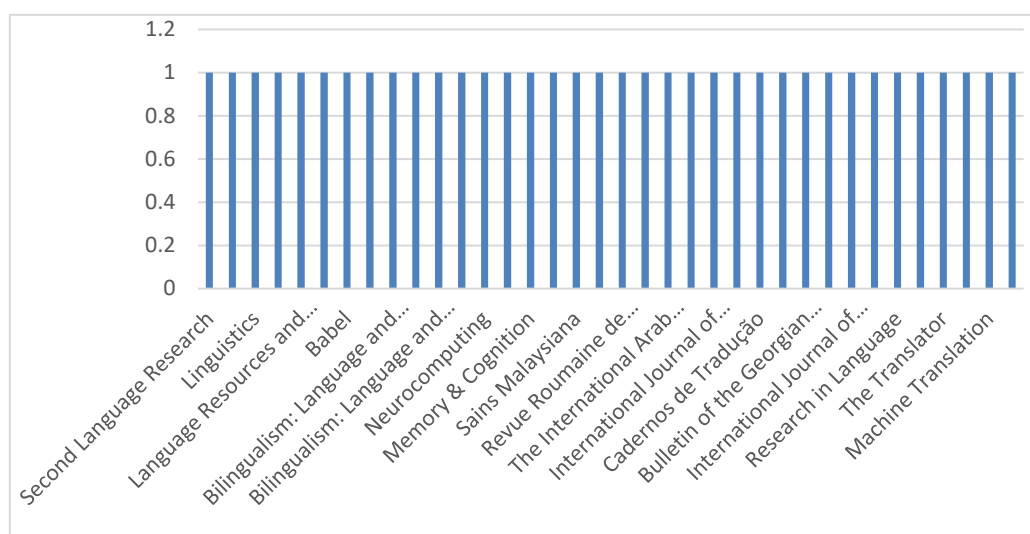


Figure 5. Distribution of published journal from 1979 to 2025

The distribution of journals publishing research on polysemy within translation studies in Figure 5 reveals that each journal has only contributed one article. This broad yet sparse distribution underscores the diverse and interdisciplinary nature of this research area. The absence of a dominant journal serving as a primary platform for these studies indicates that polysemy research in translation remains niche and widely scattered across different academic fields.

Several factors may explain this pattern. The interdisciplinary scope of polysemy research, encompassing linguistics, cognitive science, computer science, and translation studies, leads to publications across a diverse array of journals. This distribution further indicates a consistent yet constrained level of interest in the field, where research efforts persist but have not coalesced into a focused or extensive academic discourse.

Integrating this analysis with the aforementioned publication trends, it is clear that the field has not sustained prolonged peaks in research output. Although 2017 marked a significant year with increased publication numbers, this peak did not result in a concentration of articles within specific journals. Overall, the publication trend for polysemy in translation studies reflects sporadic attention, which may gradually increase with the emergence of novel technologies and interdisciplinary methodologies.

3.1.2 Language Pair and Research Focus

Drawing on data from 36 studies addressing polysemy in translation studies, the distribution of language pairs is extensive, with research primarily concentrating on combinations involving English and other languages (30 studies), including English-German, English-Spanish, and English-Arabic pairs. This focus may be attributed to English's status as a dominant global communication language, rendering it highly relevant in translation research. In contrast, studies examining non-English language pairs (6 studies), such as German-Spanish, Danish-Spanish, and Korean-Vietnamese pairs, are less prevalent, indicating limited research

attention in these domains.

Regarding the research focus, a substantial proportion of studies concentrate on machine translation, cross-lingual information retrieval (CLIR), language processing, and bilingual lexicon induction. Less commonly addressed themes include legal translation and the cultural and pragmatic translation of specific lexical items. This distribution likely arises from the increasing emphasis on technological applications, such as machine translation, whereas philosophical and cultural translation, which demands comprehensive semantic analysis and interdisciplinary expertise, garners less attention.

Despite the limited attention to understudied language pairs and subjects, these areas merit greater focus in future research. Scholars can address this gap by fostering cross-linguistic collaboration and resource sharing, utilizing corpus-based techniques and neural machine translation methods, and exploring strategies for managing complex polysemous words within cultural and contextual frameworks. Such approaches can yield more precise and practical outcomes for both linguistics and translation studies.

3.2 Research Methods

3.2.1 Research Approaches and Research Design

Drawing on Creswell's (2010) classification framework for research approaches and designs in educational research, this review, based on an analysis of 36 empirical studies, identifies three research approaches and six research designs. As listed in Table 2, quantitative methods were employed in 29 studies, comprising 15 corpus analyses, 5 experimental studies, and 9 quasi-experimental studies, underscoring the field's emphasis on empirical precision and data-driven methodologies. Mixed-methods approaches, adopted in four studies integrating automated techniques with human evaluation, reflect an increasing interest in balancing computational efficiency with interpretive depth. Conversely, qualitative methods remain significantly underrepresented, with only three studies utilizing discourse analysis and case studies, which demonstrate their potential to provide nuanced, context-sensitive insights.

Table 2. Research approaches and research designs in 36 empirical studies

Research Approach	Research Design	Number of Studies
Qualitative	Contextual Analysis	1
	Case Study	2
	Corpus Analysis	15
Quantitative	Experimental Research	5
	Quasi-experimental Research	9
Mixed Methods	Automated Methods and Human Evaluation	4

This synthesis of research on polysemy in translation studies reveals considerable progress, predominantly driven by quantitative analysis and technology-oriented methodologies. Nevertheless, there is significant potential for deeper exploration through qualitative research. The existing literature suggests that case studies have been employed to investigate translation strategies and the cultural adaptability of polysemous words across diverse contexts, yet such studies are notably scarce. Discourse analysis enables a systematic examination of texts to uncover contextual usage and translation strategies for polysemous words in varied cultural settings, while case studies provide in-depth insights into the efficacy and challenges of specific translation decisions. Consequently, future research should prioritize discourse analysis and case studies to enhance the understanding of the diversity and complexity of polysemy in translation practice, thereby offering a more comprehensive perspective and actionable insights for translation scholarship.

3.2.2 Data Collection

The literature reviewed in this study utilized a range of data collection methods. Van (2007) employed document analysis to extract data from entries in translation studies dictionaries and encyclopedias, examining how polysemy and synonymy facilitate translation learners' understanding of theoretical concepts. Lefever (2014) gathered quantitative data, applying metrics such as F-score and accuracy to assess model performance.

An analysis of 36 studies on polysemy in translation research reveals that data collection methods predominantly center on corpus analysis and experimental data, reflecting a reliance on objective data. Nevertheless, methods such as interviews and surveys, which capture subjective insights, remain underutilized, constraining a comprehensive understanding of translators' experiences and strategies. Although textual and discourse analysis is employed, there is considerable scope for further exploration to elucidate subtle cultural and semantic nuances in translation practices.

3.2.3 Data Analysis

Across the 36 studies addressing polysemy in translation research, scholars employed a diverse range of data analysis methods. Qualitative data analysis was utilized in three studies. Zhang et al. (2022) conducted construction analysis and comparison to elucidate semantic structures and translation strategies across languages, while Abdul-Ghafour et al. (2019) applied Murphy's Relational Contrast Theory (RC-S) to examine semantic distinctions. These qualitative approaches seek to yield profound insights into context and translation strategies, revealing how polysemy manifests in varied cultural and linguistic contexts. Quantitative data analysis was employed in 29 studies, encompassing descriptive statistics, regression analysis, ANOVA, and performance metrics. Elston & Williams (2008) utilized descriptive statistics and ANOVA to assess reaction times and error rates in semantic judgment tasks among second-language learners, Yang et al. (2021) evaluated machine translation performance using BLEU and Levenshtein distance metrics, and Cañizares & Gathercole (2020) applied ANOVA to investigate the proportion of erroneous cognate selections in translation tasks. These quantitative methods aim to evaluate translation quality and language learning outcomes through data-driven approaches. Four studies adopted a mixed-methods approach, integrating

quantitative and qualitative analyses. For instance, Lan (2017) combined corpus analysis with case studies to ensure accuracy and precision in bilingual translation, while Viberg (2012) performed comparative analysis of translations in multilingual corpora to explore semantic shifts across languages. This approach provides a comprehensive analytical framework, balancing objectivity with in-depth exploration of translation practices.

Future research should strive to expand the scope and methods of data collection to incorporate more subjective and qualitative perspectives. Utilizing interviews and surveys can yield deeper insights into how translators manage polysemy across diverse contexts and the rationales underlying their decisions. Integrating multiple data sources, such as observations of real-time translation tasks and translator feedback, can provide a more holistic perspective. Furthermore, the development of cross-cultural corpus analysis should be prioritized to enhance understanding of how polysemy manifests and is addressed across varied languages and cultural contexts.

3.3 Research Themes

Through a rigorous content analysis, this systematic review has identified five primary research themes, as delineated in Table 3. The predominant themes encompass the interplay between polysemy and language acquisition as well as cognitive processes, the integration of polysemy in machine translation systems, the significance of polysemy in cross-lingual information retrieval (CLIR) and the development of lexical resources, and the representation of polysemy in the translation of literary and cultural texts. A significant proportion of the analyzed studies address multiple research themes concurrently (Zhou et al., 2022).

Table 3. Classification of Research Themes and Number of Studies

Category	Subcategory	No. of Studies
Polysemy in language learning and cognition (23 studies)	Second language semantic processing	9
	Cross-language vocabulary acquisition	10
	Bilingual lexical representation	4
Polysemy in machine translation (18 studies)	Word sense disambiguation and model optimization	11
	Technical vocabulary handling	4
	Translation quality improvement	3
Polysemy in CLIR and lexical resource construction (12 studies)	Semantic expansion and query optimization	4
	Lexical resource alignment	

	Information retrieval models	5
		3
Polysemy in literary and cultural translation (3 studies)	Culture specific expressions	1
	Polysemy in literary works	2
Polysemy in legal translation and terminology studies (11 studies)	Bijural translation of legal terms	3
	Terminology education and lexicography	8

3.3.1 Polysemy in Language Learning and Cognition

Among the 36 studies included in this review, 23 specifically investigate the impact of polysemy on second language semantic processing, cross-linguistic vocabulary acquisition, and bilingual lexical representation. The scholarly consensus, supported by extensive research, indicates that polysemous words in the first language (L1) substantially impede second language (L2) semantic acquisition. Elston & Williams (2008) conducted an empirical study to assess the effect of polysemy on second language learners' accuracy in semantic judgment tasks, demonstrating that polysemous vocabulary from L1 significantly elevates the probability of semantic selection errors in L2 contexts. Cañizares & Gathercole (2020) extended this inquiry by examining the interference caused by L1 polysemy in translation tasks, revealing that comprehension of L1 polysemy introduces systematic biases in L2 translation outcomes, particularly when the semantic frameworks of L1 exhibit greater complexity than those of L2. These findings underscore the complexity of mapping polysemous structures across linguistic boundaries, particularly in scenarios requiring learners to execute precise semantic decisions, where polysemy frequently engenders inconsistencies in comprehension.

In the domain of cross-linguistic vocabulary acquisition, research examines the differential impacts of formal and semantic ambiguity associated with polysemous words on the process of vocabulary acquisition. Degani & Tokowicz (2010) conducted a detailed analysis of the cognitive challenges posed by polysemy during vocabulary acquisition, focusing particularly on how the formal and semantic diversity of polysemous words complicates learners' memory encoding and meaning retrieval. Studies on bilingual lexical representation investigate the dynamic interplay between L1 and L2 lexical representations of polysemy. Degani & Tokowicz (2013) explored the storage mechanisms of polysemous words within the mental lexicons of bilingual individuals, revealing that the semantic structures of polysemous words frequently demonstrate inconsistencies between L1 and L2. In translation tasks, bilinguals exhibit a pronounced tendency to prioritize simpler semantic meanings in L2, while polysemous words characterized by more intricate L1 structures are more likely to generate multiple interpretive pathways.

When L1 lexical structures exhibit greater complexity, L1 polysemy, characterized by multiple meanings of a single word, can markedly impair L2 semantic comprehension. This finding underscores the practical significance of polysemy research for language pedagogy and

translator training, highlighting the necessity of precise and consistent interpretation of polysemous terms across diverse linguistic and cultural contexts. However, many existing studies are confined to controlled laboratory environments, limited by insufficient analysis of naturalistic translation contexts. Consequently, future research should prioritize naturalistic settings, examining translators' cognitive and contextual strategies in authentic translation tasks. Furthermore, research should focus on translators' individual decision-making strategies, elucidating the cognitive processes underlying semantic selection of polysemy, thereby enhancing our understanding of its complexities in translation cognition.

3.3.2 Polysemy in Machine Translation

Polysemous words exhibit multiple interpretations contingent on context, posing significant challenges for effective disambiguation and the selection of appropriate translations in enhancing the accuracy and practical utility of machine translation (MT) systems. Among the 36 studies reviewed, 18 address the role of polysemy in machine translation. Researchers aim to enhance MT systems' ability to disambiguate meanings of polysemous words, thus enhancing translation accuracy. Mall & Jaiswal (2017) investigated the extent to which improvements in corpus annotation and alignment techniques contribute to enhancing WSD performance, employing metrics such as F-score and accuracy to evaluate the model's polysemy disambiguation performance. Additionally, Nguyen et al. (2020) developed a neural network-based approach, proposing a deep learning WSD method that demonstrated effective performance in disambiguating subtle semantic nuances, particularly for context-sensitive polysemous terms. These studies underscore the necessity of effective WSD for polysemy disambiguation, with neural networks offering a robust mechanism for enhancing translation accuracy.

Furthermore, the handling of technical vocabulary constitutes a critical area of inquiry, particularly in domains such as medicine and engineering, where specialized terminology exhibits polysemous complexities. Frînculescu (2014) investigated polysemy in medical translation, employing co-occurrence frequency analysis to mitigate misinterpretation of polysemous technical terms, thus enhancing the quality of medical text translations. These studies highlight the intricacies of disambiguating polysemous terms in specialized domains, demonstrating the critical role of integrating comprehensive contextual cues in technical texts to minimize translation errors.

Moreover, studies addressing translation quality enhancement investigate the extent to which accuracy metrics and automated evaluation methods contribute to effective polysemy disambiguation in MT. For instance, certain studies utilize automated metrics such as BLEU and TER to quantitatively assess model performance in disambiguating polysemous terms, thereby enhancing evaluation frameworks to optimize overall translation quality. Yang et al. (2021) proposed combining BLEU and TER metrics in MT evaluation to identify error rates associated with polysemy disambiguation, demonstrating that a multi-metric approach facilitates a more robust evaluation of translation quality.

Through refining WSD models, incorporating deep learning, and integrating co-occurrence frequency and contextual information, MT systems have achieved notable advancements in

polysemy disambiguation. However, numerous studies remain confined to specific corpora and controlled experimental settings, lacking comprehensive validation in naturalistic translation contexts. Furthermore, polysemous terms in practical applications are subject to diverse cultural and contextual influences, thereby impacting MT accuracy. Future research should prioritize evaluating translation performance in naturalistic settings and developing adaptive models designed to dynamically address semantic shifts in polysemous terms, thereby enhancing polysemy disambiguation across diverse domains and cultural contexts.

3.3.3 Polysemy in CLIR and Lexical Resource Construction

Among the 36 studies reviewed, 12 address the semantic alignment processes of polysemous terms. Researchers predominantly aim to enhance CLIR systems' polysemy disambiguation through semantic techniques, particularly within translation contexts, where maintaining semantic accuracy during query expansion remains essential. Yunus et al. (2013) investigated the role of semantic expansion in CLIR, proposing a lexically layered expansion method that improves cross-linguistic retrieval precision through incorporating multiple semantic variants for polysemous terms within queries. Similarly, Zhou et al. (2022) enhanced polysemy disambiguation in cross-linguistic information retrieval through implementing lexical alignment and semantic hierarchy matching, yielding more accurate translation results. These studies highlight the necessity of semantic expansion and query optimization within translation contexts, demonstrating that effective polysemy disambiguation contributes to enhancing semantic coherence in translation.

Lexical resource alignment research centers on aligning polysemous terms within multilingual lexical resources to ensure semantic consistency. Apidianaki & Sagot (2014) constructed a robust lexical resource alignment model through comprehensive analyses of definitions and contextual variations of polysemous terms across languages within a multilingual WordNet. Their findings demonstrate that precise annotation and semantic decomposition of polysemous terms contribute to maintaining semantic consistency across languages, thereby enhancing translation accuracy. Ding et al. (2024) developed a multilingual lexical mapping strategy designed to align polysemous terms across languages, ensuring semantic coherence and consistency in translation resources, especially in addressing complex cultural and linguistic differences. In information retrieval models, researchers investigate the extent to which neural technologies and deep learning models contribute to enhancing the representation and disambiguation of polysemous terms in both CLIR and translation tasks. Zhou et al. (2022) developed a neural topic-enhanced polysemy representation method, embedding the semantics of polysemous terms into information retrieval and translation models by leveraging neural networks and deep learning techniques. This approach yielded enhanced precision in cross-linguistic queries and translation outcomes.

Semantic expansion and query optimization facilitate CLIR systems in effectively disambiguating polysemous terms, mitigating ambiguity in translation tasks and enhancing semantic precision. Furthermore, a primary challenge in multilingual lexical resources involves aligning polysemous terms across languages to support diverse translation applications. Neural technologies and deep learning provide advanced methodologies, substantially improving the

disambiguation of polysemous terms within translation studies. However, many studies are limited to specific experimental datasets and models, lacking comprehensive validation across diverse languages and domains. Future research should extend the application of these models to diverse linguistic contexts, particularly by evaluating polysemy disambiguation in naturalistic translation contexts to enhance their reliability and adaptability in practical translation applications across varied cultural settings.

3.3.4 Polysemy in Literary and Cultural Translation

Polysemy plays a pivotal role in maintaining semantic depth and coherence in cross-cultural translation. Among the 36 studies reviewed, three address polysemy in literary and cultural translation. Research on culturally specific expressions investigates the translation of polysemous terms in cultural symbols, culinary terminology, and film titles. Oster & Molés-Cases (2016) investigated the polysemy of culinary cultural terminology, elucidating the extent to which specific cultural meanings of Eastern culinary terms are effectively translated into Western contexts. Their findings demonstrate that polysemous terms exhibit distinct interpretations across cultural backgrounds, necessitating translators to align these meanings to facilitate accurate comprehension by the target audience. Wook-Dong (2017) investigated the translation of film titles, examining the extent to which translators address the cultural metaphors and symbolic meanings conveyed by polysemous terms. He demonstrated that polysemous terms in film titles frequently convey profound cultural symbols, necessitating translators to balance semantic fidelity and cultural metaphor to preserve the intended impact. These studies indicate that translating polysemous terms in culturally specific expressions plays a critical role in ensuring cross-cultural semantic coherence, demanding cultural competence and translational expertise.

Furthermore, researchers investigate strategies to preserve the multifaceted semantic structure and metaphorical richness of the source text within the target language. Zhang & Humblé (2022) examined the translation of the polysemous term “yao” in *Dream of the Red Chamber*, exploring strategies to preserve its multiple meanings and symbolism across languages. Their findings demonstrate that polysemous terms in literary works convey profound metaphorical and cultural significance, necessitating translators to identify expressions in the target language that capture these deeper meanings. Corbett & Li (2021), when investigating cross-cultural translation of literary metaphors, observed that the translation of polysemous terms encompasses both semantic transfer and the conveyance of cultural and emotional resonance. Preserving the emotional undertone and literary style associated with polysemous terms remains essential to translational efficacy.

In translating polysemous terms in culturally specific expressions and literary works, translators need to address the multifaceted semantic structures and cultural symbols to achieve precise representation of the original text's core meanings. These studies highlight the distinct challenges of polysemy in cross-cultural translation, demonstrating that the translation of polysemous terms in cultural and religious texts encompasses both semantic transfer and the integration of cultural context and emotional resonance. Future research should investigate the extent to which polysemy manifests across a broader range of cultural contexts and language

pairs, particularly evaluating the efficacy of various translation strategies in translating polysemous terms within naturalistic translation contexts. Additionally, elucidating translators' strategies for addressing polysemy in diverse cultural and religious contexts can offer comprehensive guidance, ultimately enhancing semantic accuracy and cultural adaptability in translation.

3.3.5 Polysemy in Legal Translation and Terminology Studies

Legal terminology frequently displays polysemy, with meanings that diverge considerably across distinct legal systems and jurisdictional contexts. Precise translation of polysemous terms in legal contexts remains essential to ensure the legal accuracy and terminological consistency of translated texts. Of the 36 studies reviewed, 11 investigate polysemy in legal translation and terminology studies. Bijural translation of legal terms constitutes a critical research domain, particularly in addressing the polysemous nature of legal terminology across systems. Due to the conceptual disparities between legal systems, translators frequently encounter semantic challenges in managing polysemous terms. Chromá (2011) examined the translation of polysemous terms in the English-French bijural system, elucidating the extent to which semantic adaptations ensure terminological alignment with the target legal framework. Their findings demonstrate that, owing to conceptual disparities, certain polysemous terms necessitate semantic refinement to conform to the terminological standards of the target legal system. Lan (2017) advanced the study of polysemy management in bijural terminology alignment, advocating a “differential translation” approach to reconcile semantic disparities across legal systems. Through the application of differential translation strategies, translators effectively mitigate semantic disparities, thereby enhancing the legal accuracy and practical utility of translated texts.

Terminology education and lexicography constitute critical domains for addressing polysemy in legal translation training and resource development. Van (2007) investigated the function of polysemy in legal translation dictionaries, elucidating how precise definitions and semantic annotations facilitate students' comprehension of polysemous legal terminology. Their findings demonstrate that incorporating examples of polysemous terms in translation dictionaries enhances learners' ability to discern nuanced meanings, thereby supporting precise lexical selections in legal translation tasks. Chromá (2011) further examined the integration of polysemy and synonymy analysis into terminology education, elucidating its role in fostering students' comprehension of polysemous terms in bijural translation. Their findings indicate that illustrating semantic distinctions through authentic legal translation examples heightens students' awareness of legal text semantics, thereby enhancing their capacity to differentiate polysemous and synonymous terms. These studies underscore the necessity of precise polysemy management in translation education, demonstrating that systematic terminology instruction is essential for cultivating translators' expertise in addressing polysemy in legal translation.

Implementing differential translation strategies to address polysemy effectively mitigates semantic disparities across legal systems, thereby enhancing translation precision and practical utility. Furthermore, integrating polysemy management into terminology education and

lexicography equips translation students to select precise lexical items in legal translation, thereby elevating the professional caliber of translated texts. Nevertheless, existing research predominantly relies on experimental settings and case studies, rather than extensive empirical validation across diverse legal translation contexts. Future research is encouraged to apply these strategies across diverse legal systems and contexts, particularly through empirical investigations into polysemy management in naturalistic legal translation settings, in order to ascertain their broad applicability and efficacy in professional practice.

3.3.6 Domain-specific Synthesis for Polysemy Study

With the increasing demand for cross-disciplinary and multilingual translation, research on polysemy has achieved significant progress across domains. Nevertheless, a primary challenge in translating polysemous terms lies in the diverse translation strategies required across domains such as law, literature, and technical communication (Naveen & Trojovský, 2024). For instance, in legal translation, polysemy requires rigorous precision owing to the potential legal ramifications of misinterpretation. For instance, the term “charge” within legal domains may denote either an accusation in criminal law or a financial obligation in business law. Consequently, legal translators employ disambiguation strategies, leveraging contextual analysis and terminological alignment, to ensure accurate rendering of meanings within their respective legal frameworks.

Conversely, literary translation adopts a distinct approach to polysemy, as translators often employ dynamic equivalence to convey comparable emotional resonance in the target language. For instance, the term “light” may encompass meanings ranging from brightness to hope and spiritual enlightenment. Literary translators often prioritize metaphorical or symbolic interpretations to resonate with the target audience, depending upon the genre.

In the realm of machine translation, polysemy is typically managed via statistical models leveraging extensive corpora. However, this approach encounters significant challenges in disambiguating terms such as “bank”, which can denote either a financial institution or a river’s edge. While neural machine translation (NMT) systems increasingly excel at context-based disambiguation, they frequently misinterpret polysemous terms in the absence of sufficient context, resulting in inaccuracies in automated translations.

An analysis of these three domains demonstrates that while polysemy’s theoretical foundation remains consistent, practical approaches and translation strategies differ significantly contingent upon the domain. For instance, where legal translation prioritizes clarity and precision, literary translation emphasizes interpretive flexibility and cultural nuance. On the other hand, machine translation which relies on context-driven algorithms, encounters limitations in nuanced semantic disambiguation.

4. Recommendation on Polysemy Study in Translation

This review identifies several directions for future research on polysemy in translation studies, building upon cross-domain insights. First, significant limitations remain in the scope and

depth of research themes, particularly regarding culturally nuanced and genre-specific texts, such as literary texts. Beyond the linguistic complexity of polysemy, cultural factors significantly influence the translation of polysemous terms. For instance, the term family in English typically denotes a nuclear family, whereas in many non-Western cultures, such as the Arab world, it denotes an extended kinship group including cousins, uncles, aunts, and close associates. In literary translation from Arabic, translators must determine whether to retain the cultural connotations of the term or select a more generalized equivalent aligned with the target culture's familial norms. Inadequate attention to these cultural nuances results in either overly generalized or inaccurate translations. Therefore, future research should conduct a rigorous analysis of how cross-cultural differences in interpreting polysemous terms shape the selection and formulation of translation strategies. For example, the term freedom is rendered differently in U.S. legal documents compared to Saudi Arabia, where cultural conceptions of rights and freedoms differ. Inadequate focus on these issues may result in misinterpretations concerning polysemous terms, extending beyond linguistic inaccuracies to affect the representation of core cultural values.

Additionally, quantitative methods alone provide limited insights into practical translation contexts, particularly in scenarios requiring nuanced emotional and cultural expression. Quantitative analysis frequently fails to capture the layered semantic and symbolic meanings of polysemous terms within specific contexts. This shortcoming is particularly evident in the translation of literary texts, where semantic intricacies are critical. Integrating qualitative research methods, such as content and case analysis, facilitates a more thorough analysis of polysemous terms in literary contexts, offering robust theoretical foundations for translation practice.

Furthermore, existing polysemy research under emphasizes highly ambiguous polysemous terms. This emphasis limits the field's ability to address complex texts and meet distinct translation requirements. Future research examining highly ambiguous polysemous terms, particularly in the context of Chinese literature such as wuxia novels, would substantially expand the theoretical framework of polysemy research in translation. Through integrating qualitative methods, such as content and case analysis, researchers can achieve a thorough understanding of how polysemous terms function within specific cultural contexts, elucidating their emotional and metaphorical dimensions. This methodological innovation would facilitate the development of a more robust theoretical framework for polysemy in translation, equipping the field to address the distinct requirements of literary translation and improve cross-cultural communication.

5. Conclusion

Employing the PRISMA 2020 framework, this review systematically examines studies on polysemy in translation from 1979 to the present, representing a comprehensive effort to explore the interplay between polysemy and translation across diverse disciplines and linguistic contexts. This review identifies an increasing focus on polysemy research within fields requiring high precision, such as law, medicine, and technology, underscoring the necessity of

precise management of polysemous terms in multilingual communication.

Methodologically, the majority of studies emphasize disambiguation strategies and statistical modeling, reflecting a quantitative orientation in polysemy research. However, this methodological emphasis highlights a gap in qualitative approaches, constraining nuanced insights into contexts with layered semantic and cultural nuances. Additionally, research themes predominantly concentrate on polysemy disambiguation in specialized fields, with minimal exploration of highly ambiguous polysemous terms within culturally nuanced contexts.

This review contributes to translation studies by elucidating trends, methodologies, and thematic priorities, while highlighting underexplored areas, such as the management of polysemous terms in literary translation and research on low-resource language pairs. A notable limitation lies in the predominant focus on high-resource language pairs, with limited attention to the distinct polysemous structures of less-studied languages. Additionally, overreliance on high-quality yet limited corpora may constrain the applicability of findings to diverse linguistic and cultural contexts. Future research should prioritize low-resource languages, broader cross-cultural settings, and qualitative methodologies, such as content and case analysis, to enhance understanding of polysemy's function across diverse translation contexts. Emphasizing these underexplored areas will strengthen both the practical applicability and theoretical rigor of polysemy research, establishing a more robust theoretical framework for the management of polysemous terms in translation.

References

- Abdul-Ghafour, A. Q. K. M., Awal, N. M., Zainudin, I. S., & Aladdin, A. (2019). The Interplay of Qur'ānic synonymy and polysemy with special reference to Al-asfār and Al-kutub (the books) and their English translations. *3L, Language, Linguistics, Literature*, 25(1). <http://dx.doi.org/10.17576/3L-2019-2501-10>
- Abdul-Raof, H. (2004). The Qur'an: Limits of translatability. *Cultural encounters in translation from Arabic*, 91-106. <https://doi.org/10.21832/9781853597459-010>
- Adelstein, A., & Cabré, M. T. (2002). The specificity of units with specialized meaning: polysemy as explanatory factor. *delta: documentação de estudos em lingüística teórica e aplicada*, 18, 1-25. <https://doi.org/10.1590/S0102-44502002000300003>
- Akhobadze, B. (2019). Polysemy in machine translation exemplified in english and georgian. *Bull. Georg. Natl. Acad. Sci*, 13(1).
- Alqinai, J. (2011). Convergence and divergence in the interpretation of quranic polysemy and lexical recurrence. *Kalbu Studijos*, (19), 27-38. <https://doi.org/10.5755/j01.sal.0.19.943>
- Al-Saudi, J. (2023). Translation of polysemous meanings of the word “Qadha”(قضى) in the Holy Qur'an: an analytical semantic study. *Dirasat: Human and Social Sciences*, 50(2), 265-274. <https://doi.org/10.35516/hum.v50i2.4936>
- Apidianaki, M., & Sagot, B. (2014). Data-driven synset induction and disambiguation for

wordnet development. *Language Resources and Evaluation*, 48, 655-677. <https://doi.org/10.1007/s10579-014-9291-2>

Araghi, S., & Palangkaraya, A. (2024). The link between translation difficulty and the quality of machine translation: a literature review and empirical investigation. *Language Resources and Evaluation*, 1-22. <https://doi.org/10.1007/s10579-024-09735-x>

Bolduc, M. (2022). Translation and the promise of analogy. *Asia Pacific Translation and Intercultural Studies*, 9(3), 245-263. <https://doi.org/10.1080/23306343.2022.2133486>

Bouveret, M. (1998). Approche de la dénomination en langue spécialisée. *Meta*, 43(3), 393-410. <https://doi.org/10.7202/002130ar>

Burnham, J. F. (2006). Scopus database: A review. *Biomedical Digital Libraries*, 3(1), 1-8. <https://doi.org/10.1186/1742-5581-3-1>

Burton, B., & Carter, R. (2006). Literature and the language of literature. In K. Brown (Ed.), *Encyclopedia of Language & Linguistics* (2nd ed., pp. 267-274). Elsevier. <https://doi.org/10.1016/B0-08-044854-2/00522-8>

Cañizares-Álvarez, C., & Gathercole, V. C. M. (2020). The influence of first language polysemy and first language and second language lexical frequencies on second language learners' use of false cognates. *International Journal of Bilingualism*, 24(3), 530-541. <https://doi.org/10.1177/1367006918814380>

Chromá, M. (2011). Synonymy and polysemy in legal terminology and their applications to bilingual and bijural translation. *Research in Language*, 9(1), 31-50. <https://doi.org/10.2478/v10015-011-0004-2>

Corbett, J., & Li, L. (2021). Polysemy, synonymy, and metaphor: The use of the Historical Thesaurus of English in translation studies. *Digital Scholarship in the Humanities*, 36(4), 827-839. <https://doi.org/10.1093/llc/fqab008>

Creswell, J. W. (2010). Mapping the developing landscape of mixed methods research. *SAGE handbook of mixed methods in social & behavioral research*, 2(0), 45-68. <https://doi.org/10.4135/9781506335193.n2>

Degani, T., & Tokowicz, N. (2010). Ambiguous words are harder to learn. *Bilingualism: Language and cognition*, 13(3), 299-314. <https://doi.org/10.1017/S1366728909990411>

Degani, T., & Tokowicz, N. (2013). Cross-language influences: Translation status affects intraword sense relatedness. *Memory & Cognition*, 41, 1046-1064. <https://doi.org/10.3758/s13421-013-0322-9>

Ding, Q., Cao, H., Feng, Z., Yang, M., & Zhao, T. (2025). Enhancing bilingual lexicon induction via harnessing polysemous words. *Neurocomputing*, 611, 128682. <https://doi.org/10.1016/j.neucom.2024.128682>

Elston-Güttler, K. E., & Williams, J. N. (2008). First language polysemy affects second language meaning interpretation: Evidence for activation of first language concepts during

second language reading. *Second Language Research*, 24(2), 167-187.
<https://doi.org/10.1177/0267658307086300>

Finkbeiner, M., Forster, K., Nicol, J., & Nakamura, K. (2004). The role of polysemy in masked semantic and translation priming. *Journal of memory and language*, 51(1), 1-22.
<https://doi.org/10.1016/j.jml.2004.01.004>

Frassi, P. (2022). La représentation de la polysémie et des termes complexes de type locution faible dans une base de données terminologique: Travail et son entourage dans le domaine du commerce international. *Terminology*, 28(1), 103-128. <https://doi.org/10.1075/term.21004.fra>

Frinculescu, I. C. (2014). Etymology, polysemy and translation. the case of the word pattern in the romanian medical language. *Revue Roumaine De Linguistique*, 59(4), 369-380.
<https://dspace.bcu-iasi.ro/handle/123456789/15708>

Hawkins, S. (2017). Differential translation: A proposed strategy for translating polysemous language in German philosophy. *Translation and Interpreting Studies*, 12(1), 116-136.
<https://doi.org/10.1075/tis.12.1.06haw>

L'Homme, M. C. (2024). Managing polysemy in terminological resources. *Terminology*, 30(2), 216-249. <https://doi.org/10.1075/term.22017.lho>

Lan, Y. (2017). Accuracy and precision of polysemous judgment terms in legal translation: A Corpus-based method and discussion. *Journal of Language Teaching and Research*, 8(1), 199-203. <http://dx.doi.org/10.17507/jltr.0801.25>

Lefever, E., & Hoste, V. (2014). Parallel corpora make sense: Bypassing the knowledge acquisition bottleneck for Word Sense Disambiguation. *International Journal of Corpus Linguistics*, 19(3), 333-367. <https://doi.org/10.1075/ijcl.19.3.02lef>

Lin, T. J., & Lan, Y. J. (2015). Language learning in virtual reality environments: Past, present, and future. *Journal of Educational Technology & Society*, 18(4), 486-497. <http://dblp.uni-trier.de/db/journals/ets/ets18.html#LinL15>

Macaro, E., Handley, Z., & Walter, C. (2012). A systematic review of CALL in English as a second language: Focus on primary and secondary education. *Language Teaching*, 45(1), 1-43.
<https://doi.org/10.1017/S0261444811000395>

Mall, S., & Jaiswal, U. C. (2017). Shallow Parsing and Word Sense Disambiguation Used for Machine Translation from Hindi to English Languages. *International Journal of Intelligent Engineering & Systems*, 10(3). DOI: 10.22266/ijies2017.0630.43

Naveen, P., & Trojovský, P. (2024). Overview and challenges of machine translation f or contextually appropriate translations. *Iscience*, 27(10). <https://doi.org/10.1016/j.isci.2024.110878>

Okoli, C. (2015). A guide to conducting a standalone systematic literature review. *Communications of the Association for Information Systems*, 37. <https://doi.org/10.17705/1CAIS.03743>

- Oster, U., & Molés-Cases, T. (2016). Eating and drinking seen through translation: A study of food-related translation difficulties and techniques in a parallel corpus of literary texts. *Across Languages and Cultures*, 17(1), 53-75. <https://doi.org/10.1556/084.2016.17.1.3>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *bmj*, 372. <https://doi.org/10.1136/bmj.n71>
- Pak, A., Hurbanska, S., Boiko, O., Avramenko, V., & Katerynych, P. (2023). The Formalized Semantics of Neologisms-Slangisms in the Context of the English Translation of A Military Narrative. *World Journal of English Language*, 13(6). <https://doi.org/10.5430/wjel.v13n6p537>
- Pranckutė, R. (2021). Web of Science (WoS) and Scopus: The titans of bibliographic information in today's academic world. *Publications*, 9(1), 12. <https://doi.org/10.3390/publications9010012>
- Prieto Ramos, F. (2021). Translating legal terminology and phraseology: between inter-systemic incongruity and multilingual harmonization. *Perspectives*, 29(2), 175-183. <https://doi.org/10.1080/0907676X.2021.1849940>
- Raukko, J. (2003). Polysemy as flexible meaning: experiments with English get and Finnish pitää. *Trends in Linguistics Studies and Monographs*, 142, 161-194. <https://doi.org/10.1515/9783110895698.161>
- Rodd, J., Gaskell, G., & Marslen-Wilson, W. (2002). Making sense of semantic ambiguity: Semantic competition in lexical access. *Journal of memory and language*, 46(2), 245-266. <https://doi.org/10.1006/jmla.2001.2810>
- Steinhardt, I., Schneijderberg, C., Götze, N., Baumann, J., & Krücken, G. (2017). Mapping the quality assurance of teaching and learning in higher education: The emergence of a specialty?. *Higher Education*, 74(2), 221-237. <https://doi.org/10.1007/s10734-016-0045-5>
- Tsafnat, G., Glasziou, P., Choong, M. K., Dunn, A., Galgani, F., & Coiera, E. (2014). *Systematic review automation technologies*. *Systematic reviews*, 3, 1-15. <https://doi.org/10.1186/2046-4053-3-74>
- Van Vaerenbergh, L. (2007). Polysemy and synonymy: Their management in Translation Studies dictionaries and in translator training. A case study. *Target. International Journal of Translation Studies*, 19(2), 235-254. <https://doi.org/10.1075/target.19.2.05van>
- Viberg, Å. (2012). Language-specific meanings in contrast: A corpus-based contrastive study of Swedish få 'get'. *Linguistics*, 50(6), 1413-1461. <https://doi.org/10.1515/ling-2012-0044>
- Vu, V. H., Nguyen, Q. P., Nguyen, K. H., Shin, J. C., & Ock, C. Y. (2020). Korean-Vietnamese neural machine translation with named entity recognition and part-of-speech tags. *IEICE TRANSACTIONS on Information and Systems*, 103(4), 866-873. <https://doi.org/10.1587/transinf.2019EDP7154>
- Wook-Dong, K. (2017). Lost in translation: (Mis) translation of foreign film titles in Korea.

Babel, 63(5), 729-745. <https://doi.org/10.1075/babel.00006.woo>

Yang, K., Liu, D., Qu, Q., Sang, Y., & Lv, J. (2021). An automatic evaluation metric for Ancient-Modern Chinese translation. *Neural Computing and Applications*, 33, 3855-3867. <https://doi.org/10.1007/s00521-020-05216-8>

Yunus, M. A. M., Zainuddin, R., & Abdullah, N. (2013). Semantic method for query translation. *Int. Arab J. Inf. Technol.*, 10(3), 253-259.

Zaw, M. C. M., & Alpatova, P. N. (2023). *Ambiguity in the Russian terminology of the energy industry*. *XLinguae*, 16(1), 60-69. <https://doi.org/10.18355/XL.2023.16.01.05>

Zhang, T., Wen, X., & Humblé, P. (2022). An RCG-Based Analysis of the Translation of Polysemous ‘Yao’ in A Dream of Red Mansions. *Cadernos de Tradução*, 42, e84498. <https://doi.org/10.5007/2175-7968.2022.e84498>

Zhou, D., Qu, W., Li, L., Tang, M., & Yang, A. (2022). Neural topic-enhanced cross-lingual word embeddings for CLIR. *Information Sciences*, 608, 809-824. <https://doi.org/10.1016/j.ins.2022.06.081>

Acknowledgments

We thank the anonymous reviewers for their valuable comments on my manuscript.

Funding

Not Applicable.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Macrothink Institute.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

Open access

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.