

Representation of polysemy in the digital age: from traditional lexicography to word sense disambiguation algorithms

Mahasti Shuxratjonovna Sayfilloyeva
Samarkand State Institute of Foreign Languages

Abstract: This article explores polysemy as a central issue in modern linguistics in the context of digital transformation. It examines the evolution of approaches to meaning representation, from traditional lexicography to computational linguistics and Word Sense Disambiguation (WSD) algorithms. Particular attention is given to the cognitive nature of polysemy, the mechanisms of semantic extension, and the crucial role of context in interpreting multiple meanings. The study concludes that despite significant advances in artificial intelligence, the accurate interpretation of meaning remains one of the most challenging problems in language science.

Keywords: polysemy, semantic structure, lexicography, cognitive linguistics, digital linguistics, context, WSD, ambiguity

Language transcends its role as a mere signaling system, functioning instead as a profound mirror of human intellect and cultural perspectives. This symbiotic relationship is most vividly illustrated by polysemy - the capacity of a single lexical unit to encompass a network of interconnected meanings within a coherent semantic framework. Far from being a series of arbitrary definitions, polysemantic structures act as sophisticated cognitive tools that enable the compression of multifaceted concepts into streamlined linguistic forms. In the contemporary digital landscape, the study of these structures has gained unprecedented importance, driven by the necessity for artificial intelligence and Natural Language Processing (NLP) systems to decode lexical ambiguity with high precision. While traditional lexicography offers a structured classification of meanings, it often fails to encapsulate the fluid, context-contingent nature of language in practice. Consequently, modern scholarship is increasingly gravitating toward computational, data-driven paradigms that transition from mere description to the automated processing of semantic networks.

From a cognitive standpoint, polysemy reflects the fundamental architectonics of human categorization. Rather than proliferating unique words for every novel concept, the human mind utilizes metaphorical extension and metonymic transfer to map observable phenomena onto abstract ideas. Metaphorical mapping is central to this process; for instance, both the English *branch* and the Uzbek *shox* transition from botanical terms to descriptors of organizational or familial structures. This illustrates a

universal cognitive tendency to conceptualize social and institutional hierarchies through the prism of familiar physical experiences.

Metonymy further enriches this landscape by establishing associative links between concepts, as exemplified by the terms *crown* in English and *toj* in Uzbek. Both words transcend their literal meaning as headpieces to symbolize institutional authority, honor, and social prestige, revealing that polysemy is a vital carrier of social meaning. Additionally, the role of context in interpreting words like *light* or *yorug'* highlights that meaning is not static but dynamically triggered by situational, pragmatic, and sociocultural cues.

The divergent semantic trajectories of English and Uzbek are fundamentally dictated by their respective cultural ontologies. In English, polysemantic evolution is deeply intertwined with an extensive literary tradition and its dominance in global technical nomenclature, frequently emphasizing conceptual abstraction and the primacy of the individual. For instance, lexical units like *apple* or *home* encapsulate a dense stratification of meanings, ranging from theological symbolism to modern digital branding and subjective emotional states. Conversely, the Uzbek language - anchored in a pastoral-nomadic legacy, Sufi philosophical thought, and interdependent societal structures - exhibits semantic expansions that give voice to ecological, metaphysical, and collective experiences. Lexemes such as *Oq*, *uy*, or *ruh* act as linguistic archives, where meanings are prioritized based on communal duties and the preservation of historical identity rather than mere utilitarian description.

The advent of the digital era has radically altered the linguistic landscape, employing neural architectures and massive datasets to confront the intricacies of Word Sense Disambiguation (WSD). Modern computational frameworks are now tasked with deciphering the same semantic nuances that the human intellect processes subconsciously, utilizing high-dimensional contextual embeddings and sophisticated algorithmic learning. Nevertheless, achieving authentic semantic transparency remains a formidable challenge; WSD persists as a critical frontier because genuine understanding necessitates a fusion of statistical linguistic patterns with expansive, real-world encyclopedic knowledge. This evolution from static, descriptive lexicography to dynamic, predictive modeling emphasizes an urgent requirement: the synthesis of cognitive linguistic theory with advanced data science. Only through this integration can we hope to develop artificial systems capable of a depth of semantic interpretation that truly approximates human cognitive processing.

In conclusion, polysemy serves as a definitive mirror of the intricate bond between the human mind and its cultural environment. While the technical mechanisms of semantic expansion - metaphor and metonymy - are globally consistent, the values they transmit are distinctly national. A comparative analysis reveals that English polysemy often highlights technological progress and abstraction, whereas Uzbek polysemy

emphasizes spiritual depth and social cohesion. Ultimately, polysemantic words provide efficient, holistic representations of complex realities, acting as a bridge between abstract cognition and lived cultural experience. Future research must continue to synthesize theoretical linguistics with technological innovation to achieve a comprehensive understanding of how distinct communities conceptualize reality through the power of the word.

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