

Verb Argument Structure

Entry #:	38.81.7
Word Count:	13727 words
Reading Time:	69 minutes
Last Updated:	September 28, 2025

"In space, no one can hear you think."

Table of Contents

Contents

1	Verb Argument Structure	2
1.1	Introduction to Verb Argument Structure	2
1.2	Historical Development of Argument Structure Theory	3
1.3	Theoretical Frameworks for Analyzing Argument Structure	5
1.4	Core Concepts and Terminology	7
1.5	Types of Argument Structures	9
1.6	Cross-linguistic Variation in Argument Structure	11
1.7	Syntactic Realization of Arguments	13
1.8	Semantic Roles and Thematic Relations	15
1.9	Acquisition of Argument Structure	17
1.10	Processing and Psycholinguistics of Argument Structure	20
1.11	Computational Approaches to Argument Structure	23
1.12	Applications and Future Directions	25

1 Verb Argument Structure

1.1 Introduction to Verb Argument Structure

Verbs stand as the dynamic core of human language, driving the action and state descriptions that form the backbone of communication. The concept of verb argument structure represents one of the most fundamental insights in modern linguistics, revealing how verbs dictate the grammatical architecture of sentences around them. At its essence, verb argument structure refers to the specification of how many and what types of arguments a particular verb requires to form a complete and grammatical expression. Consider how verbs like “sleep,” “eat,” and “give” demand different grammatical environments: we can say “She sleeps” but not “She sleeps the book”; “She eats” is complete, but “She eats the apple” adds more information; while “She gives” feels incomplete without additional elements, as in “She gives the book to him.” These differences reflect each verb’s argument structure, a blueprint that determines which participants must be expressed and how they relate to the verbal event. The distinction between arguments and adjuncts proves crucial here—arguments are complements required by the verb’s meaning, while adjuncts represent optional elements that provide additional information but are not demanded by the verb itself. For instance, in “She eats apples in the kitchen,” “apples” functions as an argument required by “eat,” whereas “in the kitchen” serves as an optional adjunct that could be omitted without affecting grammaticality. The concept of valency, borrowed from chemistry by linguist Lucien Tesnière in the mid-twentieth century, provides a useful metaphor for understanding how verbs “bind” with different numbers of arguments, ranging from zero (as in weather verbs like “It rains”) to three or more in complex predicates.

The systematic study of verb argument structure represents a convergence of insights stretching back to ancient grammatical traditions. Early Greek and Roman grammarians, though not using our modern terminology, recognized that verbs required different types of complements to form complete thoughts. The Indian grammarian Panini, whose sophisticated analysis of Sanskrit dates to the 4th century BCE, identified relationships between verbs and their accompanying elements through his intricate system of rules. However, it was not until the development of modern linguistic theory in the twentieth century that argument structure emerged as a central concept bridging lexical meaning and syntactic form. The generative revolution initiated by Noam Chomsky in the 1950s and 1960s brought new precision to these observations, establishing the Projection Principle which maintains that lexical properties like argument structure must be represented at every level of syntactic analysis. This principle elegantly captures how the information stored in our mental lexicon about individual verbs constrains the possible sentence structures in which they can appear. The significance of argument structure extends far beyond mere syntactic description—it represents a critical interface between semantics and syntax, revealing how the meaning of a verb determines its grammatical behavior. Different theoretical frameworks, from Government and Binding Theory to Lexical-Functional Grammar and Construction Grammar, have developed sophisticated mechanisms for modeling argument structure, each offering unique insights into this fundamental aspect of human language. The universality of argument structure across languages suggests it reflects cognitive patterns deeply embedded in how humans conceptualize events and their participants.

This comprehensive exploration of verb argument structure will unfold through twelve carefully crafted sections, each building upon previous insights while introducing new dimensions of this fascinating linguistic phenomenon. The journey begins with a historical overview in Section 2, tracing the evolution of argument structure theory from ancient grammatical traditions to contemporary frameworks. Section 3 then surveys the major theoretical approaches currently employed to analyze argument structure, comparing their explanatory power and theoretical commitments. In Section 4, we establish the technical vocabulary essential for deeper engagement with the topic, defining key concepts with precision and clarity. Section 5 presents a typology of argument structures found across languages, from basic intransitive and transitive patterns to more complex psych verb constructions. The cross-linguistic variation in argument structure receives detailed treatment in Section 6, revealing both universal patterns and language-specific innovations. Section 7 examines how arguments are realized in syntactic structures, exploring the mapping between semantic roles and grammatical positions. The semantic dimensions of argument structure take center stage in Section 8, where we delve into the classification of semantic roles and theories of role hierarchy. The acquisition of argument structure by children forms the focus of Section 9, illuminating how humans develop this aspect of linguistic knowledge. Section 10 shifts to psycholinguistic perspectives, examining how argument structures are processed in real-time comprehension and production. Computational approaches to argument structure are explored in Section 11, revealing both challenges and advances in modeling this phenomenon artificially. Finally, Section 12 considers practical applications and future directions, highlighting the relevance of argument structure theory to fields ranging from language teaching to cognitive science. Throughout this exploration, we will encounter fascinating questions that continue to animate linguistic research: How universal are argument structure patterns across human languages? What principles govern the mapping between semantic roles and syntactic positions? How do children acquire the complex argument structures of their native language? And how might our understanding of argument structure inform our broader theories of human cognition and communication?

1.2 Historical Development of Argument Structure Theory

The historical trajectory of argument structure theory illuminates not only the development of linguistic thought but also the evolving understanding of how human language systematically encodes events and their participants. This journey through intellectual history reveals how ancient observations about verb-complement relationships gradually transformed into sophisticated theoretical frameworks, each building upon previous insights while introducing new perspectives on the fundamental architecture of linguistic expression.

Ancient grammatical traditions across multiple civilizations laid important groundwork for modern understanding of argument structure, though these early scholars framed their observations in different conceptual terms. In India, the remarkable grammarian Panini, working around the 4th century BCE, developed an intricate system for analyzing Sanskrit that implicitly recognized relationships between verbs and their accompanying elements through his sutras. His sophisticated analysis of verb roots and their affixal requirements demonstrated an early recognition that verbs demand specific grammatical environments for complete

expression. Meanwhile, in the Greek tradition, Aristotle's logical analysis of propositions distinguished between subjects and predicates, establishing a conceptual foundation for understanding how verbs relate to their arguments. The Stoics further developed these ideas, examining how different types of verbs require different complements to form complete thoughts. Dionysius Thrax, in his influential "Art of Grammar" (2nd century BCE), classified verbs according to their syntactic behavior, noting differences between transitive and intransitive constructions and implicitly recognizing what we now call valency differences. Roman grammarians like Priscian (5th-6th century CE) preserved and expanded upon these Greek insights, creating detailed classifications of verb types based on their complementation patterns. During the medieval period, the Modistae grammarians of the 13th and 14th centuries developed speculative grammars based on Aristotelian philosophy, conceptualizing language as reflecting the structure of reality itself. Their examination of modes of being (*modi essendi*), understanding (*modi intelligendi*), and signifying (*modi significandi*) led to sophisticated analyses of how verbs convey different types of actions and states and how these require appropriate complements to fully express their meaning. Though these early approaches lacked the formal precision of modern linguistic theory, they demonstrated remarkable insight into the systematic relationship between verbs and their arguments.

The emergence of modern linguistic theory in the 20th century brought revolutionary advances in the understanding of argument structure. Lucien Tesnière's groundbreaking work in the 1930s and 1940s introduced the concept of valency to linguistics, borrowing the metaphor from chemistry to describe how verbs "bind" with different numbers of arguments. His dependency grammar framework, detailed in "Éléments de syntaxe structurale" (published posthumously in 1959), represented sentences as hierarchical structures with verbs at their centers, connected to their arguments through dependency relations. This structuralist approach provided a powerful visual metaphor for understanding how verbs impose specific structural requirements on sentences. Meanwhile, in America, the generative revolution initiated by Noam Chomsky transformed the study of syntax and with it, the understanding of argument structure. In "Syntactic Structures" (1957) and subsequent works, Chomsky developed the concept of subcategorization, formalizing the idea that verbs belong to different categories based on the types and numbers of complements they require. The Projection Principle, introduced in the 1980s within the Government and Binding framework, established that lexical properties like argument structure must be represented at every level of syntactic analysis, creating a direct link between the mental lexicon and syntactic structure. This period also saw significant developments in the understanding of thematic relations, with Charles Fillmore's case grammar (1968) proposing that underlying semantic cases such as Agent, Patient, and Instrument determine syntactic realization. Jeffrey Gruber's work on thematic relations (1965) and Ray Jackendoff's further refinements established the concept of theta roles, which became central to the Government and Binding framework's theta theory. These developments collectively established argument structure as a crucial interface between lexical semantics and syntactic form, providing increasingly precise tools for analyzing how verb meaning determines grammatical structure.

Recent decades have witnessed continued theoretical innovation in the study of argument structure, with competing frameworks offering distinct perspectives on this fundamental aspect of language. The 1980s saw the emergence of lexical-functional approaches that challenged purely syntactic treatments of argument structure. Lexical-Functional Grammar (LFG), developed by Joan Bresnan and Ronald Kaplan, proposed a

more flexible architecture where argument structure information in the lexicon maps to both syntactic and functional representations. Head-Driven Phrase Structure Grammar (HPSG), pioneered by Carl Pollard and Ivan Sag, integrated argument structure within a richly articulated lexical hierarchy, allowing for highly detailed specifications of verbs' combinatorial properties. The 1990s and early 2000s witnessed the rise of construction grammar approaches, most notably in the work of Adele Goldberg, who argued that argument structure is determined not just by individual verbs but by constructional patterns that carry their own meaning. Her "Constructions: A Construction Grammar Approach to Argument Structure" (1995) demonstrated how sentence-level patterns like the ditransitive construction ("She gave him a book") contribute meaning independently of the verbs that appear in them. Meanwhile, within the generative tradition, the minimalist program initiated by Chomsky in the 1990s sought to reduce argument structure phenomena to more fundamental operations like Merge and feature checking, proposing that argument structure realization follows from broader principles of efficient computation. These diverse approaches reflect ongoing theoretical debates about the nature of argument structure: Is it primarily a lexical property, a constructional property, or an emergent phenomenon? How universal are argument structure patterns across languages? What principles govern the mapping between semantic roles and syntactic positions? Contemporary research continues to explore these questions through increasingly sophisticated methodologies, including corpus linguistics, experimental approaches, and computational modeling, ensuring that argument structure remains a vibrant area of linguistic inquiry.

This historical development of argument structure theory reveals a fascinating intellectual journey from ancient observations to modern theoretical sophistication, each era building upon previous insights while introducing new conceptual tools. As we turn to examine the major theoretical frameworks currently employed in the study of argument structure, we will see how these historical developments continue to shape contemporary approaches to understanding how verbs relate to their arguments in human language.

1.3 Theoretical Frameworks for Analyzing Argument Structure

The historical evolution of argument structure theory has culminated in a diverse landscape of contemporary theoretical frameworks, each offering distinctive perspectives on how verbs relate to their arguments and how this relationship shapes linguistic structure. These frameworks, developed over decades of linguistic research, provide complementary lenses through which we can analyze the complex interplay between lexical meaning, syntactic form, and semantic interpretation. The theoretical diversity in modern linguistics reflects the multifaceted nature of argument structure itself—a phenomenon that simultaneously touches upon semantics, syntax, cognition, and cross-linguistic patterns. As we examine these major approaches, we will discover how each framework addresses fundamental questions about argument structure while highlighting different aspects of this essential linguistic concept.

Generative approaches to argument structure, rooted in Chomsky's groundbreaking work, have evolved significantly since their inception in the 1950s. Within the Government and Binding framework of the 1980s, theta theory emerged as a central component, proposing that each argument is assigned a theta role (such as Agent, Patient, or Goal) by the verb, and that the Projection Principle ensures these lexical requirements

are reflected at every level of syntactic representation. This theoretical apparatus elegantly captures why a sentence like “John devoured the sandwich” is grammatical while “John devoured” feels incomplete—the verb “devour” requires both an Agent (the devourer) and a Patient (what is devoured), and these requirements must be satisfied syntactically. The development of the Minimalist Program in the 1990s reframed these phenomena in terms of feature checking and Merge operations, suggesting that argument structure follows from more fundamental computational principles. In this view, verbs carry features that must be checked against their arguments, and the syntactic structure emerges through the recursive application of Merge to combine these elements. Lexical conceptual structure, another key component of generative approaches, represents the interface between lexical semantics and syntax, encoding event types and participant roles that determine syntactic realization. For example, the verb “break” in its causative sense (“John broke the window”) involves a causing subevent and a becoming subevent, with different participants mapped to different syntactic positions. This rich generative tradition continues to evolve, offering increasingly sophisticated tools for analyzing how argument structure constrains and is constrained by the broader syntactic system.

Lexical-Functional Grammar (LFG), developed by Joan Bresnan and Ronald Kaplan in the 1980s, presents a distinctly different architecture for modeling argument structure. Unlike generative approaches that emphasize hierarchical syntactic structure, LFG proposes parallel levels of representation—including c-structure (constituent structure) and f-structure (functional structure)—with argument structure information primarily mediating between these levels. In LFG, verbs in the lexicon specify not only their argument structure but also how these arguments map to grammatical functions like Subject, Object, and Oblique Object. This mapping is governed by correspondence principles that link the semantic roles to their syntactic realizations. The framework’s flexibility becomes apparent in its handling of argument structure alternations, which are analyzed through lexical rules that transform one argument structure into another. For instance, the passive alternation in English (“The cat chased the mouse” → “The mouse was chased by the cat”) involves a lexical rule that demotes the Agent to an optional oblique function while promoting the Patient to subject position. LFG’s parallel architecture allows it to capture languages with freer word order than English, as the same underlying f-structure can be expressed through various c-structure configurations. The framework’s integration of syntax and semantics within a constraint-based, rather than derivational, system offers a powerful alternative to generative approaches, particularly in its ability to model typological diversity without positing language-specific syntactic operations.

Role and Reference Grammar (RRG), developed by Robert Van Valin and Randy LaPolla, offers yet another perspective on argument structure, one that places semantic and pragmatic considerations at the forefront of syntactic analysis. RRG posits two universal semantic macroroles—Actor and Undergoer—that abstract away from the proliferation of specific theta roles found in other frameworks. The Actor macrorole encompasses the more active participant in an event (typically Agents), while the Undergoer represents the more affected participant (typically Patients). These macroroles are determined by the semantic properties of the verb and the event it describes, creating a system that directly links lexical semantics to syntactic realization. RRG’s layered structure of the clause provides a sophisticated framework for understanding how argument structure interacts with other aspects of clause organization. The nucleus (predicate) and core (predicate plus its core arguments) form the central layers, while the periphery contains optional adjuncts. The framework’s

linking algorithm provides a systematic way to map semantic macroroles to syntactic positions, accounting for cross-linguistic variation while maintaining universal principles. For example, in a ditransitive clause like “Mary gave John a book,” RRG analyzes “Mary” as the Actor (initiator of the giving event), “John” as the first Undergoer (recipient), and “the book” as the second Undergoer (entity transferred), with their syntactic positions determined by language-specific mapping rules. RRG’s attention to information structure and discourse pragmatics further enriches its approach to argument structure, allowing it to explain why certain argument realizations are preferred in different discourse contexts.

Construction Grammar approaches, most notably associated with Adele Goldberg’s work, represent a significant departure from verb-centered models of argument structure. In Construction Grammar, argument structure is viewed as emerging from the interaction between verb meaning and constructional meaning, with constructions themselves carrying semantic and pragmatic information independent of the verbs that appear in them. A construction in this framework is a form-meaning pair, such as the ditransitive construction [SUBJ V OBJ1 OBJ2], which contributes the meaning of “transfer” or “caused reception.” This approach elegantly explains why we can say “She faxed him the letter” even though “fax” didn’t originally have a ditransitive use—the verb’s meaning is compatible with the constructional meaning, allowing for innovative expressions. Construction Grammar handles argument structure alternations by positing multiple constructions that verbs can participate in, rather than deriving one form from another through lexical rules. For example, the sentences “He loaded the hay onto the wagon” and “He loaded the wagon with hay” involve different constructions (caused-motion and with-adjunct, respectively) that emphasize different aspects of the same event. This framework’s emphasis on the construction as the basic unit of grammar rather than the word or phrase allows it to capture idiomatic expressions and partially filled constructions that challenge purely lexical approaches. By integrating lexical and constructional information, Construction Grammar provides a flexible model of argument structure that accounts for productivity, innovation, and cross-linguistic variation while maintaining a psychologically plausible account of how speakers construct and understand sentences.

These four theoretical frameworks—Generative, Lexical-Functional, Role and Reference, and Construction Grammar—offer complementary perspectives on the complex phenomenon of verb argument structure. Each approach illuminates different aspects of how verbs relate to their arguments, from the syntactic constraints emphasized in generative approaches to the semantic macroroles of RRG, the parallel representations of LFG, and the constructional meanings of Construction Grammar. The diversity of these frameworks reflects the multifaceted nature of argument structure itself, which simultaneously engages with semantics, syntax, cognition, and discourse. As we move forward in our exploration of verb argument structure, having established these theoretical foundations, we will now turn to examining the core concepts and terminology that provide the technical vocabulary necessary for deeper engagement with this fascinating area of linguistic study.

1.4 Core Concepts and Terminology

Having explored the diverse theoretical frameworks that analyze verb argument structure, we now turn to establishing the precise conceptual vocabulary that underpins this field of study. Regardless of whether one

approaches argument structure through generative, lexical-functional, role and reference, or constructionist lenses, certain core concepts and terminology form the essential toolkit for linguistic analysis. These fundamental ideas provide the descriptive and analytical apparatus needed to dissect how verbs relate to their arguments across languages, revealing patterns that both unify and distinguish human linguistic systems. By carefully defining these terms and examining their interrelationships, we lay the groundwork for the more specialized discussions that follow, ensuring that our exploration of argument structure proceeds with clarity and precision.

The distinction between arguments and adjuncts represents one of the most fundamental categorizations in the study of verb argument structure, separating those elements required by a verb's meaning from those that merely provide additional information. Arguments function as essential participants in the event described by the verb, forming a grammatical core without which the sentence becomes incomplete or ungrammatical. Consider the verb “devour” in English: while “The lion devoured” leaves us expecting more information, “The lion devoured the gazelle” provides the necessary Patient argument to satisfy the verb's semantic requirements. In contrast, adjuncts represent optional modifiers that enrich the description but can be omitted without affecting grammaticality. In “The lion devoured the gazelle in the savanna at dawn,” both “in the savanna” and “at dawn” function as adjuncts, providing temporal and spatial context that could be removed while leaving a perfectly grammatical sentence. Selectional restrictions offer crucial evidence for determining argument status, as verbs impose semantic constraints on their arguments that reveal their essential nature. The verb “drink,” for instance, requires a liquid as its object—we can say “She drank water” or “She drank the juice,” but “She drank the rock” violates the verb's selectional restrictions, demonstrating that “the rock” cannot function as a legitimate argument. Obligatoriness provides another diagnostic tool, though with some complications: arguments typically cannot be omitted without rendering the sentence ungrammatical, while adjuncts can. However, this criterion becomes nuanced in languages with pro-drop phenomena or in discourse contexts where arguments can be recovered pragmatically. The boundary between arguments and adjuncts sometimes blurs in complex cases, such as with locative expressions. The verb “put” requires a locative argument (“She put the book *on the table*”), making the location obligatory and thus argumental, while “sleep” takes optional locations (“She slept *in the bedroom*”) that function as adjuncts. These borderline cases reveal that argumenthood exists on a continuum rather than as a binary distinction, challenging linguists to develop more sophisticated diagnostic tests and theoretical models.

Theta roles and thematic relations form the semantic backbone of argument structure, providing a vocabulary for describing the semantic relationships between verbs and their arguments. Theta roles (from the Greek letter theta, θ) represent the specific semantic functions that arguments fulfill within the event expressed by the verb, creating a bridge between lexical meaning and syntactic realization. The inventory of theta roles includes several recurring types that appear across languages: Agents, who intentionally initiate actions (“John opened the door”); Patients or Themes, who undergo the action or change state (“The door opened”); Experiencers, who perceive or feel emotions (“Mary fears spiders”); Goals, toward which motion or transfer occurs (“She gave the gift *to her friend*”); Sources, from which motion or transfer originates (“She received the gift *from her uncle*”); and Instruments, used to perform an action (“She cut the paper *with scissors*”). These theta roles represent a linguistic formalization of broader semantic roles, refined through decades of

theoretical development to capture the precise relationships that verbs establish with their arguments. The debate about the universality and fixedness of theta roles continues to animate linguistic discussion: some theorists propose a universal, finite set of primitive theta roles that apply across all languages, while others argue for a more flexible, language-specific inventory that may vary according to lexical and grammatical patterns. The theoretical status of theta roles also remains contested—are they fundamental primitives derived directly from cognitive representations of events, or are they epiphenomena emerging from more basic conceptual structures? This question has profound implications for how we model the relationship between language and cognition, touching upon deeper issues about the nature of semantic representation. Regardless of their theoretical status, theta roles provide an indispensable descriptive tool for analyzing how meaning maps onto form, revealing systematic patterns that illuminate the architecture of human language.

Valency and subcategorization offer complementary perspectives on the number and type of arguments that verbs require, building upon the chemical metaphor introduced by Lucien Tesnière in the mid-twentieth century. Valency, borrowed from the concept of chemical bonding, describes the number of arguments that a verb “binds” with to form a complete syntactic and semantic structure. Just as oxygen has a valency of two (forming O_2) while carbon has four (forming CH_4), verbs exhibit different valencies that constrain their syntactic environments. Intransitive verbs like “sleep” have a valency of one, requiring only a subject (“The cat sleeps”); transitive verbs like “chase” have a valency of two, requiring both subject and object (“The cat chases the mouse”); and ditransitive verbs like “give” have a valency of three, requiring subject, direct object, and indirect object (“The girl gives the boy a book”). Subcategorization frames provide the syntactic counterpart to valency, specifying not only the number of arguments but also their grammatical categories and structural positions.

1.5 Types of Argument Structures

With this conceptual foundation established, we can now explore the rich typology of argument structures that manifests across human languages. The valency patterns we’ve examined—ranging from one-argument intransitive constructions to three-argument ditransitive patterns—represent just the beginning of a complex landscape of argument realization. Languages around the world exhibit remarkable diversity in how verbs combine with their arguments, creating patterns that both reflect universal cognitive principles and showcase the creative potential of linguistic systems.

Intransitive, transitive, and ditransitive patterns form the backbone of argument structure typology, representing the most fundamental ways verbs relate to their arguments. Intransitive constructions, characterized by a single argument typically realized as the subject, appear in all documented languages. These constructions express events or states that do not directly affect another entity, such as “The snow melts” in English, “Die Frau schläft” (The woman sleeps) in German, or “Watashi wa hashiru” (I run) in Japanese. While seemingly simple, intransitive patterns reveal interesting cross-linguistic variations in how the single argument is marked. In ergative-absolutive languages like Basque, the single argument of an intransitive verb takes the same case marking (absolutive) as the patient of a transitive verb, creating a distinct pattern from nominative-accusative languages where the single intransitive argument patterns with the agent of transitive

verbs. This fundamental difference illustrates how argument structure patterns reflect deeper grammatical alignments across languages. Transitive constructions, involving two arguments (subject and direct object), express events where one entity acts upon another, such as “The cat catches the mouse” in English, “El perro come la carne” (The dog eats the meat) in Spanish, or “Kanojo ga ringo o taberu” (She eats the apple) in Japanese. These constructions often serve as the unmarked pattern for expressing causative events across languages, though the specific marking of these arguments varies significantly—from case marking in languages like German and Latin to strict word order in languages like English and French. Ditransitive constructions expand this pattern further with three arguments, typically involving transfer of possession or information. English offers two primary realizations: the double object construction (“She gave him the book”) and the prepositional dative (“She gave the book to him”). This variation is not merely stylistic but reflects subtle semantic differences—native speakers generally prefer the double object construction when the recipient is animate and definitively specified, while the prepositional dative allows more flexibility with recipient types. Other languages show even greater diversity: German allows double objects only with certain verbs (“Ich schenke ihm das Buch” - I give him the book), while Japanese uses a serial verb construction for ditransitive meanings (“Kare wa kanojo ni hon o ageta” - He her to book gave). The cross-linguistic variation in ditransitive realization reveals how languages balance semantic clarity, cognitive processing constraints, and grammatical economy in expressing three-participant events.

Complex predicate constructions challenge traditional notions of argument structure by creating multi-word verbal complexes that behave as single syntactic and semantic units. Serial verb constructions, prominent in West African, Southeast Asian, and Oceanic languages, illustrate this complexity particularly well. In Yoruba, for instance, “Ó ra àpò wá” (He buy bag bring) means “He brought a bag,” where two verbs combine to express a single event with a more complex meaning than either verb alone. These constructions often maintain a single set of arguments shared across the verbs, creating intricate patterns that blur the boundaries between words and syntactic constituents. Light verb constructions represent another fascinating type of complex predicate, where a semantically “light” verb combines with a noun or adjective to create a predicate with specific semantic content. Hindi-Urdu offers rich examples: “nehar karna” (river do) means “to flow,” where “karna” (do) provides the verbal inflection while “nehar” (river) supplies the core meaning. These constructions challenge traditional valency theory by distributing argument structure requirements across multiple elements—the light verb may contribute valency while the nominal element provides semantic selectional restrictions. Resultative constructions, found in languages like English, German, and Chinese, further complicate argument structure analysis. In “She wiped the table clean,” the resultative adjective “clean” introduces a new argument position while the verb “wipe” maintains its own argument structure, creating a complex interaction between the two elements. Causative constructions, which may be formed morphologically (“The king enlarged the palace”), periphrastically (“The king made the palace larger”), or through lexical means (“The king expanded the palace”), demonstrate how languages create complex predicates that add arguments to express causative relationships. These diverse complex predicate constructions reveal that argument structure cannot always be neatly attributed to individual verbs but often emerges from the interaction of multiple elements within a syntactic and semantic complex.

The distinction between unaccusative and unergative verbs represents one of the most significant theoretical

developments in argument structure analysis, revealing that intransitive constructions are not monolithic but fall into two distinct types with different syntactic behaviors. Unaccusative verbs, such as “break,” “arrive,” or “die,” describe events where their single argument undergoes the action or change of state rather than initiating it. In contrast, unergative verbs like “run,” “sleep,” or “speak” have arguments that actively perform or control the action. This

1.6 Cross-linguistic Variation in Argument Structure

distinction has profound implications for syntactic theory, as these verb classes exhibit different behaviors across languages. In Italian, for instance, unaccusative verbs like “arrivare” (to arrive) select the auxiliary “essere” (to be), while unergative verbs like “correre” (to run) take “avere” (to have). Similarly, in French, ne-cliticization applies differently to these verb classes, with unaccusatives allowing cliticization in certain contexts where unergatives do not. This cross-linguistic pattern suggests that the unaccusative-unergative distinction reflects a fundamental cognitive organization of events and their participants, rather than merely language-specific syntactic quirks.

Psychological verbs, or psych verbs, present yet another fascinating dimension of argument structure variation, involving complex relationships between mental states and their syntactic expression. These verbs, which describe emotions, perceptions, and cognitive states, exhibit intriguing patterns of argument realization that often invert typical subject-object mappings. In English, we find both experiencer-subject verbs like “fear” (“The child fears the dark”) and experiencer-object verbs like “frighten” (“The dark frightens the child”), where the same semantic relationship can be expressed with different syntactic structures. This phenomenon becomes even more complex when examined cross-linguistically. German, for instance, shows a strong preference for experiencer-object constructions with certain psych verbs (“Das Kind fürchtet sich vor der Dunkelheit” - literally “The child fears itself before the darkness”), while Spanish often uses reflexive constructions to express similar concepts (“El niño tiene miedo a la oscuridad” - literally “The child has fear to the darkness”). These patterns reveal how different languages conceptualize and grammaticalize the relationship between experiencers and stimuli, raising profound questions about the universality of thematic role mappings and the influence of cultural conceptualizations on grammatical structure.

This leads us to examine the broader landscape of cross-linguistic variation in argument structure, where we discover both remarkable diversity and surprising universals in how languages express events and their participants. The major typological patterns of argument structure reflect deep architectural differences between language families and grammatical systems. Indo-European languages, which have served as the foundation for much of linguistic theory, typically exhibit nominative-accusative alignment, where the subject of both transitive and intransitive verbs receives similar marking (nominative case), distinct from the object marking (accusative case). This pattern, familiar from languages like English, German, and Russian, creates a clear grammatical distinction between subjects and objects that permeates the entire argument structure system. In contrast, Afro-Asiatic languages, particularly those in the Semitic branch like Arabic and Hebrew, employ root-and-pattern morphology where consonantal roots carry core meaning while vowel patterns and affixes indicate grammatical relations, creating a fundamentally different approach to encoding argument structure.

In Arabic, for example, the root k-t-b relates to writing, while patterns like ka-ta-ba (he wrote), ku-ti-ba (it was written), and ka-ttab-a (he caused to write) create different argument structures through morphological variation rather than syntactic reconfiguration.

East and Southeast Asian languages present yet another approach to argument structure, often relying more on word order, particles, and context rather than inflectional morphology. Mandarin Chinese, with its relatively strict SVO order and lack of overt case marking, uses particles like “bǎ” to mark objects that undergo some action or change, creating constructions like “Wǒ bǎ shū fàng zài zhuōzi shàng” (I BA book put at table on), which roughly means “I put the book on the table.” Japanese and Korean, while having SOV basic order, employ elaborate systems of particles to mark grammatical relations, with “ga” marking subjects, “o” marking direct objects, and “ni” marking indirect objects or locations. These particles create flexible word order possibilities while maintaining clear argument structure relationships, demonstrating how languages can achieve similar communicative ends through dramatically different grammatical means.

Austronesian languages, particularly those of the Philippines and Indonesia, exhibit focus systems that create remarkable variation in argument realization. In Tagalog, for example, the same verb can appear in different forms depending on which argument is in focus: “Kumain ang bata ng bigas” (The child ate rice) has the child as focus, while “Kinain ng bata ang bigas” (The rice was eaten by the child) focuses on the rice. This system, known as Austronesian alignment, creates a complex interplay between argument structure, information structure, and grammatical form that challenges traditional subject-object distinctions.

Differential argument marking represents another fascinating area of cross-linguistic variation, where languages employ different marking strategies for arguments based on semantic properties like animacy, definiteness, or specificity. Split ergativity, found in languages like Hindi, Georgian, and Dyirbal, creates different marking patterns based on tense, aspect, or other grammatical categories. In Hindi, for instance, the perfective aspect exhibits ergative marking (subject takes ergative case, object takes nominative), while the imperfective aspect shows nominative-accusative alignment. This creates intriguing patterns where the same event can be expressed with different argument marking depending on how it is framed aspectually.

Differential object marking, widespread in languages like Spanish, Turkish, and Hebrew, marks certain objects more prominently than others based on properties like animacy or definiteness. In Spanish, for example, human direct objects require the preposition “a” (“Veó a María” - I see Maria), while inanimate objects do not (“Veó la casa” - I see the house). This phenomenon, known as differential object marking or “personal a,” creates a complex interaction between semantic properties and grammatical marking that reflects cognitive salience hierarchies.

Polysynthetic languages like Mohawk, Inuktitut, and Greenlandic present perhaps the most radical departure from typical argument structure patterns, incorporating what would be separate words in other languages into complex verbal forms. In Mohawk, a single verb can express what requires an entire sentence in English: “Washakotya’tawitsheráhake” translates to “He made the thing that one uses to open locks with,” incorporating multiple arguments within the verb itself through extensive affixation. Inuktitut exhibits similar complexity, with verbs carrying markers for subject, object, indirect object, and various spatial relationships, creating what linguists call “morphological incorporation” of arguments. These polysynthetic patterns chal-

lenge traditional notions of wordhood and argument structure, suggesting that the boundaries between words and syntactic constituents may be more fluid than previously assumed.

Sign languages, often overlooked in cross-linguistic studies of argument structure, offer unique insights through their visual-spatial modality. American Sign Language (ASL), British Sign Language (BSL), and other sign languages utilize spatial locations and classifier constructions to represent arguments and their relationships. In ASL, for example, the sign for “give” can be modified to indicate different argument structures by changing the direction and path of movement, with the starting point representing the giver and the endpoint representing the recipient. Classifier constructions, which use handshapes to represent categories of objects, allow signers to simultaneously express both the action and the arguments involved, creating a fundamentally different approach to encoding argument structure that leverages the unique affordances of the visual-spatial modality.

This remarkable cross-linguistic variation in argument structure reveals both the creative

1.7 Syntactic Realization of Arguments

This remarkable cross-linguistic variation in argument structure reveals both the creative diversity of human linguistic systems and the underlying cognitive principles that constrain them. As we continue our exploration of verb argument structure, we now turn to examining how these semantic participants are actually expressed in syntactic structures across languages. The syntactic realization of arguments represents a crucial interface between meaning and form, where abstract semantic roles like Agent, Patient, and Goal become concrete grammatical entities like subjects, objects, and obliques. This mapping process, governed by principles that are both universal and language-specific, reveals the intricate architecture of human language and provides insights into how speakers conceptualize and communicate events.

The relationship between grammatical relations and case marking forms the foundation of how arguments are syntactically realized across languages. Grammatical relations—typically subject, direct object, and indirect object—represent the core syntactic positions that arguments occupy, while case marking provides morphological signals of these relationships. In languages with robust case systems like Latin, German, or Finnish, the mapping between thematic roles and grammatical relations is explicitly marked through case affixes. The Latin sentence “Puer puellam videt” (The boy-NOM sees the girl-ACC) clearly distinguishes the Agent (marked with nominative case) from the Patient (marked with accusative case), creating a transparent mapping between semantic roles and grammatical positions. This nominative-accusative alignment pattern, found in approximately 55% of the world’s languages, treats the single argument of intransitive verbs and the agent argument of transitive verbs similarly, distinct from the patient argument. In contrast, ergative-absolutive languages like Basque, Georgian, or Dyirbal create a different alignment where the single argument of intransitive verbs patterns with the patient of transitive verbs (both marked with absolutive case), while the agent receives ergative case. A Basque example illustrates this: “Gizona etorri da” (The man-ABS has come) and “Gizonak mutila ikusi du” (The man-ERG boy-ABS has seen), where “gizona” (the man) takes absolutive case in the intransitive sentence but ergative case in the transitive one. The relationship between case and grammatical relations becomes even more complex in languages with split ergativity, where

the alignment pattern changes based on tense, aspect, or other factors. Hindi, for instance, shows ergative marking only in perfective aspects: “Larki khana kha rahi hai” (Girl-NOM food eat-PROG is) versus “Larke-ne khana khaya” (Boy-ERG food-ABS ate). Languages without rich case morphology, like English or French, rely on word order, prepositions, and agreement to signal grammatical relations. In English, the strict SVO order creates a clear distinction between subject and object positions, while prepositions mark oblique arguments (“She gave the book to him”). These diverse systems demonstrate how languages have developed different solutions to the universal challenge of mapping semantic roles to syntactic positions, balancing clarity, economy, and processing efficiency.

Voice, valency, and argument alternations represent powerful mechanisms that languages employ to adjust argument structure, allowing speakers to highlight different aspects of events while maintaining core semantic relationships. Passive constructions, found in virtually all languages, provide a prime example of how syntactic realization can be manipulated to change perspective while preserving meaning. In English, the passive transforms “The cat chased the mouse” into “The mouse was chased by the cat,” promoting the Patient to subject position while demoting the Agent to an optional prepositional phrase. This alternation serves important discourse functions, allowing speakers to focus on the affected entity rather than the actor, or to omit the agent entirely when it is unknown or irrelevant. Antipassive constructions, the ergative counterpart to passive, perform a similar function in ergative-absolutive languages by demoting the Patient and promoting the Agent to subject status. In Inuktitut, for example, an antipassive might transform “Angutik nanoq takuvaa” (Man-ERG polar bear-ABS sees) into “Angutip nanoq takunik” (Man-ABS polar bear-see-ANTIPASS), allowing the speaker to focus on the Agent’s experience rather than the Patient’s fate. Causative formations add another dimension to argument alternations by introducing a new causing argument. Japanese illustrates this elegantly with its causative suffix “-(s)ase”: “Kodomo ga hashiru” (Child-NOM runs) becomes “Okaasan ga kodomo o hashirasete” (Mother-NOM child-ACC run-CAUSED), adding a causer argument while maintaining the original event structure. Applicative constructions, found in Bantu languages like Swahili, add new object positions to verbs, allowing oblique arguments to become direct objects: “Aliandikia barua” (He wrote-APPL letter) versus “Aliandika barua” (He wrote letter), where the applicative suffix “-i-” introduces a recipient. Other valency-changing operations include middle constructions (“The book reads well”), reflexives (“She washed herself”), and reciprocals (“They helped each other”), each creating unique mappings between semantic roles and syntactic positions. These alternations reveal the flexible nature of argument structure and demonstrate how languages provide speakers with multiple perspectives on the same events.

Non-canonical argument realization patterns further enrich the expressive possibilities of language by allowing arguments to appear in unexpected positions or through unconventional structures. Existential and presentational constructions exemplify this phenomenon by reorganizing typical argument structures to emphasize existence or introduction of entities. English existential sentences like “There is a book on the table” place the locative argument in postverbal position while introducing a dummy subject “there,” creating a structure optimized for presenting new information. Similar patterns appear in languages as diverse as French (“Il y a un livre sur la table”), Spanish (“Hay un libro en la mesa”), and German (“Es gibt ein Buch auf dem Tisch”), each employing language-specific strategies to achieve similar presentational functions. Impersonal constructions provide another example of non-canonical realization by removing or reducing the

prominence of agent arguments. In Spanish, impersonal expressions use the reflexive pronoun “se” (“Se habla español aquí” - Spanish is spoken here), while English employs the dummy pronoun “one” or passive constructions (“One speaks Spanish here” or “Spanish is spoken here”). Other non-canonical patterns include locative inversions (“Into the room walked a strange man”), object fronting (“That book, I really enjoyed”), and right-dislocation (“She’s very intelligent, my sister”), each serving specific discourse functions by manipulating argument position and prominence. These constructions demonstrate how information structure—concerns about what is given versus new, topic versus comment—profoundly influences syntactic realization, revealing that argument structure cannot be fully understood without considering its role in communication.

The phenomenon of null arguments and pro-drop represents perhaps the most striking variation in how arguments are syntactically realized across languages. Pro-drop languages, which include Spanish, Italian, Japanese, Arabic, and many others

1.8 Semantic Roles and Thematic Relations

The phenomenon of null arguments and pro-drop represents perhaps the most striking variation in how arguments are syntactically realized across languages. Pro-drop languages, which include Spanish, Italian, Japanese, Arabic, and many others, allow arguments to be omitted when they can be recovered from context, creating sentences that would appear incomplete in English but are perfectly grammatical in these languages. A Spanish speaker might say “Habla español” (Speaks Spanish) without an explicit subject, as the verbal ending indicates the third person singular subject. Japanese takes this even further with its topic-comment structure, allowing both subject and object to be omitted when contextually clear: “Tabeta” (Ate) can function as a complete sentence meaning “I ate it” if the context provides the necessary information. These patterns reveal the intricate relationship between syntactic realization and informational context, demonstrating that arguments need not always be explicitly present in the surface structure of a sentence. This leads us naturally to examine the semantic foundation that underlies these syntactic variations—the system of semantic roles and thematic relations that constitute the conceptual core of argument structure.

Semantic roles represent the fundamental conceptual categories that capture how participants relate to the events described by verbs, forming the bridge between real-world situations and their linguistic expression. These roles, often referred to as theta roles or thematic relations, classify arguments according to their function within the event structure, creating a system that is both remarkably consistent across languages and flexible enough to accommodate the diversity of human experience. Agentive roles form one major category, encompassing entities that intentionally initiate or control actions. The prototypical Agent, as in “John opened the door,” exhibits volition, sentience, and causal responsibility for the event. However, agentive roles exist on a continuum of agency, with Force representing a non-intentional but still causative entity (“The wind broke the window”) and Instrument denoting an entity used by an Agent to perform an action (“She cut the paper with scissors”). These subtle distinctions reveal how languages categorize different types of causal forces, reflecting sophisticated cognitive distinctions about responsibility and control. Patient-like roles constitute another major category, encompassing entities that undergo change or are affected by events.

The Patient or Theme, as in “The ball rolled” or “She read the book,” represents the entity that moves, changes state, or is acted upon. Undergoer extends this category to include affected participants more broadly, while Experiencer denotes entities that perceive, feel, or undergo psychological states (“The child fears the dark”). Location and direction roles complete this basic inventory, with Source (“She came from the city”), Goal (“She went to the store”), and Location (“She waited at the station”) marking spatial relationships that are fundamental to event conceptualization. These semantic roles are not merely linguistic constructs but reflect fundamental cognitive categories that humans use to make sense of events and their participants, suggesting deep connections between language and thought.

The classification of semantic roles leads naturally to questions about how these roles relate to syntactic realization, giving rise to theories of role hierarchy and linking that seek to explain the mapping between conceptual categories and grammatical positions. The observation that certain semantic roles consistently appear in particular syntactic positions across languages has led linguists to propose hierarchical arrangements of thematic roles. The Agent-Theme hierarchy, one of the most influential proposals, suggests that Agent roles are typically mapped to subject positions, while Theme roles are mapped to object positions, with other roles occupying positions based on their relative prominence in this hierarchy. This principle helps explain why “The boy kicked the ball” (Agent-Theme) is more natural than “The ball kicked the boy” (Theme-Agent), despite both being theoretically possible descriptions of physical events. More sophisticated linking theories have been developed to account for the full complexity of role-to-syntax mapping. The Uniformity of Theta Assignment Hypothesis (UTAH), proposed within the Government and Binding framework, posits that identical thematic relationships are mapped to identical structural positions across all languages. This hypothesis predicts, for instance, that Agents will always be mapped to the same structural position regardless of the language, a claim supported by cross-linguistic evidence but complicated by languages with non-standard alignments like ergative-absolutive systems. Competing linking principles have been proposed to handle these complexities. The Theta Criterion, which states that each argument must bear exactly one theta role and each theta role must be assigned to exactly one argument, provides a basic constraint on argument structure realization. The Burzio’s Generalization, which links unaccusativity to the absence of an external theta role, explains why verbs like “arrive” cannot assign accusative case to their single argument. These principles collectively form a system that constrains the possible mappings between semantic roles and syntactic positions while allowing for the cross-linguistic variation we observe in argument realization.

The recognition that semantic roles exist on continua rather than as discrete categories has led to the development of proto-role approaches, which offer a more nuanced understanding of role prominence and its relationship to syntactic realization. David Dowty’s influential theory of proto-roles represents a significant departure from traditional role inventories, proposing instead two clusters of properties—proto-agent properties and proto-patient properties—that arguments can possess to varying degrees. Proto-agent properties include volition, sentience, causation, movement, and independent existence, while proto-patient properties include undergoing change, being causally affected, being stationary relative to the agent, and existing dependently. Under this approach, an argument’s syntactic behavior is determined not by its assignment to a specific role but by the number and type of proto-properties it exhibits. For example, in “The hammer broke

the window,” “the hammer” exhibits few proto-agent properties (it lacks volition and sentience) but still appears in subject position because it has more proto-agent properties than “the window,” which exhibits strong proto-patient properties by undergoing change. This approach elegantly handles problematic cases that challenge traditional role classifications, such as instruments in subject position (“This key opens the door”) or experiencers with mixed properties (“The music delights me”). The concept of role prominence, central to proto-role theory, suggests that syntactic prominence (like subject position) corresponds to conceptual prominence, with arguments exhibiting more proto-agent properties typically receiving more syntactic prominence. This relationship between semantic and syntactic prominence provides a powerful explanatory principle for understanding argument realization across languages. Proto-role approaches also offer insights into language acquisition, suggesting that children might learn argument structures by identifying clusters of properties rather than memorizing role assignments for individual verbs. This perspective aligns well with usage-based theories of language acquisition, where children extract patterns from linguistic input rather than applying innate categorical distinctions.

The temporal and aspectual dimensions of events introduce another layer of complexity to our understanding of semantic roles and their relationship to argument structure. Aspectual roles, which reflect how events unfold in time, interact with thematic roles to influence both syntactic realization and semantic interpretation. Telicity—the property of events having a natural endpoint—provides a crucial example of this interaction. A sentence like “She ate the apple” is telic because the apple represents a bounded entity that, when completely consumed, marks the natural endpoint of the eating event. In contrast, “She ate apples” is atelic because the plural object does not specify a bounded quantity, allowing the eating to continue indefinitely. This aspectual difference has significant implications for argument structure, as telic events typically require specific types of arguments that can serve as “measures” of event completion. The interaction between aspect and argument structure becomes even more apparent when examining different event types. States, like “She knows the answer,” involve no change over time and typically take single arguments that possess stative properties. Activities, such as “She runs,” involve ongoing action without a natural endpoint and often take arguments that can be construed as unbounded. Achievements, like “She reached the summit,” involve instantaneous change and typically require arguments that can mark the endpoint of change. Accomplishments, such as “She built a house,” involve duration culminating in a natural endpoint and require both an agent and a result argument. These aspectual distinctions are not merely semantic curiosities but have concrete effects on syntactic behavior, influencing phenomena like argument selection, passivizability, and the possibility of certain syntactic alternations. For instance, accomplishment predicates readily allow resultative constructions (“She wiped the table clean”), while activity predicates resist them (*“She wiped the table dirty”). The relationship between aspectual roles and argument structure reveals that verbs do not simply select arguments based on thematic roles alone but also based on how those arguments contribute

1.9 Acquisition of Argument Structure

The relationship between aspectual roles and argument structure reveals that verbs do not simply select arguments based on thematic roles alone but also based on how those arguments contribute to the temporal

contour of events. This complex interplay between semantics, syntax, and aspect presents a formidable acquisition challenge for children learning their native language. How do young language learners, with their limited cognitive resources and linguistic experience, navigate this intricate system of verb-argument relationships? The acquisition of argument structure represents one of the most remarkable achievements in human development, as children progress from single-word utterances to sophisticated sentences with multiple arguments, all within a remarkably short timeframe. This journey of linguistic discovery reveals both the innate predispositions that guide language acquisition and the learning mechanisms that allow children to master the argument structures of their native language.

The early development of verb usage in children follows a fascinating trajectory that reflects both universal patterns and individual variations. During the one-word stage, typically beginning around 12 months of age, children's first verbs often express basic actions or states that involve minimal argument structure complexity. Verbs like "eat," "go," "sleep," and "fall" appear frequently in early vocabularies precisely because they describe events with straightforward participant structures. The verb "eat," for instance, typically requires only an Agent (the eater), while "fall" involves a Theme that moves downward. These early verb choices demonstrate children's sensitivity to the cognitive salience of basic events and their participants. As children enter the two-word stage around 18-24 months, they begin combining verbs with their arguments, producing utterances like "Mommy eat" or "Daddy go." These combinations reveal an emerging understanding of argument structure, as children systematically pair verbs with appropriate arguments rather than producing random word strings. Longitudinal studies of children's speech have shown that the proportion of verbs with appropriate arguments increases dramatically during this period, from approximately 30% at the beginning of the two-word stage to over 80% by age three. This progression suggests a rapid refinement of argument structure knowledge, even as children's overall vocabulary expands. By age three, most children can produce sentences with multiple arguments, such as "I want cookie" (with a psychological verb taking an Experiencer and Theme) or "Give me juice" (with a ditransitive verb taking Agent, Recipient, and Theme). The relationship between vocabulary growth and argument structure complexity becomes particularly evident during this period, as children who acquire more verbs tend to develop more sophisticated argument structure patterns. This correlation reflects the bootstrapping nature of language acquisition, where knowledge of individual verbs' argument structures facilitates the learning of new verbs and more complex syntactic patterns.

Several competing theories attempt to explain the mechanisms by which children acquire verb argument structures, each emphasizing different aspects of the learning process. The syntactic bootstrapping hypothesis, proposed by Lila Gleitman, suggests that children use syntactic cues to infer verb meanings and their argument structures. According to this view, when children encounter a novel verb in a transitive sentence frame like "The man is gorping the ball," they can infer that "gorp" is a causative action verb requiring an Agent and Patient, even without knowing its exact meaning. Experimental studies have supported this hypothesis by showing that children as young as two can use syntactic frames to constrain their interpretations of novel verbs. In contrast, the semantic bootstrapping approach, championed by Steven Pinker, argues that children begin with conceptual knowledge of event types and their participants, which they then map onto syntactic structures. Under this view, children's understanding that events like giving involve a giver, a gift, and a recipient precedes and guides their acquisition of ditransitive sentence structures. Evidence

for semantic bootstrapping comes from studies showing that children's early verb meanings and argument structures align with universal conceptual categories of events. More recently, usage-based approaches have emphasized the role of statistical learning and pattern extraction from input. These approaches suggest that children track the frequency and distribution of verb-argument patterns in the speech they hear, gradually building probabilistic representations of argument structure possibilities. The entrenchment and preemption hypotheses, developed within this framework, propose that children learn to avoid overgeneralizations like "Don't giggle me" through exposure to the entrenched patterns of individual verbs ("giggle" typically occurs intransitively) and preemption by alternative constructions ("Don't make me giggle"). Computational modeling has shown that these distributional learning mechanisms can successfully account for many aspects of argument structure acquisition without positing innate syntactic knowledge. The debate between these theories continues to animate research in language acquisition, with accumulating evidence suggesting that multiple mechanisms likely work in concert to guide children's mastery of argument structure.

Despite the remarkable speed of argument structure acquisition, children's speech is punctuated by characteristic errors that provide crucial insights into their developing linguistic knowledge. Among the most fascinating of these are argument structure overgeneralizations, where children apply a verb's argument structure inappropriately based on semantic similarity to other verbs. The classic example is "Don't giggle me," where the typically intransitive verb "giggle" appears in a transitive frame, likely by analogy to causative verbs like "make me laugh" or verbs of perception like "see me." Similar errors occur with verbs of motion ("Can you disappear it?"), psychological states ("I'm boring of this toy"), and locative predicates ("I'm pouring it with water"). These overgeneralizations reveal that children are not simply memorizing verb-specific frames but are forming productive rules about argument structure based on semantic classes. Longitudinal studies have shown that these errors peak around age three, when children's verb vocabularies expand rapidly and they begin to form more abstract linguistic categories. The subsequent decline in overgeneralizations reflects the refinement of these categories through continued exposure to adult speech patterns. Another common error pattern involves omission of obligatory arguments, as when a child says "I eating" instead of "I am eating" or "Daddy coming" rather than "Daddy is coming." These omissions typically follow systematic patterns, with arguments that are pragmatically recoverable from context being most likely to be omitted. For example, children are more likely to omit objects when referring to highly predictable entities ("I'm eating [the expected food]") than when introducing new information. The relationship between errors and learning mechanisms becomes particularly apparent when examining how children recover from these errors. Research has shown that children are sensitive to corrective feedback, both explicit ("We don't say 'giggle me'; we say 'make me giggle'") and implicit (recasts like "Don't make me giggle"). However, the role of negative evidence remains controversial, as some studies suggest that children can learn correct argument structures primarily through positive evidence alone. The gradual retreat from overgeneralizations appears to reflect a statistical learning process where children update their representations of verb argument structures based on the frequency and consistency of input patterns.

The acquisition of argument structure takes on added complexity when viewed from a cross-linguistic perspective, as children must master language-specific patterns while potentially drawing on universal cognitive predispositions. Comparative studies of argument structure acquisition across languages reveal both strik-

ing similarities and intriguing differences in developmental trajectories. Children learning languages with rich case marking, like Turkish or German, show earlier sensitivity to grammatical relations than children learning languages like English, which rely more on word order. Turkish children, for instance, demonstrate understanding of subject-object distinctions through case markers before their second birthday, while English-speaking children typically master this distinction later through word order patterns. This difference suggests that the salience of grammatical cues in the input influences the developmental timeline of argument structure acquisition. The acquisition of ergative-absolutive languages presents another fascinating case, as children must learn an alignment pattern that differs from the nominative-accusative system predominant in the world's languages. Studies of children acquiring Inuktitut, an ergative language, show that they initially produce ergative marking correctly but may overgeneralize it to intransitive subjects before refining their usage. This pattern suggests that children approach ergative systems with certain predispositions but ultimately master language-specific patterns through exposure. The acquisition of complex predicate constructions reveals further cross-linguistic variation in learning challenges. Children learning serial verb languages like Yoruba must learn to

1.10 Processing and Psycholinguistics of Argument Structure

The acquisition of complex predicate constructions reveals further cross-linguistic variation in learning challenges. Children learning serial verb languages like Yoruba must learn to combine multiple verbs into single semantic units, a process that requires sophisticated integration of argument structures across verb boundaries. This developmental journey from simple verb-argument pairings to the mastery of language-specific argument structures leads us naturally into examining how adults process these intricate patterns in real-time comprehension and production. The psycholinguistic exploration of argument structure processing reveals the remarkable efficiency with which the human mind handles the complex mapping between verbs and their arguments, shedding light on the cognitive architecture that underlies our linguistic competence.

Real-time comprehension of argument structure has been extensively studied through experimental methodologies that capture the millisecond-by-millisecond process of interpreting verbs and their arguments. Eye-tracking studies have provided particularly compelling evidence for how rapidly and automatically listeners activate argument structure expectations. When participants hear sentences like “The man will arrest...” their eyes immediately begin scanning displays for a potential arrestee, demonstrating that verb information instantly activates expectations about upcoming arguments. This anticipatory processing occurs remarkably quickly—within 200-300 milliseconds of hearing the verb—suggesting that argument structure knowledge is accessed automatically during comprehension. Event-related potential (ERP) studies have complemented these findings by revealing distinct brain responses to argument structure violations. When listeners encounter sentences like “The journalist interviewed the idea,” where the verb “interview” requires an animate object, a characteristic N400 effect emerges approximately 400 milliseconds after the violation, reflecting the brain's detection of semantic anomaly. More critically, sentences with argument structure violations like “The boy slept the doll” elicit a P600 effect, a positive-going wave around 600 milliseconds post-stimulus that indicates syntactic reanalysis processes. These neurophysiological markers reveal that argument structure

processing involves both semantic integration and syntactic computation, with the brain rapidly detecting mismatches between verb requirements and argument properties. The time course of argument structure processing has been further illuminated by self-paced reading experiments, which show that readers slow down precisely at points where argument structure expectations are violated or when verbs with complex argument structures are encountered. For instance, reading times increase at the object position when a verb is ambiguous between transitive and intransitive uses (e.g., “The chef began...”), reflecting the computational cost of resolving argument structure ambiguity. Together, these findings paint a picture of argument structure comprehension as a highly interactive process where lexical, semantic, and syntactic information are integrated incrementally as the sentence unfolds.

The production of argument structures presents a mirror image of comprehension, revealing how speakers transform conceptual representations into grammatically appropriate utterances. Speech error patterns provide naturalistic evidence for the psycholinguistic processes underlying argument structure production. Errors involving argument exchange, such as “I’m going to fill the glass up with water” becoming “I’m going to fill water up with the glass,” demonstrate that arguments are represented as distinct units during production planning. More telling are errors where entire argument structures are misapplied, as when a speaker says “Don’t worry me” instead of “Don’t make me worry,” revealing that argument structure frames can be activated independently of specific lexical items. Experimental studies using picture-description tasks have shown that speakers plan argument structures incrementally, often beginning to speak before having fully determined all arguments. For example, when describing transitive events, speakers typically initiate utterances with the subject while still processing the object, suggesting a cascading planning process where syntactic and conceptual encoding proceed in parallel. The relationship between conceptualization and syntactic formulation becomes particularly evident in studies of argument structure alternations. When given a choice between “The boy loaded the hay onto the wagon” and “The boy loaded the wagon with hay,” speakers consistently select the construction that matches their conceptualization of the event—emphasizing either the hay being moved or the wagon being filled. This alignment between conceptual perspective and syntactic choice suggests that argument structure production is not merely a matter of retrieving stored frames but involves dynamic mapping between event conceptualization and grammatical encoding. Planning complex argument structures with multiple arguments imposes additional cognitive demands, as evidenced by increased speech onset latencies and higher rates of disfluency when producing ditransitive sentences compared to simpler transitive constructions. These findings collectively indicate that argument structure production involves a delicate interplay between conceptual preparation, lexical retrieval, and syntactic assembly, with speakers managing these processes in real-time to produce fluent speech.

Memory constraints play a crucial role in argument structure processing, revealing the cognitive limitations that shape how we handle complex linguistic information. Working memory capacity has been shown to significantly influence both comprehension and production of sentences with complex argument structures. Individuals with higher working memory spans demonstrate superior ability to comprehend sentences with multiple embeddings or non-canonical argument realizations, such as object-relative clauses (“The reporter that the senator attacked admitted the error”). This relationship suggests that maintaining multiple arguments and their relationships in working memory is essential for successful argument structure processing.

Long-term memory representations of verb argument structures are equally important, with psycholinguistic research revealing that speakers store detailed statistical information about argument structure frequencies. For instance, verbs that frequently appear in both transitive and intransitive frames (like “break” in “The window broke” and “She broke the window”) are processed differently from verbs that strongly prefer one frame over another. This frequency sensitivity affects processing speed, with more frequent argument structure patterns being accessed more rapidly during both comprehension and production. Individual differences in argument structure processing extend beyond memory capacity to include factors like processing speed and cognitive control, with some individuals showing particular difficulty in resolving argument structure ambiguities or revising initial misinterpretations. These individual differences become especially apparent when processing complex argument structures in real-time, as when encountering garden-path sentences like “The horse raced past the barn fell,” where initial assignment of “raced” as a main verb must be revised when “fell” is encountered. The cognitive load imposed by such revisions can overwhelm the processing resources of some individuals, leading to comprehension failures. Memory limitations also affect the production of complex argument structures, with speakers often simplifying their utterances when under cognitive load, as evidenced by increased use of intransitive constructions and reduced syntactic complexity in dual-task situations.

Disorders of argument structure processing provide compelling evidence for the specialized cognitive mechanisms underlying this linguistic domain, revealing how damage to specific neural systems can selectively impair argument structure knowledge while sparing other aspects of language. Aphasic patterns of argument structure impairment vary systematically according to lesion location and type. Broca’s aphasia, typically associated with left frontal lobe damage, often manifests as difficulty producing and comprehending sentences with non-canonical argument structures, such as passives (“The cat was chased by the dog”) or object-clefts (“It was the cat that the dog chased”). Patients with this condition show a strong preference for active, subject-verb-object constructions, suggesting damage to the neural systems responsible for syntactic operations that reassign arguments to non-canonical positions. In contrast, Wernicke’s aphasia, resulting from temporal lobe damage, often features relatively preserved syntactic structure but impaired semantic integration, leading to argument structure errors that reflect thematic role confusion, such as using instruments as agents (“The key opened the door” to mean “Someone opened the door with the key”). Specific Language Impairment (SLI) in children provides another window into argument structure processing disorders, with affected individuals showing particular difficulty with verb argument structure acquisition and use. These children often produce argument structure overgeneralizations beyond the typical developmental period and struggle with verbs that have complex or optional argument structures. The aging process also affects argument structure processing, with healthy older adults showing increased difficulty in comprehending and producing sentences with complex argument structures, particularly those requiring revision of initial interpretations. This age-related decline appears to reflect reduced processing speed and working memory capacity rather than loss of argument structure knowledge per se. Neurodegenerative diseases like Alzheimer’s can progressively erode argument structure processing abilities, with patients eventually losing the ability to distinguish between grammatical and ungrammatical argument structures as the disease advances. The selective patterns of impairment observed across these disorders provide crucial evidence for the modularity of argument structure

processing within the broader language system, suggesting that the cognitive mechanisms responsible for mapping verbs to their arguments rely on distinct neural circuits that can be differentially affected by brain damage or developmental abnormalities.

As we have seen, the psycholinguistic study of argument structure processing reveals the intricate cognitive machinery that enables humans to rapidly comprehend and produce sentences with complex verb-argument relationships. From the millisecond-level anticipatory processes revealed by eye-tracking and ERP studies to the broader cognitive constraints imposed by memory limitations, this research demonstrates both the remarkable efficiency and the vulnerability of argument structure processing. The patterns observed in typical processing, speech errors, and language disorders collectively paint a picture of a specialized cognitive system that interfaces conceptual representations of events with grammatical encoding, allowing for the fluent expression and comprehension of human experience. This understanding of argument structure processing naturally leads us to consider how these

1.11 Computational Approaches to Argument Structure

As our understanding of argument structure processing reveals the intricate cognitive machinery that enables humans to comprehend and produce language, we naturally turn to computational approaches that seek to model these processes artificially. The challenge of representing and acquiring argument structure in computational systems has driven significant innovation in computational linguistics and natural language processing (NLP), bridging theoretical linguistics with practical applications. This computational journey reflects not only technological advancement but also deepening insights into the fundamental nature of verb-argument relationships, as researchers grapple with how to encode the richness of human linguistic knowledge in machine-processable form.

Representation in computational grammars requires translating linguistic theories into formal architectures that can be implemented algorithmically. Head-Driven Phrase Structure Grammar (HPSG) offers one particularly sophisticated approach, with its rich type hierarchy and feature structures that explicitly encode argument structure information. In HPSG implementations, verbs are associated with an ARG-ST (argument structure) feature that lists their arguments along with syntactic and semantic constraints. For instance, the verb “give” would specify three arguments: a subject with the semantic role Agent, a direct object with the role Theme, and an indirect object with the role Goal. This representation allows the grammar to enforce selectional restrictions and predict syntactic behavior across constructions. The LinGO Matrix project, a multilingual HPSG resource, demonstrates how these representations can be shared across languages while accommodating language-specific variations in argument realization. Lexical-Functional Grammar (LFG) provides another influential framework for computational implementation, with its parallel levels of representation including f-structures that map arguments to grammatical functions. In LFG-based systems like ParGram, argument structure information in the lexicon determines the linking between semantic roles and grammatical functions like SUBJ, OBJ, and OBL (oblique object). This architecture elegantly handles languages with free word order, as the same underlying f-structure can surface through different c-structure configurations. Minimalist Grammar implementations, while less common in practical NLP systems due to their

abstract nature, have been explored in research contexts like the Minimalist Grammar Toolkit. These systems represent argument structure through feature checking operations, where verbs carry unvalued features that must be checked against their arguments during derivation. The challenge of representing argument structure in computational grammars lies in balancing descriptive adequacy with computational tractability—systems must capture the full complexity of linguistic phenomena while remaining efficient enough for practical implementation. This tension has led to hybrid approaches that combine insights from multiple theoretical frameworks, creating robust representations that can handle the diversity of human language.

The automatic acquisition of argument structure from text corpora represents a frontier where machine learning meets linguistic theory, seeking to extract verb-argument patterns without explicit human annotation. Supervised learning approaches leverage resources like FrameNet and PropBank, which provide large-scale annotations of argument structures for thousands of verbs. FrameNet, developed at Berkeley, organizes verbs into semantic frames like “Giving” or “Perception_active,” with frame elements corresponding to thematic roles (Giver, Given, Recipient for the Giving frame). Machine learning systems trained on FrameNet data can predict frame assignments for new sentences with impressive accuracy, achieving F-scores above 80% on well-represented frames. PropBank, another key resource, annotates arguments with numbered labels (ARG0 for Agent, ARG1 for Patient, etc.) rather than semantic roles, making it particularly useful for syntactic applications. Supervised systems using PropBank annotations have enabled the development of semantic role labeling (SRL) systems that automatically identify arguments and their roles in running text. Unsupervised learning approaches, while more challenging, offer the tantalizing possibility of discovering argument structure patterns without human annotation. These methods typically rely on distributional clustering—verbs that appear in similar syntactic contexts (e.g., frequently followed by noun phrases with certain prepositions) are grouped together and assumed to share argument structure properties. For example, verbs like “give,” “send,” and “hand” might cluster together based on their co-occurrence patterns with recipient arguments. The acquisition process faces significant hurdles, including the sparsity problem—many verbs appear infrequently in corpora, making it difficult to establish reliable argument structure patterns. Additionally, the semantic granularity of roles presents challenges; should “eat” and “devour” be assigned the same argument structure despite their different connotations? Recent advances in weak supervision and distant learning have begun to address these issues by combining limited human annotation with large amounts of unlabeled data, creating systems that can bootstrap argument structure knowledge from noisy signals. The ongoing quest to automatically acquire argument structure reflects a deeper ambition: to create computational systems that can learn language as humans do, extracting patterns from experience while building structured knowledge.

Argument structure information proves indispensable across a wide range of natural language processing applications, enabling systems to move beyond surface-level text processing to deeper semantic understanding. In machine translation, mismatches in argument structure between source and target languages have historically been a major source of errors. Early systems often failed when translating ditransitive constructions between languages with different realization patterns—for instance, translating English “She gave him a book” into a language like Japanese that requires a serial verb construction for ditransitive meaning. Modern neural translation systems have improved dramatically, but argument structure awareness remains crucial

for handling complex predicates and idiomatic expressions. Systems that explicitly model argument structure can better handle cross-linguistic divergences, such as the difference between English double object constructions and prepositional datives, or the ergative patterns found in languages like Basque. Information extraction represents another domain where argument structure knowledge transforms system capabilities. Beyond simple named entity recognition, systems that understand argument structure can extract complex events and their participants from text—identifying not just that a company was mentioned, but that it acquired another company, with specific acquisition terms and dates. This capability powers applications ranging from financial analysis to intelligence gathering. Question answering systems similarly benefit from argument structure modeling, as understanding whether a question is asking about the agent, patient, or instrument of an event dramatically improves answer selection. When asked “Who discovered penicillin?” the system must recognize that “discover” typically takes an agent argument, leading it to seek the person rather than the substance. Dialogue systems leverage argument structure information to track entity references across conversational turns and generate appropriate responses that respect semantic role expectations. For instance, if a user says “I booked the hotel,” the system should infer that “I” is the agent and “the hotel” is the patient, enabling coherent follow-up like “Would you like me to send you the confirmation?” These applications demonstrate how argument structure knowledge moves NLP systems beyond pattern matching toward genuine language understanding, enabling more sophisticated interactions between humans and machines.

Neural network approaches have revolutionized argument structure processing in recent years, offering both remarkable successes and intriguing challenges. Modern transformer-based models like BERT, GPT, and T5 learn rich representations of language through self-supervised training on massive text corpora, implicitly capturing argument structure patterns without explicit linguistic rules. These models process input text through attention mechanisms that dynamically weight the importance of different words relative to each other, effectively learning which elements are likely to be arguments of which verbs. For example

1.12 Applications and Future Directions

Neural network approaches to argument structure processing, while demonstrating remarkable capabilities in pattern recognition and prediction, still face significant challenges in capturing the full richness of verb-argument relationships. These limitations highlight both the sophistication of human linguistic knowledge and the potential for more integrated approaches to argument structure analysis. As we move beyond purely computational considerations, we find that argument structure theory has profound implications across multiple domains, extending far beyond theoretical linguistics into practical applications that touch upon education, clinical practice, and our understanding of human cognition itself.

The application of argument structure theory in language teaching represents one of the most fruitful intersections between linguistic research and educational practice. Understanding verb-argument relationships provides language instructors with powerful tools for explaining grammatical patterns and helping learners avoid common errors. In second language acquisition, for instance, learners often struggle with verbs that have different argument structures across languages. An English speaker learning Spanish might incorrectly say “Yo pago el libro” (I pay the book) when meaning “Yo pago por el libro” (I pay for the book), not re-

alizing that the verb “pagar” typically requires a prepositional complement rather than a direct object. By explicitly teaching the argument structures of high-frequency verbs, instructors can help learners develop more accurate mental representations of how verbs function in the target language. This approach has been particularly successful in teaching ditransitive verbs, where learners must master both double object constructions (“She gave him the book”) and prepositional datives (“She gave the book to him”), understanding that these patterns have subtle semantic differences rather than being interchangeable alternatives. Language teaching materials have increasingly incorporated argument structure information, with textbooks featuring verb tables that specify required arguments and common patterns. The Cambridge International Dictionary of English, for example, includes argument structure patterns in its entries, showing learners that “explain” requires both an object and a prepositional phrase (“explain something to someone”) while “discuss” takes only a direct object (“discuss something”). Research in instructed second language acquisition has demonstrated that explicit attention to argument structure significantly improves learners’ accuracy in verb usage, particularly for verbs with complex or idiosyncratic patterns. Furthermore, understanding argument structure helps learners develop strategies for comprehending authentic language, as they can use their knowledge of verb requirements to predict upcoming elements in sentences and infer meanings of unfamiliar words from context. This pedagogical application of argument structure theory demonstrates how linguistic research can directly enhance language learning outcomes, bridging the gap between theoretical knowledge and practical language use.

The clinical and therapeutic applications of argument structure theory have transformed approaches to diagnosing and treating language disorders across the lifespan. Speech-language pathologists have found that assessing argument structure knowledge provides crucial insights into the nature and severity of various language impairments. In developmental language disorders, children often exhibit particular difficulty with verbs that have complex argument structures or optional arguments. A child might correctly use simple transitive verbs (“I eat cookie”) but struggle with ditransitive constructions (“I give mommy cookie”) or psychological verbs (“I like ice cream”). These specific patterns of difficulty help clinicians differentiate between language disorders and other developmental conditions, leading to more accurate diagnoses and targeted interventions. Therapeutic approaches targeting argument structure have proven highly effective in both developmental and acquired disorders. For individuals with aphasia following stroke, therapy focusing on verb-argument structures can improve both comprehension and production of sentences. One successful approach involves “mapping therapy,” where clients systematically practice the relationship between thematic roles and grammatical positions, learning to distinguish between sentences like “The boy chased the girl” and “The girl was chased by the boy.” This therapy has been shown to generalize to untrained verbs and structures, suggesting that it addresses underlying cognitive processes rather than merely teaching specific forms. In autism spectrum disorder, where pragmatic aspects of language use are often impaired, argument structure interventions help individuals understand how different verbs require different types of information, improving their ability to produce appropriate and complete sentences. Assessment tools like the Northwestern Assessment of Verbs and Sentences (NAVS) specifically evaluate argument structure comprehension and production, providing clinicians with detailed profiles of clients’ strengths and weaknesses. These assessment results inform individualized treatment plans that target specific deficits in argument struc-

ture knowledge, leading to more efficient and effective therapy. The application of argument structure theory in clinical settings exemplifies how linguistic research can directly improve the lives of individuals with communication disorders, providing evidence-based approaches to assessment and intervention.

The interdisciplinary connections of argument structure research extend far beyond traditional linguistics, creating bridges with cognitive science, philosophy, anthropology, and numerous other fields. In cognitive science, argument structure provides a window into how humans conceptualize events and their participants, revealing fundamental cognitive categories that organize experience. Research on event perception has shown that speakers of languages with different argument structure patterns often attend to different aspects of the same events, suggesting that linguistic categories influence cognition itself. For example, speakers of languages with extensive verb-framing (like Spanish, where motion is typically expressed in the verb: “entró corriendo” - entered running) versus satellite-framing (like English, where path is expressed separately: “ran in”) show differences in how they remember and describe motion events. These findings contribute to ongoing debates about linguistic relativity and the relationship between language and thought. In philosophy of language, argument structure raises profound questions about reference, truth conditions, and the nature of meaning. How do the arguments of a verb contribute to the truth conditions of a sentence? What is the relationship between the semantic roles encoded in argument structure and the metaphysical structure of events? Philosophers have used argument structure phenomena to explore questions about causation, agency, and event individuation, with verb meaning providing crucial evidence for theories of events and their participants. Anthropological research on argument structure reveals cultural patterns in how different societies conceptualize agency, responsibility, and social relationships. The prevalence of different psych verb constructions across languages, for instance, reflects cultural attitudes toward emotion and responsibility. Some languages predominantly use experiencer-subject constructions (“I fear spiders”), emphasizing the experiencer’s emotional state, while others favor experiencer-object constructions (“Spiders frighten me”), highlighting the external stimulus of emotion. These patterns suggest that argument structure reflects not just universal cognitive constraints but also cultural conceptualizations of experience. This interdisciplinary perspective on argument structure research demonstrates its value as a nexus for understanding human cognition, culture, and communication, with insights flowing freely between traditional disciplinary boundaries.

As we look toward the future of argument structure research, emerging methodologies and theoretical developments promise to reshape our understanding of this fundamental linguistic domain. New technologies are enabling unprecedented levels of data collection and analysis, with large-scale corpora, brain imaging techniques, and computational modeling opening new avenues for investigation. The advent of massive cross-linguistic databases like the World Atlas of Language Structures (WALS) and the Universal Dependencies project allows researchers to test claims about argument structure universals against data from hundreds of languages, moving beyond the Indo-European bias that has historically characterized the field. These resources have already yielded surprising findings, such as the discovery that certain argument structure patterns once thought to be rare are actually more widespread than previously believed, challenging existing typological classifications. Neuroimaging studies using functional magnetic resonance imaging (fMRI) and magnetoencephalography (MEG) are beginning to map the neural networks involved in argument structure

processing, revealing how different brain regions contribute to the comprehension and production of verb-argument relationships. These studies suggest that argument structure processing involves a distributed network of areas, including regions associated with semantic memory, syntactic processing, and conceptual knowledge, with different patterns of activation for different types of verbs and constructions. Computational approaches continue to evolve, with neural models becoming increasingly sophisticated in their handling of argument structure phenomena. Recent developments in few-shot learning and meta-learning are enabling systems to acquire argument structure knowledge from minimal examples, more closely approximating human learning abilities. Despite these advances, fundamental questions remain unresolved. How universal are argument structure patterns across human languages? What principles govern the mapping between semantic roles and syntactic positions? How do children acquire the complex argument structures of their native language with such apparent ease? These questions continue to animate