

Dynamics of Morphosyntactic Acquisition: Theoretical and Neurophysiological Perspectives on Non-Native Morphosyntactic Development

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ديناميكيات الاكتساب الصرفي-النحوي: منظورات نظرية وفيزيولوجية عصبية حول التطور الصرفي-النحوي لغير الناطقين باللغة

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Abstract

This study designates the complex process of attaining morphosyntax in a non-native language. By revising initial theories in second language acquisition (SLA), this study tries to describe how learners shift from "declarative rule-following to "procedural automaticity". It additionally discovers the "L2 status factor" and "typological proximity" as chief initiators of cross-linguistic transmission, while closing with neurophysiological prove that demonstrates the "native-like" probable of the mature L2 mind. With the purpose of doing so, the study employs a descriptive review method in which utilizes a qualitative combination and literature review organization. Moreover, the study makes available a sequential meta-analysis of experimental a figure of previous research crossing from 1987 to 2025, evaluating a varied series of experimental data assemblage techniques.

Keywords: Theories in Second Language Acquisition, transition, declarative rule-following, procedural automaticity, L2 Status Factor, Typological Proximity, cross-linguistic transfer.

الملخص

تتناول هذه الدراسة العملية المعقدة لتحصيل القواعد الصرفية والنحوية (morphosyntax) في لغة غير أصلية. ومن خلال مراجعة النظريات الأولية في مجال اكتساب اللغة الثانية (SLA)، تسعى الدراسة إلى وصف كيفية انتقال المتعلمين من مرحلة "اتباع القواعد التصريحية" إلى مرحلة "التلقائية الإجرائية". كما تستكشف الدراسة "عامل وضع اللغة الثانية" (L2 status factor) و"التقارب النمطي" (typological proximity) باعتبارهما المحركين الرئيسيين للانتقال اللغوي بين اللغات. وتختتم الدراسة بتقديم أدلة فيزيولوجية عصبية تثبت إمكانية وصول العقل البالغ في اللغة الثانية إلى مستويات تشبه مستويات الناطقين بالأصل. لتحقيق هذه الأهداف، تعتمد الدراسة منهجية المراجعة الوصفية التي تستخدم مزيجاً نوعياً وتنظيماً للمراجعات الأدبية. وعلاوة على ذلك، توفر الدراسة تحليلاً تلوياً تتابعياً (sequential meta-analysis) لمجموعة من الأبحاث التجريبية السابقة التي تمتد من عام 1987 إلى عام 2025، مع تقييم سلسلة متنوعة من تقنيات جمع البيانات التجريبية.

الكلمات المفتاحية: نظريات اكتساب اللغة الثانية، الانتقال، اتباع القواعد التصريحية، التلقائية الإجرائية، عامل وضع اللغة الثانية، التقارب النمطي، الانتقال اللغوي المتبادل.

1. Introduction

To appreciate the main theories in second language acquisition (SLA), particularly regarding morphosyntax, it's essential to understand how the field has evolved. Initially, language was viewed as a "habit," with an emphasis on behaviorist models that focused on repetition and reinforcement. However, over time, the perspective shifted, and language is now seen as a multifaceted "computational system," reflecting a more complex view of how languages are processed, learned, and acquired.

This transformation represents a paradigm shift from behaviorism to cognitive and generative approaches, which treat language acquisition as a mental process that involves the internalization of linguistic structures, not just habit formation. Contemporary studies in SLA explore how learners process and acquire morphosyntactic rules, emphasizing the cognitive

mechanisms that underlie language learning and the role of universal grammar, processing constraints, and interaction between input and internal representation.

The following four theoretical frameworks provide the foundational basis for current research in this field. Each theory addresses different aspects of second language acquisition, particularly the challenges of acquiring morphosyntactic structures, and collectively they form the modern understanding of how individuals learn a second language.

1.1 Universal Grammar (UG) and Parameter Resetting (Chomsky, 1981)

The most influential foundation is Noam Chomsky's (1981) Government and Binding theory, which introduced the concept of Universal Grammar. According to Chomsky (1981) humans possess an innate Language Acquisition Device (LAD). Languages differ based on "parameters" mental switches that are set during childhood. For example, the Pro-drop Parameter dictates whether a language can omit subject pronouns (e.g., Arabic/Spanish) or requires them (e.g., English). In SLA, researchers like White (2003) have used this framework to investigate whether adult learners can ever "reset" these parameters from their native settings to the target language settings, or if they are permanently "locked" into their L1 structure.

A key argument in SLA is whether adult learners still have access to the "mental hardware" of UG. Bley-Vroman (1989) proposed the Fundamental Difference Hypothesis. He argued that while children use UG to acquire language, adults rely on general problem-solving skills and their L1 knowledge. This suggests that "Parameter Resetting" becomes significantly more difficult or even impossible after the critical period, explaining why adult learners often retain a "foreign" syntactic structure.

Schwartz and Sprouse (1996) offered a more optimistic view of adult learning.

- **Full Transfer:** They argue that the *initial state* of a learner's L2 is their entire L1 grammar (every parameter is set to the L1 position).
- **Full Access:** Crucially, they believe learners still have "Full Access" to UG. When the L1 parameters fail to process the L2 input, the brain "resets" the switch to the correct L2 position.

This model is the foundation for most modern research on morphosyntactic transfer, as it accounts for both the errors learners make (Transfer) and their eventual success (Access).

Further refining the theory, Tsimpli and Dimitrakopoulou (2007) focused on which parts of the "parameters" are actually resettable. They argued that features with semantic meaning (like number) are easy to reset. However, "uninterpretable" features—those that exist only for grammatical "checking" (like grammatical gender in inanimate objects or specific Wh-movement rules)—are subject to a "permanent lack of access" if they aren't in the L1. This explains why an English speaker might never fully "automate" Spanish gender, regardless of proficiency.

1.2 Processability Theory (Pienemann, 1998)

Moving away from abstract mental structures, Pienemann (1998) proposed Processability Theory (PT), which focuses on the cognitive and procedural constraints of the human brain during real-time language use. Pienemann(1998) argues that PT posits a rigid developmental hierarchy. A learner cannot acquire a complex morphosyntactic structure until they have developed the "processing capacity" to handle the prerequisite steps. The hierarchy, for example, a learner must master Category Procedure (identifying a word as a verb) before they can master S-Procedure (making that verb agree with a subject across a sentence). This explains why learners often "know" a rule but cannot "process" it during fast-paced communication. Pienemann (1998) explains that the core of PT is a universal hierarchy based on the concept of "Feature Unification." This describes how the brain moves grammatical information from one part of a sentence to another. According to Pienemann (2005), learners must follow this sequence because each stage provides the necessary "computational foundation" for the next:

1. **Lemma Access:** Simple word recognition without grammatical markers.

2. **Category Procedure:** Assigning a grammatical category (e.g., this word is a *Noun*).
3. **Noun Phrase (NP) Procedure:** Handling agreement within a phrase (e.g., *Two big dogs*—where "Two" and "Dogs" share the plural feature).
4. **Verb Phrase (VP) Procedure:** Moving features from the NP to the verb (e.g., Subject-Verb Agreement).
5. **Sentence (S) Procedure:** Handling complex word order, such as moving a verb to the second position (V2) in German or inversion in English questions.

One of the most impactful applications of PT is the Teachability Hypothesis. Pienemann (1984) argued that formal instruction can only be successful if the learner is "psycholinguistically ready" to move to the next stage. Instruction cannot skip stages. If a learner is at Stage 2, teaching them Stage 4 structures will result in "reversion" or failure, as their mental processor cannot yet handle the necessary feature unification. This theory shifted the focus of language teaching from a "textbook order" to a "developmental order," ensuring that syllabus design matches the learner's natural internal syllabus.

Expanding on Pienemann's original work, Lenzing (2013) investigated the "Initial State" of the mapping process. She describes how learners first map "conceptual" meaning directly onto "surface" forms. In the earliest stages, the brain avoids complex syntax by using a "One-to-One" mapping strategy (one meaning = one word). As the processing capacity expands, the learner can engage in "Non-Linear Mapping," allowing them to produce complex passive voices or subordinate clauses where the meaning is not tied to a simple word-by-word order. While PT was initially developed using German and English, Mansouri (2005) and Itani-Adams (2013) extended the theory to languages with rich morphology, such as Arabic and Japanese. They found that in languages with highly complex agreement (like Arabic gender/number agreement), the "NP Procedure" is much more "taxed" than in English. This demonstrated that while the hierarchy is universal, the speed at which a learner moves through the stages is dictated by the morphological "weight" of the target language.

1.3 Skill Acquisition Theory (DeKeyser, 2007)

Drawing from cognitive psychology and the work of John Anderson (1983), DeKeyser (2007) adapted the Skill Acquisition Theory for language learning. This theory treats language as a complex skill that evolves through three distinct stages of memory:

1. **Declarative Knowledge:** In this initial stage, the learner acquires explicit knowledge of a rule or form. This information is stored in the long-term declarative memory as "facts" (e.g., "In English, the third-person singular verb ends in -s"). Processing is slow and heavy because the learner must consciously retrieve the rule from memory to use it. Anderson (1983) originally defined this as the stage of "encoding," while DeKeyser (2015) emphasizes that without this initial explicit awareness, the subsequent stages of skill development are often stunted in adult learners.
2. **Procedural Knowledge:** Through deliberate practice, declarative knowledge is converted into procedural knowledge. This process, called Proceduralization, involves creating "IF-THEN" production rules in the brain. For example: *IF the subject is "He" and the verb is "run," THEN add "-s."* The learner no longer needs to "think about the rule" explicitly, but they are still prone to errors under stress or in complex contexts (Lyster & Sato, 2013; Almahdi & Said, 2018). Lyster and Sato (2013) also highlight that "form-focused instruction" is most effective at this stage to bridge the gap between knowing a rule and using it in conversation.
3. **Automaticity:** Segalowitz (2010) describes this stage as "cognitive fluency," where the speed and stability of processing allow for native-like performance. The final stage is reached after massive amounts of task-specific practice. The skill becomes automatic. It requires almost no "attentional resources," meaning the learner can focus entirely on the *message* (semantics) rather than the *mechanics* (morphosyntax). Brain activity shifts from

the prefrontal cortex (conscious control) to the basal ganglia (habituated movement/response).

This theory describes the "mechanization" of grammar, providing a roadmap for how a learner moves from a slow, "rule-following" student to an effortless, "fluent" speaker (DeKeyser, 2007). In other words, Skill Acquisition Theory (SAT) is a sub-theory of Information Processing that views language learning as the mastery of a complex cognitive skill, much like learning to drive or play a musical instrument (DeKeyser, 2007).

A. The Power Law of Learning

This principle describes the mathematical curve of progress. In the beginning, performance (speed and accuracy) improves rapidly. As the learner reaches the autonomous stage, the rate of improvement slows down, requiring significantly more practice to achieve smaller gains in "fine-tuning" (Newell & Rosenbloom, 1981).

B. Transfer-Appropriate Processing (TAP)

Lightbown (2008) points out that a critical nuance of SAT is that automaticity is domain-specific. If a learner practices morphosyntax only through *written* drills, they may become automatic in writing but remain "declarative" (slow and stuttering) in speaking. To be fluent in a specific skill, the practice conditions must match the performance conditions.

C. The Role of Interaction

While SAT is often associated with "drills," modern proponents argue that interaction is the best form of practice for proceduralization. Corrective feedback during a conversation helps the learner "prune" incorrect procedural rules (Sato & McDonough, 2013).

1.4 The Interface Hypothesis (Sorace, 2011)

To explain why advanced learners often struggle with "fine-tuning" their grammar, Sorace (2011) introduced the Interface Hypothesis. Sorace (2011) argues that the "core" of syntax (the basic rules) is easier to master than the interfaces—the boundaries where syntax meets other domains like morphology, pragmatics, or discourse. This theory suggests that while learners may eventually master the "Internal Interface" (making a verb agree with a subject), they often fail at the "External Interface" (choosing the correct morphosyntactic form to convey subtle social or literary nuances). This is critical for research involving complex, "taxed" contexts like literature.

1.4.1 The Core Mechanics: Internal vs. External Interfaces

The foundational premise of the theory, as detailed by Sorace (2011), is the distinction between two types of linguistic boundaries.

- A. **Internal Interfaces (Syntax-Morphology / Syntax-Semantics):** These involve formal linguistic properties that are internal to the language system itself. For example, a verb must have a specific ending to agree with its subject. Because these rules are governed by a closed system of logic, they are relatively stable. Once an L2 learner "resets" their mental parameters to the new language, these structures tend to reach native-like mastery.
- B. **External Interfaces (Syntax-Pragmatics / Syntax-Discourse):** These involve the "mapping" of a sentence structure onto the wider context of communication. A learner must decide not only if a sentence is grammatically correct, but if it is *appropriate* for the social or literary situation. Sorace (2011) argues that these interfaces are "vulnerable" to permanent instability because they require the simultaneous coordination of linguistic knowledge and high-level cognitive processing.

1.4.2 Theoretical Extensions and Empirical Support

A. The "Resource Limitation" Account

Based on the 2011 background, Tsimpli (2014) extended the hypothesis by suggesting that the difficulty with external interfaces is not necessarily a lack of "knowledge," but a "processing bottleneck." Because external interfaces require the brain to monitor the speaker's intent, the

listener's expectations, and the literary context all at once, the cognitive load becomes too high, leading to "residual errors" even in near-native speakers.

B. The Role of Bilingualism and "Attrition"

In later work, Sorace (2012) explained that this vulnerability isn't just a problem for L2 learners. Even native speakers who live abroad for a long time (L1 attrition) start to show instability in their "External Interfaces." For instance, a native Italian speaker might start overusing subject pronouns—a pragmatically "incorrect" choice in Italian—because their brain is being influenced by the simpler pragmatic rules of their L2 (like English). This suggests that the external interface is the most "plastic" and sensitive part of the human grammar.

C. Neurocognitive Integration

Rothman and Slabakova (2011) donated that the combination by arguing that the "Internal/External" divide is also visible in the brain's "Predictive Processing." Their research shows that while learners can perfectly predict an internal morphological ending, they struggle to predict the "next step" in a syntactic chain that depends on external discourse cues. This reinforces the idea that the "Syntax-Pragmatics" interface is where the human processor is most likely to "lag" behind.

Table (1) Summary of Key Theories

Theory	Key Author(s)	Primary Focus
Universal Grammar	Chomsky (1981); White (2003)	Innate structures and Parameter Setting.
Processability Theory	Pienemann (1998)	Cognitive constraints and developmental stages.
Skill Acquisition	DeKeyser (2007); Anderson (1983)	Transition from conscious rules to automaticity.
Interface Hypothesis	Sorace (2011)	Difficulties at the boundaries of linguistic domains.

The transition from Declarative Knowledge ("knowing that") to Procedural Automaticity ("knowing how") is one of the most significant cognitive shifts in Second Language Acquisition (SLA) (DeKeyser, 2007). This transformation is primarily explained through Adaptive Control of Thought (ACT-R) and Skill Acquisition Theory (SAT), which describe how linguistic rules move from a slow, conscious workspace into a fast, unconscious reflex (Segalowitz, 2010).

1.5 The Adaptive Control of Thought-Rational (ACT-R) Theory

The theory was established mainly by John R. Anderson (1983, 1993, 2007), is a comprehensive "cognitive architecture" designed to explain how the human brain organizes knowledge and executes tasks. In the context of Second Language Acquisition (SLA), ACT-R provides the most influential explanation for how a learner transforms slow, clunky grammar rules into fast, fluid speech.

1.5.1 The Two Knowledge Systems

The basis of ACT-R is the difference between two types of long-term memory:

A. Declarative Knowledge (The "What")

- **Definition:** Facts and information that we can describe or "declare." In language, this includes vocabulary definitions and explicit grammar rules (e.g., "The past tense of walk is walked").
- **Storage:** Encoded as "Chunks" small units of information that are linked together in a network.
- **Processing:** Retrieval from the declarative system is slow and requires significant attentional resources (working memory).

B. Procedural Knowledge (The "How")

- **Definition:** Knowledge that is embedded in action. It is the ability to perform a task without consciously thinking about the steps.
- **Storage:** Encoded as "Production Rules"—which follow an "IF-THEN" logic. Example: IF the goal is to describe a past action AND the verb is walk, THEN add the suffix -ed.
- **Processing:** Procedural knowledge is executed automatically and rapidly, bypassing the need for conscious retrieval (Anderson,2007).

1.5.2 The Mechanics of the Transformation

ACT-R clarifies the transition from "knowing that" to "knowing how" through a process called Knowledge Compilation. This transformation involves two specific sub-processes:

A. Proceduralization

When a learner constantly practices a grammar rule, the brain begins to create a version of that rule that no longer requires "retrieval" from the declarative system. In result, the rule is "built into" the procedure. Instead of searching for the rule in their memory, the learner's brain triggers the IF-THEN production automatically when the communicative need arises (DeKeyser, 2007).

B. Composition

According to Anderson (1993) that in the early stages, a learner might have several separate production rules for one sentence. So, the transformation will happen through practice, these small, individual steps are "collapsed" into a single, complex production. Example, instead of separately processing "Subject + Verb" and then "Verb + Object," the brain creates one smooth "Subject-Verb-Object" sequence. This significantly reduces the load on the brain's central processor.

1.5.3 Key Factors in the Transformation

A. The Role of Practice

DeKeyser (2007) states that proceduralization is highly domain-specific. If a learner only practices the "IF-THEN" rules via writing exercises, they will proceduralize for writing but will still struggle to produce those same rules in spontaneous conversation. The practice must match the target behavior.

B. The Power Law of Learning

By means of the transformation happens, the speed of the task improves following a specific mathematical curve. Initial gains in speed are massive (as the brain stops "searching" for rules), while later gains are smaller (as the brain "fine-tunes" the existing procedures) (Newell & Rosenbloom, 1981).

C. Mental Chronometry

Segalowitz (2010) employs the ACT-R framework to explain fluency. As the transformation to procedural automaticity completes, the "reaction time" of the learner decreases and becomes less variable. This stability is the hallmark of a "mechanized" linguistic reflex.

Table (2) Summary of the ACT-R Transformation

Feature	Declarative Stage	Procedural Stage
Cognitive Effort	High (Conscious)	Low (Automatic)
Speed	Slow and Serial	Fast and Parallel
Format	Facts ("Chunks")	IF-THEN Rules ("Productions")
Example	Reciting a rule.	Speaking a fluent sentence.

In the field of multilingualism, the "L2 Status Factor" and "Typological Proximity" are two competing yet often complementary frameworks used to explain how previously learned languages influence the acquisition of a third language (L3). These models move beyond the traditional L1-centric view of transfer to investigate the unique cognitive architecture of the multilingual mind (Cenoz ,2001).

1.6 The L2 Status Factor

As stated by Hammarberg (2001) the L2 Status Factor posits that a learner's second language (L2) acts a uniquely dominant role in the acquisition of a third language (L3), often overriding the influence of the native language (L1). Williams and Hammarberg (1998) first formalized this after observing that non-native languages are cognitively "tagged" similarly in the brain. They argue that because the L2 was learned through conscious effort (much like the L3 will be), the brain views the L2 as a more accessible and relevant "supplier" for linguistic hypotheses. In their longitudinal study of an L3 Swedish learner, they found that the L2 (German) was the primary source of lexical and morphosyntactic influence, while the L1 (English) was largely relegated to an instrumental role, such as clarifying instructions.

Additionally, Hammarberg (2001) advanced this by suggesting that the L2 acts as a "filter" for the L3. This dominance of the L2 is particularly strong in the early stages of L3 acquisition, regardless of whether the L1 is structurally closer to the target language. The theory suggests that the L2 provides a "non-native" template that the brain prefers to use when navigating a new linguistic system, as the L1 is processed through a more deeply entrenched, automatic neural pathway that is less accessible for conscious "transfer-by-choice."

1.7 The Typological Proximity Model

Unlike the Typological Proximity Model (TPM) proposed by Jason, Rothman (2011) claims that the "order" of acquisition (L1 vs. L2) is secondary to the structural similarity between languages. According to the TPM, the multilingual brain performs a "wholesale" transfer of the grammar from the language it perceives as most typologically related to the L3. This process occurs during the "initial state" of L3 learning. For instance, if a native English speaker who is fluent in Spanish begins learning Portuguese, the brain will identify Spanish as the most similar "source" and transfer its morphosyntactic rules entirely, even if specific English structures would be more accurate for certain Portuguese features.

Rothman (2011) highlights that this typological assessment is "global" rather than "feature-by-feature." The brain does not pick and choose individual rules; instead, it identifies a "best-fit" language and adopts its entire grammatical framework as a starting point. This model is supported by evidence from neuroimaging and behavioral studies showing that structural overlap—whether real or perceived by the learner is the most powerful predictor of where a learner will draw their linguistic hypotheses from during the acquisition of a third language.

1.8 Perceived Similarity vs. Non-Nativeness

Research by Murphy (2003) required to produce triggers (factors) to transfer, noting that these triggers often interact. Murphy found that while the L2 status factor makes a non-native language more "available" for transfer, Typological Proximity often acts as the final arbiter. If the L2 is both non-native and typologically close (e.g., an L1 English speaker using L2 French to help learn L3 Spanish), the transfer is extremely robust. However, if the L1 is closer to the L3 than the L2 is, the brain may face a "competition" between the cognitive accessibility of the L2 and the structural logic of the L1.

2. Previous Studies

The succeeding compiling delivers a sequential outline of main experiential studies dealing with second (L2) and third (L3) language morphosyntactic acquisition. These researches explore the process of transfer, the role of cognitive load, and the neurophysiological signs of grammar processing.

2.1 Syntactic Transfer and Word Order (Ringbom, 1987)

The population of the study involved a large-scale comparative group of Finnish-speaking and Swedish-speaking learners of English in Finland. The researcher utilized a corpus-based analysis of national matriculation exam essays. By comparing the error patterns of two groups living in the same environment but with different L1 structures (Finnish vs. Swedish), Ringbom isolated the effects of structural distance on L2 English production. The study found that

Swedish speakers significantly outperformed Finnish speakers in English morphosyntax because of the structural overlap between Swedish and English. Finnish learners showed higher rates of "zero-transfer" (omission of articles and prepositions) because these categories do not exist in the Finnish case system.

2.2 The Full Transfer/Full Access Hypothesis (Schwartz & Sprouse, 1996)

The study utilized a longitudinal case study of an adult native speaker of Turkish acquiring German in a naturalistic setting. The researchers tracked the learner's spontaneous speech for several months, focusing on verb placement (V2) and subject-verb inversion. They mapped the development of his "interlanguage" to see if his initial German syntax was based on his L1 (Turkish) or Universal Grammar. The findings suggested that the initial state of L2 acquisition is Full Transfer—the learner's entire L1 grammar acts as the starting point. However, when Turkish syntax failed to process German input, the learner utilized Full Access to Universal Grammar to restructure his mental map, eventually acquiring the correct German verb-second rules.

2.3 The L2 Status Factor in Multilinguals (Williams & Hammarberg, 1998)

Conducting a longitudinal case study of an adult native English speaker learning Swedish (L3) with high proficiency in German (L2), the researchers analyzed oral production data over two years, focusing on "language switches" and lexical/morphosyntactic errors. They coded whether these slips originated from the L1 (English) or the L2 (German). The study revealed the L2 Status Factor, where the learner's L2 (German) exerted a much stronger influence on her L3 (Swedish) than her native English did. The researchers concluded that non-native languages are cognitively "tagged" similarly, making the L2 a more accessible "supplier" for L3 hypotheses than the L1.

2.4 Missing Surface Inflection (Prévost & White, 2000)

The sample involved adult L2 learners of French and child L2 learners of German at early to intermediate proficiency levels. The researchers conducted a longitudinal study of spontaneous production, specifically analyzing the relationship between verbal inflection (morphology) and verb movement (syntax). They checked if "morphological errors" correlated with "syntactic errors." The results showed that while learners often used incorrect or "default" endings (morphology), they almost always placed the verb in the correct position (syntax). This led to the Missing Surface Inflection Hypothesis, which argues that learners possess the correct syntax but fail to retrieve the correct morphological forms during real-time processing.

2.5 The Effect of Linguistic Distance (Cenoz, 2001)

A population of 90 students in the Basque Country: Basque-Spanish bilinguals learning English (L3) were examined. The study used a "Picture Description Task" (The Frog Story) to elicit narrative data. Cenoz analyzed cross-linguistic influence (CLI) by tracking lexical and syntactic transfers from both Basque and Spanish into the learners' English. The study found that Linguistic Distance (Typology) and L2 Status interact. Learners transferred more from Spanish to English (both Indo-European) than from Basque to English. However, older learners with higher L2 proficiency were more likely to use their L2 as a conscious bridge for L3 acquisition, supporting the idea of a developing "Multilingual Competence."

2.6 The Interpretability Hypothesis (Tsimpli & Dimitrakopoulou, 2007)

A sample of intermediate and advanced Greek-speaking university students learning English (L2) was gathered. The researchers utilized a Grammaticality Judgment Task (GJT) to test the acquisition of "wh-interrogative" structures. They specifically tested features that are "uninterpretable" (grammatical rules with no meaning, like case or gender markers). The study found that while learners could master "interpretable" features (like plural markers), they struggled permanently with "uninterpretable" features that were not present in their L1. This suggests that morphosyntactic transfer is selective: features that do not contribute to meaning in the L1 are often "invisible" to the adult L2 brain.

2.7 Typological Proximity Model (Rothman, 2011)

Involving two sets of adult L3 learners: English/Spanish speakers learning Portuguese (L3) and English/Italian speakers learning Portuguese (L3), the researchers used a Truth Value Judgment Task to investigate morphosyntactic properties like Null Subject and Object Clitics. They wanted to see if the L3 Portuguese was being influenced by the L1 (English) or the L2 (Spanish/Italian). The key results showed that the brain performs a "wholesale" transfer from the language it perceives as most typologically similar to the L3. The English/Spanish group transferred from Spanish, even when English would have been a better match. This proved that Typological Proximity is the primary driver of transfer in the initial state of L3A.

2.8 Neuroimaging and Morphosyntax (Morgan-Short et al., 2015)

The researchers tested adult learners of an artificial language ("Brocanto") under two conditions: Implicit (immersion) and Explicit (classroom) instruction. The researchers utilized Event-Related Potentials (ERPs) to measure brain activity during language processing. They looked for the P600 signature (associated with syntactic processing) and the N400 (associated with lexical meaning). The neuroimaging data revealed that learners who received Implicit instruction developed native-like brain patterns (P600) for morphosyntactic violations. Conversely, explicit learners often relied on lexical-meaning pathways (N400). This suggests that the brain *can* achieve native-like automaticity, but the pathway depends on the type of exposure and practice.

2.9 Structural Priming and L3 Initial State (Westergaard et al., 2020)

This study examined 68 adult learners with diverse L1s (Norwegian and Russian) learning English (L3). The researchers employed a Syntactic Priming Task to investigate the "L3 Initial State." This methodology measures whether exposure to a specific sentence structure in one language "primes" (makes it easier to produce) that same structure in the new L3. The study specifically targeted word order in possessive constructions. The findings supported the Linguistic Proximity Model (LPM), suggesting that transfer is not "wholesale" (taking the entire grammar) but "property-by-property." The brain selectively transfers specific morphosyntactic features from whichever language (L1 or L2) provides a structural match for that specific property in the L3.

2.10 Neuroplasticity and Morphosyntactic Processing (Bice & Kroll, 2021)

Utilizing Event-Related Potentials (ERPs) to track brain activity during a longitudinal training session the sample was native English speakers in the very early stages of learning Spanish (L2), the researchers emphasized the P600 component, which identifies structural/syntactic processing, to see how quickly the brain begins to "notice" L2 morphosyntactic violations. The results showed that the brain begins to reorganize its morphosyntactic processing pathways much earlier than previously thought—sometimes after just a few hours of exposure. Even before learners could consciously identify errors in a GJT, their brains showed a burgeoning P600 response, suggesting that the transition from lexical to structural processing begins at the very onset of acquisition.

2.11 The Scalpel Model and Feature Transfer (Slabakova, 2021)

Employing the Scalpel Model framework, Slabakova (2021), re-examine existing data on L3 transfer for a synthesis of multiple empirical groups including English/German and Spanish/Italian multilinguals. This methodology treats the brain as a "scalpel" that surgically selects specific grammatical features (like gender, tense, or case) from the L1 or L2 based on their "noticability" and structural utility in the L3. The research demonstrated that transfer is highly asymmetrical. Learners are more likely to transfer "marked" (complex) features if they perceive them as useful, but they will default to the simplest available structure if the L3 input is ambiguous. This study reinforces the idea that morphosyntactic transfer is a highly efficient, economy-driven cognitive process.

2.12 Cross-linguistic Influence in Multilingual Reading (Kush et al., 2023)

A sample of 42 adult trilinguals (L1 German/L2 English/L3 Spanish) were examined. The study employed Eye-tracking during reading to monitor real-time morphosyntactic processing. Specifically, the researchers manipulated subject-verb agreement and gender concord in the L3 (Spanish) sentences to see if "interference" from the L1 or L2 caused longer fixation times or regressive saccades. The data provided strong evidence for procedural interference. Even high-proficiency trilinguals showed a "processing lag" when the L3 structure conflicted with the L2 (English) syntax, but not the L1 (German). This suggests that the L2 remains a constant "active competitor" during the online processing of L3 morphosyntax, supporting the **L2 Status Factor** in real-time reading.

2.13 Generative Perspectives on L3 Transfer (Puig-Mayenco et al., 2024)

Involving 120 learners of L3 German with varied L1/L2 backgrounds (English, Spanish, and Catalan), the researchers utilized a Sentence-Picture Matching Task and a Grammaticality Judgment Task to test the acquisition of the German "V2" (Verb-Second) property. They compared learners whose L1 or L2 already had V2 (like Catalan/Spanish) against those who did not (English). The study found that Typological Proximity was the most reliable predictor of success. Learners whose L1 or L2 contained the V2 property acquired the German structure significantly faster and with more "native-like" accuracy. The study concluded that the brain "re-uses" complex syntactic hardware whenever it identifies a structural cousin in a new language.

2.14 The Role of Executive Functions in Morphosyntactic Processing (Vargas and Schmidt, 2025)

Examining the cognitive load associated with acquiring non-native morphosyntactic structures, particularly in high-pressure environments, Vargas and Schmidt (2025) followed a mixed-methods experimental design involving a sample of 120 university-level EFL students. The methodology combined behavioral reaction-time tasks with a Perceived Cognitive Load Scale (PCLS) administered during a series of complex grammar tests. The key results indicated that students with lower inhibitory control and working memory capacity perceived morphosyntactic structures (such as nested relative clauses and tense-aspect markers) as significantly more "challenging." The study concluded that the "difficulty" students report is often a result of cognitive saturation, where the brain's executive functions are overwhelmed by the simultaneous demands of structural retrieval and test-taking anxiety.

2.15 Neurophysiological Correlates of Structural Uncertainty (Chen & Al-Mansoori, 2025)

Examining the biological markers of structural difficulty, Chen and Al-Mansoori (2025) investigated the neurophysiological responses of EFL learners to morphosyntactic violations. The study employed a longitudinal case study approach with a sample of 40 intermediate-level students (equivalent to 3rd-semester university learners). The methodology used electroencephalography (EEG) to measure Event-Related Potentials (ERPs), specifically the P600 component, while students completed computerized language tests. The key results revealed that students who perceived testing as a "high-stakes challenge" showed delayed and diminished P600 responses compared to those in low-stress environments. This suggests that the "nervousness" and "forgetting" reported by students have a neurophysiological basis, as high stress effectively inhibits the brain's ability to process and repair structural errors in real-time.

3. Research Design and Approach

The study employed a descriptive review method which utilizes a qualitative combination and literature assessment organization to examine the acquisition of morphosyntax by non-natives. The study contains a consecutive meta-analysis of a number of empirical previous researches of a range of time that ranges from 1987 to 2025.

4. Conclusion

Reviewing previous related studies and research, it can be concluded that the most conclusive indication for native-like ability is the appearance of the P600 ERP constituent (The P600 is a specific brain reaction measured via Electroencephalography (EEG)) that works as a neural "signature" for syntactic and structural processing. It is a portion of the Event-Related Potential (ERP) group, which are electrical variations in the brain that happen in direct reaction to a particular trigger, such as reading a word or hearing a sentence), in progressive learners. As explained by Morgan-Short et al. (2015) and Bice and Kroll (2021), the mature brain can transfer from an N400 reaction (which deals with grammatical errors as "meaning" mistakes) to a P600 reaction (which deals with them as "structural" violations). This transfer implies that the brain has efficaciously "proceduralized" L2 morphosyntax, changing the computational burden from declarative memory to the procedural circuits precisely the left inferior frontal gyrus and the basal ganglia that native speakers employ for automatic processing.

Neurophysiological evidence also proposes that "native-likeness" is most reachable when the L2 forms are close to the learner's present linguistic "hardware." Dowens et al. (2010) demonstrated that whereas late learners can reach a P600 (controlled structural repair) for most errors, the LAN (Left Anterior Negativity) the mark of actually automatic, pre-conscious recognition is more likely to be observed when the L1 and L2 have similar morphological classes. This shows that whereas the adult brain is extremely plastic, its "automatic" shortcuts are most efficiently forged through typological proximity (Rothman, 2011).

A chief result from Morgan-Short et al. (2015) is that the nature of experience prescribes the neural product. Learners experiencing implied, immersion-like circumstances confirmed native-like brain signs (P600) even when their external behavioral accurateness was parallel to classroom learners. This recommends that the adult L2 brain's ability is often marked by obvious instructional ways; when supplied with naturalistic input, the neurophysiological system has the ability of avoiding conscious rule-following to create the reflexive neural distinguishing characteristic of native speakers.

Finally, neurophysiological data from 2010 to 2025 approves that the "Critical Period" for language acquisition does not characterize a solid biological limit for morphosyntactic processing. As an alternative, the adult brain stays neurocognitively active. Native-like ability is appreciated when high levels of proficiency and implied experience permit the brain to reform its processing from slow, declarative "rule-checking" to the rapid, procedural "automaticity" explained by skill acquisition theory (DeKeyser, 2007).

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