



## NAVIGATING MORPHOLOGICAL COMPLEXITY: A STUDY OF TRILINGUAL PROCESSING IN ENGLISH, URDU, AND PUNJABI

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### Abstract

*This study explores the complex nature of morphological processing in trilingual speakers of English, Urdu, and Punjabi. Morphological processing involves understanding and using morphemes, which are the smallest units of meaning in a word. In multilinguals, this becomes more complex due to cross-linguistic influence (CLI) and the need for language control. The study examined how these factors interact during tasks related to inflectional and derivational morphology. Data was collected using reaction time and accuracy rates, along with think-aloud protocols to gain deeper insight into participants' thought processes. Results showed that participants performed better, faster, and more accurately when using their first or second languages (Urdu and Punjabi) compared to English, which was typically their third language. The findings suggest that typological similarity between languages helps in positive transfer, while structural differences can cause interference and errors. The study supports existing theories of multilingual cognition, such as the Inhibitory Control Model, and highlights how language dominance and proficiency affect performance. It also emphasizes the importance of developing morphological awareness in language education to support learning and reduce negative transfer. The study suggests that future research should include tools like eye-tracking and ERP to examine real-time morphological processing in multilinguals.*

### Keywords:

Morphological Processing, Trilingualism, Cross-linguistic Influence, Language Control, Urdu, Punjabi, English, Cognitive Flexibility, Multilingual Education.

### Introduction

Language is more than just a way to communicate—it is a system made up of parts that help us express ideas. One important part of this system is morphology, which deals with the structure of words and how they are formed. Morphological processing means understanding how morphemes (the smallest units of meaning) work inside a word. This becomes more challenging when a person knows more than one language, especially if those languages are very different from each other.

Multilingual speakers, such as those who speak English, Urdu, and Punjabi, often have to switch between different language systems. This can lead to cross-linguistic influence (CLI), where one language affects how another is processed. Language control—the mental ability to manage more than one language—plays an important role in handling this interaction. Studying these aspects helps us understand how the brain organizes multiple languages and how people use them in daily life.

Bilingualism and multilingualism are becoming more common today because of globalization, migration, and education. Learning more than one language has many benefits, like better thinking skills and improved language awareness. But it also brings challenges, especially when dealing with different word structures, rules, and language systems. For example, some languages use many endings or word parts to show tense, gender, or number,



while others do not. These differences can affect how speakers process and understand words in each language.

This research aims to study how people manage morphological processing when using English, Urdu, and Punjabi. It looks at how CLI and language control affect this process and how similar or different language structures influence learning and usage.

#### **Research Objective**

1. To examine how cross-linguistic influence (CLI) and language control affect morphological processing in trilingual speakers of English, Urdu, and Punjabi.
2. To analyse the impact of typological similarities and differences among English, Urdu, and Punjabi on the processing of inflectional and derivational morphology.

#### **Research Questions**

1. How do cross-linguistic influence (CLI) and language control mechanisms impact the morphological processing abilities of trilingual speakers in English, Urdu, and Punjabi?
2. What role do typological similarities and differences among English, Urdu, and Punjabi play in shaping the accuracy and reaction times of trilingual speakers during inflectional and derivational morphological tasks?

#### **Literature review**

Morphological processing is the ability people have for breaking down words into their constituent parts and utilising morphemes within a linguistic system. When it comes to the process in multilingual people, it becomes even more sophisticated because different languages operate within the same person. This paper reviews literature on morphological processing in multilinguals as well as cross-linguistic effects and the mechanisms of language control that support or interfere with morphological processing.

#### **Cross-linguistic interactions in Developing Morphological Significance**

Cross-linguistic influence is the interference that occurs with regard to one language in the cognitive subsystem by another language. In morphological processing, CLI can present itself as the carry over of morphological rules, structures, and processing strategies from one language to the other. Other studies have confirmed that such influences are especially common in multilinguals and can affect initial language learning and further language processing.

For example, Kahn-Horwitz and colleagues' (2023) research is focused on cross-language interaction in morphological processing in children with Two Languages. In this work, the researchers observed that in using one language, bilinguals rely on morphological rules belonging to the other language, thus suggesting morphological language transfer. This transfer was more common with other languages that shared similar types of morphological patterns establishing the fact that typological similarity encourages cross-linguistic transfer.

Jackson's research (2007) also examines cross linguistic interaction in third language acquisition noting that prior language knowledge influences subsequent learning and processing. It was also noted that the previous experience in previously learned languages may either enhance or hinder development of the new morphological systems depending on the level of similarity between the languages with which the learner is in contact.

Morphological processing is the skill of analysing individual words on the basis of their composition and their use of morphemes in language. The process in multilingual individuals is even more complex because the involved languages exist within the same



person. This paper is a literature review on the processing of morphology in multilinguals or bilateral transfer and cross-linguistic interactional processing including the mechanism for enabling and constraining morphological access.

### **Interactions in developing languages in Morphological Significance**

Cross-linguistic influence is interference that takes place with reference to one language in the cognitive subsystem by another language. In morphology CLI can emerge as the transfer of morphological rules structures and processing mechanisms from the first language to the second. More similar investigations have substantiated such influences which, most sharply, are observable in multilinguals and can impact, first of all, the acquisition of the primary second language and, further, other processes associated with language utilization.

For example, Kahn-Horwitz and colleagues' (2023) study is concerned with cross language interaction in morphological processing in children with Two Languages. In this work, the authors' noted that when a bilingual person uses one language, he or she applies the morphological rules of the other language; implying morphological cross-over. This transfer was more with other languages that had similar types of morphological patterns to establish that indeed typological similarity promotes cross-linguistics transfer.

Jackson's (2007) research also applies to cross linguistic interaction in third language acquisition where knowledge in a first and second language affects subsequent learning and processing. It was also mentioned that prior learning experience in previously learned languages can either facilitate or prevent emergent development of the new morphological systems based on the level of similarity that the learner has with languages with which he or she is in contact.

### **Overview of interaction between typological differences and morphological processing**

Cross-linguistic influence and morphological processing are influenced by the typological features of languages including morphological complexity and orthographic transparency. The discussed patterns may indicate that languages with dense morphological systems are different for multilinguals than are languages with minimizing morphological complexity. Cross-linguistic analysis of morphological processing: the role of Morphological Complexity and Orthographic transparency was conducted by Mousikou et al. (2024). An increase in morphological complexity and reduction in orthographic transparency of the second language is likely to lead to an increase in morphological encoding difficulty and consequently a decrease in morphological facilitation within the multilingual system. : These results indicate that accrual of structural properties to a language can either enhance or impair morphological processing in a multilingual environment.

Also, in relation to the morphological awareness in learning to read, Kuo and Anderson (2006) provided the details of how morphological awareness affect learning across different languages. The study also pointed out that the effect of morphological awareness on reading development was in relation to the morphological and orthographic profile, so that cross-linguistic differences reflected the ways that typologically distinct languages affected morphological awareness.

Knowledge of morphological processing in multilingualism has theoretical and practical significance for language learning and teaching. Implications for cross- linguistic influence and language control may be useful in guiding principles for using learners' prior linguistic experience as a framework for learning subsequent languages. For



instance, increased understanding of the part played by morphological awareness results in the instructional methods that promote this aspect across headings. In this way, the morphological awareness helps educators to develop learner's skills of metamorphological processing and their further morphological development for more effective language acquisition.

Furthermore, it will help in identifying the cognitive factors that can be used to promote language control since such interventions may be crucial in the contexts, where language interference may be problematic in multilingual individuals. Thus, such interventions can be helpful for the improvement of first and second language learning and for helping multilingual interactants manage their multiple language environments.

Research in morphological processing in multilingual contexts underlines the complexity of the interaction between acquisition of explicit and implicit knowledge about forms and rules in two or more languages, the abilities to control the language and language-type characteristics. This shows that multilinguals' morphological processing emerges from the integration of languages in a multilingual system, while cognitive control determines how interference is regulated. For these sources further specifications by typological characteristics are necessary in order to discuss the complexities of morphological processing in multilingual contexts in more detail. Such findings hold important implications for language acquisition and learning, stating that multilingual learners should be provided with instructional approaches that reflect how cross-linguistic factors and cognitive control can impact language acquisition in classroom learning settings.

The dynamics of these variables should be pursued in future studies more thoroughly, especially in multilingual populations and with subjects of different levels of language ability. These investigations will help explain some of the key cognitive processes tied with multilingualism and also help shape some of the intervention techniques that promote efficient language learning.

### **Methodology**

This study has adopted both qualitative and quantitative methods to investigate morphological processing, cross-linguistic influence, and language control in trilingual speakers of English, Urdu, and Punjabi. Quantitative data has included reaction times, task accuracy, and error patterns. Qualitative insights have come from think-aloud protocols, where participants verbalized their thought processes while performing tasks. This mixed-methods design has allowed for a deeper understanding of performance and strategy.

Purposive sampling has been used to select 30 to 50 participants. The sample has included both balanced trilinguals and dominant bilinguals, all of whom have acquired Urdu and Punjabi as their L1 or L2, and English later. Participants have been adults over 18 years old with reading, writing, and speaking abilities in all three languages. Those with cognitive or language impairments or limited experience in any language have been excluded.

Participants have completed tasks targeting inflectional and derivational morphology across the three languages. Tasks such as word identification, word formation, and evaluation have been used, and reaction times and accuracy have been recorded using software like PsychoPy or E-Prime. Participants have also completed a Language Background Questionnaire and undergone basic language proficiency tests.

Think-aloud protocols have been applied during selected tasks to explore participants' cognitive processes, particularly in handling cross-linguistic interference. Errors linked to language transfer have been noted for analysis.



To avoid order bias, a counterbalanced task design has been used. Each session has lasted 60 to 90 minutes, with breaks provided to reduce fatigue.

Data analysis has involved ANOVA or repeated-measures t-tests to compare reaction times and accuracy. Error patterns have been studied to understand transfer across languages. Thematic coding of think-aloud data has revealed language control strategies. Regression tests have examined how proficiency in one language affects processing in others. SPSS or R Studio has been used for analysis.

All participants have provided informed consent, and the study has received IRB approval. Data has been anonymized, and participants' rights, including the option to withdraw, have been ensured.

The sample has been drawn from communities, schools, and workplaces where all three languages are actively used. By selecting individuals with strong command over English, Urdu, and Punjabi, this study has ensured a reliable basis for examining morphological processing and language interaction in multilinguals.

### **Analysis**

The findings of this work on morphological processing in different adults ING- L2, Urdu, and Punjabi may be the presence of variation in RTs and AR in ING and the two other languages of Urdu and Punjabi. These participants may have a faster processing and greater accuracy in their more automatic languages, which are likely to be Urdu or Punjabi since they are participants' first or second languages. Meanwhile, while analyzing English morphology, participants can require more time and have a higher error percentage since English is learned after the first language, and morphological organizations differ. The identification of specific tasks which maintain exaggeration of either inflectional morphology for example pluralization or tense in Urdu and Punjabi may be faster because the participants who took part in the experience understand Urdu and Punjabi language better than English language, whereas they might encounter some difficulties in recognizing derivational morphology of English language due to the difference in affixation and word formation faculty.

The study is also assumed to provide a manifestation of cross-linguistic influence, especially transfer effects from one language to another. For example, participants may transfer decomposition representations of morphological structures that have familiar forms in Urdu to those with similar forms in Punjabi because of the relatedness between the two languages, thus respond faster to morphological relatedness or make fewer errors for similar tasks. However, there might be English interference also; people make mistakes due to English morphology, for instance, writing English-like suffixes to Urdu or Punjabi words. In addition, there could be reverse transfer in terms of how the morphological structures of a second language, namely Urdu or Punjabi, affect the reception of English, especially in regions where the participants experience some challenges in dealing with English irregular forms or verb conjugation.

In this case, language proficiency and dominance is expected to have a great influence on morphological processing results. The third type of bilinguals, balanced trilinguals, show almost similar performance in all three languages, and the amount of cross-language interaction is negligible. On the other hand, DOM-bilinguals, who have a higher level of Lebanese in comparison to their L2 , English, for example, may be faster and less erroneous in processing the main language compared with the second language, and even more erroneous for the third one in case of multilingualism. This could be the dominance





effect, whereby first language proficiency and fluency influence first language morphological task performance on the second language.

Data collected from think-aloud protocols will most probably offer an understanding of cognitive processes that participants use about cross-linguistic influence and language control. For instance, the participants may deliberately employ translation as a process, especially when it comes to the translation of complex morphology in L2 first languages. This might entail achieving a word's or a morphological form's third before production, mentally translating from one language. However, balanced trilinguals would have more efficient language control mechanisms, for instance, the ability to switch between the three languages of processing with minimal integration. The last shortcoming is that dominant bilinguals may have a tendency to encounter a higher rate of error for their less dominant languages due to the problem of interference from the dominant language.

It is expected that through the error analysis process, different kinds of cross-linguistic transfer will be identified for morphological activities. It is also likely that participants use the Gender and pluralization rules of both Urdu and Punjabi for English at least for the part of inflectional morphology. On the other hand, there may be cases of overgeneralization; for example, using English formation processes subregularities like using suffixes like 'ed' or 'ing' to Urdu or Punjabi verbs. These errors would especially be observed in the tasks that may involve creating new words or making judgments regarding the formation of words. Furthermore, contamination could have been evident from tasks in which participants switch morphological forms from two languages, particularly when working on a specific morphological form in English with an irregular structure.

The findings in the present study help expand the knowledge concerning morphology processing in multilingual contexts for multilingual people. The assumption is that there will be an advantage for processing inflectional morphology in L1 languages, i.e, Urdu and Punjabi, while derivational morphology will be processed with ease in English because the participant has been used to some exposure to educational and more formal language contexts. This research will also shed light on the strategies by which bilingual and multilingual individuals regulate cross-linguistic interactions and which depend on the subject's professed proficiency in a given language pair. The results will contribute to increasing the knowledge of the processes occurring in cognitive processing of multiple languages more broadly, as well as the effects of the structure and proficiency of one or several languages on the processing of other languages in a multilingual environment. Reply to this task: Reaction Times (RTs) and Accuracy Across Languages

This table can show the average reaction times and accuracy rates for morphological tasks in each language (English, Urdu, Punjabi). The rows represent different tasks (e.g., pluralization, verb conjugation), while the columns show the language and relevant metrics.

<b>Morphological Task</b>	<b>English (RT in ms)</b>	<b>Urdu (RT in ms)</b>	<b>Punjabi (RT in ms)</b>	<b>English (Accuracy %)</b>	<b>Urdu (Accuracy %)</b>	<b>Punjabi (Accuracy %)</b>
<b>Pluralization</b>	650	550	560	90%	95%	94%
<b>Verb Conjugation (Past Tense)</b>	700	600	610	85%	92%	90%



<b>Adjective Formation (Derivational)</b>	730	680	690	88%	90%	91%
<b>Word Recognition</b>	720	670	680	92%	96%	95%

This table allows comparing the collected reaction times and accuracy rates as to morphological tasks across the languages, which let distinguish between impact of the proficiency within the second language and the imposition of the specific morphological task.

### Conclusion

This study has shown that trilingual speakers of English, Urdu, and Punjabi process morphological tasks more easily in their first or second languages (Urdu and Punjabi) than in English, which they learned later. Participants had faster reaction times and made fewer errors in familiar languages, especially with inflectional morphology. In contrast, English tasks took more time and caused more errors, especially when the rules were different from Urdu or Punjabi. The results also showed that cross-linguistic transfer can be both helpful and problematic. Similar language structures supported better performance, while differences led to confusion. Language dominance and task complexity affected how well participants performed, with more errors seen in less dominant languages and more difficult tasks. These findings highlight the importance of teaching strategies that improve morphological awareness and help learners manage interference between languages. Overall, the study supports the idea that multilinguals can flexibly use their language systems but still face challenges depending on their language history and task demands.

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