PROCESSING OF MORPHOLOGICALLY COMPLEX WORDS IN URDU AND ENGLISH BY URDU-ENGLISH BILINGUALS: A PSYCHOLINGUISTIC STUDY

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ABSTRACT

Processing of Morphologically Complex Words in Urdu and English by Urdu-English Bilinguals: A Psycholinguistic Study

The study investigates the processing of morphologically complex words in Urdu (L1) and English (L2). The theoretical background of the study is based on the dual mechanism theory (Pinker & Ullman, 2002) which posits that L1 users decompose the morphologically complex words before storing them in their mental lexicons whereas the morphological decomposition is not available for L2 users in the early stages of L2 learning. Thirty-nine Urdu-English bilinguals took part in two similar lexical decision-making experiments. These participants were divided into three groups according to their proficiency levels based on their scores in the LexTALE test. Two very similar masked priming experiments of Urdu and English were used in the study. In both the experiments, primes were shown to the participants for 50 milliseconds before asking the participants to respond to the target words in a lexical decision-making task. The experiments included inflections, derivations, and compound words of Urdu and English. The English experiment also included items containing words that were only orthographically related. The data was analyzed via the MANOVA in the SPSS. The results showed across the board priming effects for the Urdu experiment. In English, however, only high proficiency group displayed priming effects in inflections, derivations, and one of the three compound words. No priming was observed for the orthographically related primes and targets. The findings suggest that the native speakers of a language break down the morphologically complex words. The second language learners, however, achieve the native-like processing only after attaining higher levels of proficiency in the second language. The study is significant as it focuses on bilingual minds investigating the similarities and differences between L1 and L2 processing.

Keywords: language processing, morphologically complex words, bilingual processing, bilingualism, bilingual mind, priming, psycholinguistic priming

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
ELT	English Language Teaching
L1 (in figures and charts)	Level 1 (Low Proficiency Group)
L2 (in figures and charts)	Level 2 (Medium Proficiency Group)
L3 (in figures and charts)	Level 3 (High Proficiency Group)
MANOVA	Multivariate Analysis of Variance
PTE	Prime and Target (English)
PTU	Prime and Target (Urdu)
SPSS	Statistical Package for Social Sciences

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To my family,

For their unflinching and unconditional support!

CHAPTER 1

INTRODUCTION

Second language learning has always been under a lot of discussion and investigation. Various aspects of the target language and their relative difficulty levels for its learners have been constantly investigated. However, language is such a complex system that no amount of research and investigation can be termed enough. The constant evolution of a language makes it even more complex for its learners and researchers. Language is called a system because it involves so many parts (or sub-systems) (Beckner et. al, 2009); cognition, articulation, phonology, morphology, grammar etc. Each of the sub-systems is so complex that it can be called a system in its own right. The complexity increases manifold with the fact that all these (sub) systems keep evolving. That is why research on language can never be enough.

English language learning has also, like other languages, been under the investigative lens. It would not be incorrect to say that English, due to its status as the world's lingua franca, has been investigated more than any other human language. Being the need of the world, every nation gives English due importance in its system of education. Pakistan is no exception. In Pakistan, English is taught as a 'compulsory subject' right from grade 1 till the 14^{th} year of education. However, how successful the system has been in making the students learn the language is debatable.

The English language is, like other languages, a system made of many sub-systems. This study focuses on the sub-system of cognition. Cognition itself is a big and complex system. Since the aim of the study is to investigate learning English as a second language, the focus remains on how differently learners behave while processing the second language as compared to their first language. As the title of the research study suggests, the study compares (mental) processing of morphologically complex words in Urdu and English by Urdu-English bilinguals.

1.1 Background of the Study

The present study aims at investigating the processing of both native and non-native languages. As discussed above, language is a vast and complex entity. Therefore, the part of the languages the present study focuses on is the processing of morphologically complex words.

Processing of morphologically complex words is a widely investigated field. There are innumerable studies that involve processing of morphologically complex words in native and non-native settings (Clahsen 2006; Zeng et al., 2019). However, these studies have been mostly limited to one type of morphologically complex words. That is, the studies mostly focus on either inflections or derivations. The present study has its focus on all three types of morphologically complex words. The study investigates the processing of inflections, derivations and compound words both in Urdu and English.

As far as English is concerned, there have been numerous studies that investigated processing in general and processing of morphologically complex words in particular. However, most of these studies involve one language, mostly English (Amenta & Crepaldi, 2012). The present study investigates processing of morphologically complex words in both English and Urdu.

Processing of Urdu as a first language is an uninvestigated area. There are only a few studies that investigated Urdu processing and most of them were conducted using offline methods. The present study uses online priming experiments for the purpose. Two very similar online experiments are used for investigating processing of morphologically complex words in both Urdu and English involving individuals who use Urdu as their first and English as their second language.

Most of the studies done in processing of native and non-native languages involve one language. The usual setting is that a group of non-native speakers are experimented upon, and the results are compared with those of a native controlled group going through the same experiment (Clahsen & Felser, 2006). The present study is different as it investigates the processing of the same participants in two different languages, Urdu and English. Urdu is the native language of the participants of this study, whereas English is their second language. In this way, this study is quite different from the past practices in this area of research.

In short, this study aims at filling many research gaps. First of all, this study compares the native and non-native language processing of the same set of individuals by employing very similar experiments. It also takes into account the respondents' level of proficiency in their second language (English). The study also aims at finding out the similarities and/or differences between how inflections, derivations, and compound words are processed by the native speakers of a language and how similar morphologically complex words are processed by the non-native users of a language, taking into account three proficiency levels (low, medium, and high proficiency) in the non-native (second) language. The study is also one of the first that investigates online Urdu processing of morphologically complex words.

1.2 Statement of the Problem

This study focuses on investigating the processing of morphologically complex words in both the first language (Urdu) and second language (English) among native Urdu speakers who use English as a second language in Pakistan. Existing research suggests that native speakers typically process morphologically complex words more rapidly by storing stems and attaching morphemes during processing, while second language learners tend to process these words slower, storing them as separate entries in their mental lexicon. However, recent studies propose that non-native speakers may adopt similar processing strategies to native speakers if they achieve a higher proficiency level in the second language.

The primary objective of this study is to examine whether there is a discrepancy in processing efficiency between morphologically complex words in the participants' first and second languages. Additionally, it aims to investigate the validity of the hypothesis suggesting that non-native speakers store morphologically complex words as distinct entries in their mental lexicon. Furthermore, the study seeks to explore whether highly proficient second language users demonstrate native-like processing characteristics when dealing with morphologically complex words. By addressing these objectives, this research endeavors to enhance our understanding of morphological processing in bilingual contexts, particularly in the case of Urdu-English bilinguals in Pakistan. The findings of this study will contribute valuable insights into the role of proficiency level in second language acquisition and shed light on the mechanisms underlying morphological processing in bilingual individuals. Ultimately, this research aims to inform language teaching and learning practices, particularly in multilingual settings like Pakistan, by providing evidence-based insights into the processing of morphologically complex words.

1.3 Research Objectives

The study has the following objectives:

- To find out the similarities and/or differences between the way the native speakers of Urdu process morphologically complex words and their processing of morphologically complex words in English, their second language.
- To compare both these phenomena, one in the first language (Urdu) and the other in the second language (English) by the same individuals.
- To find out the reasons and justifications for the similarities and/or differences between the processing of morphologically complex words in first (Urdu) and second (English) languages.
- To find out whether level of proficiency in the second language has any role in how individuals process the morphologically complex words in their second language.

1.4 Research Questions

The present study tries to find answers to the following questions:

1. What are the differences and/or similarities between the processing of morphologically complex words in Urdu and in English by Urdu-English bilinguals?
2. Why are there differences and/or similarities between processing of morphologically complex words in L1 and L2 by Urdu-English bilinguals?
3. How does the proficiency of second language learners affect their processing of morphologically complex words in L2?

1.5 Theoretical Framework

The proposed study aims at investigating the processing of morphologically complex words both in L1 and L2 and examining them comparatively. Many research studies have found that native speakers process the morphologically complex words quicker than the non-native speakers because they apply decomposition rules to those words. That is, they pick out the stem morpheme by breaking the morphologically complex word down and then apply the inflections/derivations to it, if needed. Non-native speakers, on the other hand take longer time to process morphologically complex words because they are not aware (at subconscious level) of the morphological breakdown of words and, therefore, store them as separate lexical entries in their mental lexicon. Retrieving a word from a mental lexicon takes longer time than breaking down a visible word in order to form another word (e.g., go from going). There are two theories of language processing when it comes to processing derivational and inflectional words. Single mechanism theory states that there is only one mechanism involved in processing/retrieving inflected words and separate word entries in the mental lexicon. Dual mechanism theory (Pinker & Ullman, 2002), on the other hand, posits that there are two different mechanisms at work while processing the retrievals. One of these mechanisms is responsible to retrieve the entries from the mental lexicon whereas the other one is responsible to break down the already retrieved words into different morphemes and quickly recognize the stem that can be used to form other words. The latter mechanism takes less time as the word to be processed is already retrieved. The present study is based on the latter mechanism, the Dual Mechanism Theory, presented by Steven Pinker in his book, *Words and Rules: The Ingredients of Language* (Pinker, 2015; Pinker & Ullman, 2002).

The theory was originally presented by Pinker in 1994 (Pinker & Prince, 1994) positing that the native speakers of a language use a dual route mechanism while retrieving past tense forms of regular and irregular verbs. The regular past tense forms are broken into their contributing morphemes by the native language users before storing them in the mental lexicon. The irregular past tense forms, on the other hand, are stored as separate entries in the lexicon. Clahsen (2006) believes that much experimental and psychological evidence exists supporting Pinker's dual mechanism model. However, as per the scholar, the research should be extended to other types of inflections rather than keeping it limited only to regular past tense inflections (Clahsen, 2006).

There is a lot of research done in the area since the presentation of this theory. The research in the area widened the focus from regular and irregular past tense inflections to other inflections, derivations, and compound words. Earlier, only native speakers of various languages were involved in the research studies. Later, non-native speakers of languages were also put under the investigative lens. The more recent research in the area shows that even the non-native speakers of a language process morphologically complex words in a native-like fashion if they attain a certain level of proficiency in the language (Cong & Chen, 2021; Foote, 2017; Zeng et al., 2019).

In 2015, Pinker revised the dual mechanism theory acknowledging the fact that the nonnative users of a language also decompose the morphologically complex words in the second language after they achieve a high level of proficiency in the language. However, this morphological decomposition is not available to the nonnative users of a language whose proficiency level is low (Pinker, 2015).

The present study uses all the notions discussed above. The participants are experimented upon in Urdu (their native language) and English (their second language). The participants are divided into three groups based on the participants' proficiency level in English which will demonstrate the similarities and/or differences between participants' processing of morphologically complex words in their second language according to their proficiency levels.

1.6 Methodology

In this section of the introductory chapter, the participants of the study, the experiments and the procedures of the study are discussed.

The proposed study involves 39 Pakistani Urdu-English bilinguals whose native language is Urdu. These participants have various professions and belong to all age groups. The minimum qualification for the participants is matriculation (successful completion of 10^{th} Grade schooling in Pakistan). The participants use English as their second language for personal and/or professional purposes.

The study began with 42 participants in the plan. However, two of these participants did not respond properly to the experiments. Therefore, their responses were not included in the data sheet. The responses of another participant were excluded from the final analysis after the participant was found as an outlier. The outlier analysis is provided in the appendix. Thus, the actual participant size got reduced to 39 individuals.

The participants are divided into three groups according to their proficiency levels in English. These three groups are named the low proficiency group, the medium proficiency group, and the high proficiency group. The classification was done after the participants' going through a placement test in English (LexTALE placement test).

Two psycholinguistic experiments were employed to gather data from the participants. Both the experiments involved masked priming and lexical decision-making. One of these experiments was in Urdu and the other was in English.

The Urdu experiment used items having various combinations of primes and target words. Some of these items had identical primes and targets whereas some had completely unrelated primes and target words. The main focus of the experiment was on obtaining data from the participants against the items using inflections, derivations, and compound words as primes while the stems or one of the contributing free morphemes as the target words.

The English experiment was very similar to the Urdu experiment. It used the same number of items as the Urdu experiment. It also consisted of items having identical primes and targets as well as those having completely unrelated primes and targets. The focus of this experiment, too, was on obtaining data relevant to the present research project. The data obtained via items involving inflections, derivations, and compound words was under the focus, for the most part.

The English experiment contains a few items set up for the purpose of gauging orthography-related priming effects. These items include primes and targets that are orthographically similar but have no close semantic relationship. Through these items, the impact of orthography-related priming effects was traced which would determine the authenticity of the experiment.

The data collected through these experiments was quantitative in nature and was analyzed quantitatively. Statistical Package for Social Sciences (SPSS) was used for the analysis. The analysis was done via Multivariate Analysis of Variance (MANOVA).

The experiments started with a practice session containing 10 practice items. These practice items gave the respondents practical knowledge on how to respond to the items. The real experiment started after the practice session. The respondents were shown the mask, the prime and the target for each item and were asked to decide whether the target was a word or not.

As both the experiments contained more than 50 items, three breaks were given to the respondents during each experiment. Time duration for the breaks was not specified. The respondents were able to resume the experiment when they felt comfortable.

1.7 Delimitation of the Study

Both languages under the focus in this study are quite old and complex. The English language developed over many centuries borrowing its lexis and syntax from various languages like Latin, Greek, French, and German, which makes English a very complex language. This study aims at investigating morphological processing and in order to comprehensively do that, one experiment containing a limited number of items is not going to be enough. That is why the outcomes of this study cannot be generalized for the processing of morphologically complex words in the whole language.

The case of Urdu is not different. Urdu came into being as a result of the interaction of people speaking various languages including Arabic, Persian, Turkish, and Hindi. Therefore, the morphological structures and rules vary in the language a great deal. That is why investigating all aspects of morphological processing in Urdu is not a simple task and cannot be achieved in a single experiment containing a limited number of items.

This study is limited to only a few inflectional and derivational morphemes in these two languages. The case of the compound words is the same. Only one pattern of combinational morphology in the case of compound words is experimented upon in these experiments. In the case of Urdu, only regular plural morphemes of indigenous Urdu and Arabic origin are included. Derivational morphology included in this (Urdu) experiment also has two origins, indigenous Urdu, and Persian. The rest could not be included due to the limited size of the experiment.

As far as the respondents are concerned, they are residents of two closely situated cities of Pakistan. Some of them belonged to the twin cities of Rawalpindi and Islamabad while some live in Attock, a relatively smaller city 85 kilometers away from Islamabad. Although the study provides a lot of insight into how the native speakers of Urdu process morphologically complex words in their first language, Urdu, and their second language, English, the findings cannot be universalized because of the relatively smaller circle and size of the participating individuals.

1.8 Significance of the Study

There has been a lot of research on English as a Second Language across the globe. However, as mentioned earlier, language is a system of sub-systems wherein each sub-system is complex enough to be called a system itself. The proposed study focuses on how language learners process inflected, derived, and compound words.

ESL in Pakistan has been thoroughly researched. However, the focus on how ESL learners process the language has been missing for the most part. The present research revolves around the notion that the non-native speakers of a language store morphologically complex words as separate entries in their mental lexicon. The native speakers of a language, on the contrary, do not store every inflected, derived or compound word separately in their mental lexicon. That is why it takes lesser time for the native speakers to process morphologically complex words in a language. The second language learners, because of their separate storage of each inflected word, take relatively longer time to process morphologically complex words. The study investigates whether that is true in case of Pakistani ESL learners.

This research will help investigate how Pakistani English language learners process morphologically complex words in Urdu and in English. The findings of the research will be used to determine whether the processing of morphologically complex words is similar or different when it comes to the native and target languages of Pakistani ESL learners.

This study will provide an insight into how bilinguals process their first and second languages. This will help further studies in the area. Thus far, most of the studies in the area focused on one language. This study focuses on one set of bilinguals using two languages. This will greatly help in understanding how the same mind deals with two different languages. The significance of this insight is immense. It will help improve the teaching and learning of English (or any other second language) in general and teaching and learning vocabulary in particular. The insight can also help the translators translating between the two languages.

In the past, most of the research aiming at finding out comparable data between native and non-native language processing focused on one language, mostly English. The researchers would pick two groups of respondents, one native users of English, and the other one non-native users. The data obtained from the two different sets of respondents would then be analyzed and compared. This study engages one sample of respondents who are native speakers of Urdu and use English as a second language. This setting itself is significant as it obtains data from the same individuals for both their first and second languages. This provides an insight into the mental processes of the same individuals processing two different languages.

The respondents to this study are divided into three groups based on their level of proficiency in English. The significance of this division is obvious. It provides data about whether the processing of the second language changes along with the level of proficiency. There have been some studies indicating that highly proficient users of non-native languages show native-like processing of morphologically complex words. This study investigates this phenomenon in the case of Urdu-English bilinguals.

CHAPTER 2

LITERATURE REVIEW

In this chapter, the review of the related literature is presented. The chapter starts with an overview of multilingualism in general. It also discusses the status of English in Pakistan and the privileges the English speakers enjoy in this part of the world. The chapter also discusses Urdu morphology, and the way morphologically complex words are formed in Urdu. The chapter also contains an overview of English morphology including the various types of morphologically complex words. It also includes a brief discussion on Psycholinguistics as a field of study. There is a brief discussion on bilingual memory as well. The chapter also briefly discusses the theories of word processing. The latter part of the chapter presents an overview of the past studies conducted in areas similar to the present study. Towards the end, this chapter highlights the research gap and the significance of the present study as an effort to fill that gap.

In today's globalized settings, multilingualism is not a rarity. In fact, a sizeable population of the world is either bilingual or multilingual. Being bilingual refers to an individual's ability to understand and to use two languages with considerable command from listening to speaking and from reading to writing. Grosjean and Li (2013) consider any person who needs and uses two languages or dialects in their everyday lives as bilingual. Being multilingual is among the traits of a person having proficiency to use more than two languages. Interestingly, Bhatia & Ritchie (2012) suggest another term, *plurilingualism*, to replace bilingualism and multilingualism. However, I shall frequently use the term bilingualism in this document because this research primarily deals with users of two languages, namely, Urdu and English.

It is an age of globalization and information technology where people savvy in the technology and knowing the different languages are more productive and effective in business settings, in social interactions and can yield more benefits as compared to a person devoid of these features. The world is witnessing an increase in bilingualism by the day due to large-scale immigration, connectivity in globalized settings and educational needs. Crystal (2003) is of the view that almost two thirds of the world's youth are growing up in either bilingual or multilingual settings. There are roughly 5000 languages spoken around the world. That means that being bilingual or multilingual is inevitable in order to communicate within the global village scenario. With growing bilingualism in the world, the research on bilingualism is also growing at a steady rate (Bhatia & Ritchie, 2008; Ritchie & Bhatia, 2008). Two different types of bilingualisms exist in a society, namely, individual and societal bilingualism. Individual bilingualism refers to a person's individual proficiency to communicate in that very language. Individual bilingualism also elaborates a person's listening comprehension and the spoken outcome of that comprehension and similarly, reading comprehension provides the basis for writing in a specific language. Whereas societal bilingualism means that two or more languages are socially acceptable in a society. Social or societal bilingualism does not mean that every member of the society is bilingual. However, social bilingualism is a more permanent phenomenon as compared to individual bilingualism. Individual bilingualism is sometimes referred to as bilingual waystation as most of the immigrants use their mother tongue for some time before their next generations use the language of the new country and completely forget the language their ancestors used. That is why societal bilingualism is said to be more permanent because it is the conscious decision of the society (or the state) to maintain more than one language. The reasons behind societal bilingualism are international migration, international borders, colonialism and the world's focus on international language(s). The importance of bilingualism can be judged from the fact that it was stressed upon in Rome in the first century as there was a debate between two languages, Greek and Latin (Bhatia & Ritchie, 2012; Clyne, 2017). Moreover, writing in a comprehensive way about bilingualism, Grosjean and Li (2013) argue that bilingualism is not limited to speaking two different languages. They think that speaking two different dialects of the same language also makes an individual bilingual. There is a common misconception that bilinguals somehow attain equal fluency in both the languages they speak. The researchers opine that it is not necessary that bilingual individuals are equally fluent in both the languages they speak. Rather, bilingualism refers to using two languages (or two dialects of a language) in everyday life. Naturally, bilinguals are more fluent in the language that they use more in their day-to-day affairs. According to Steinberg and Sciarini (2013), bilingualism is not limited to two languages in the same modality. They argue that an individual is bilingual if he knows one language in spoken form and another in the written form. Thus, a person who knows spoken English and written Sanskrit is bilingual. The writers also include sign languages in this list. According to them, even a deaf and dumb person can be a bilingual if he/she knows two different sign languages. Similarly, a person who knows English and American Sign Language is bilingual from a broader perspective (Steinberg & Sciarini, 2013).

Some bilingual individuals acquire their second language quite early in their lives. This includes children who live in a multiethnic environment where the family language is one and the community lingua franca is another. There exist some bilingual families also. A child born to a family speaking more than one language will naturally acquire both the languages spoken at home. However, in such a case, it will be difficult to say which language is the child's first or second. In case a child is adopted, the child has to erase her first language data in order to learn her 'new' first language in the new family environment (Yip et al., 2018). This phenomenon is sometimes termed as simultaneous language acquisition and is limited to the exposure of both the languages in the first year of a child's life, according to many scholars. However, this simultaneous exposure to the language can occur at any time in one's life (Grosjean & Li, 2013). In the past there were some misconceptions regarding early bilingualism. People believed that learning a second language early in life affects first language learning as well as the intelligence of a child. Steinberg & Sciarini (2013), quoting a number of research studies, conclude that second language learning at an early age does not affect the first language acquisition. They go on to claim that being bilingual is good for the improvement of intelligence according to some studies.

Some bilinguals learn the languages in a successive way. That is, they acquire their first language in their childhood and then go on to learn another language later in their lives. In such cases, the first language of the bilingual individuals is always dominant and more frequently used as compared to the second. Critical period of language acquisition is a key factor when it comes to learning a language later in one's life. Studies have shown that early-in-life exposure to a language makes it easier for the learners to master it (P. Li, 2013).

Steinberg & Sciarini (2013) explain why the common belief that children are usually better than adults at learning the second language holds water. They write that there are two types of factors that influence second language learning: psychological and social. The psychological factors are mostly the psycholinguistic ones involving the learners' ability to analyze the grammatical rules of the second language, their memory, and their ability to produce the sounds of the second language using their motor skills. The psychological factors include the motivation and attitude of the learners towards the second language as well as all the factors in the surroundings that affect their motivation and attitude.

The social factors that affect second language learning include the surroundings of the learners. How important the target language is and how much it is used as a means of communication in the personal and professional life of an individual determine the settings for an individual learning the second language. In Pakistani English language learners' case, these social factors are a bit complicated. English is the official language in Pakistan, and it is used as the medium of instruction in many universities and elite schools. However, English is not a medium of communication in the majority of social situations. This makes English an important language in Pakistan but, at the same time, very difficult to learn. The other social factors that Steinberg & Sciarini (2013) talk about are whether the second language is exposed to the learners in natural settings, or it is only available in classroom settings. They opine that it becomes easy for the learners to learn the second language if it is available to them in natural settings like family, friends, and other natural social situations. If the exposure to the language is limited to the classroom settings only, and the learners do not get any opportunity to use or practice the language outside the classroom, it is always going to be difficult for them to learn it.

Children are capable enough at the early stages of their lives to learn more than one language. If children are exposed to two or more languages at the same time during their early lives, they learn all the patterns of all the languages as if they were learning one language. In cases where children come across new languages after having mastered their mother tongues, they still are able to learn the new language. Sometimes, the sound patterns learned in the first language affect their learning of the new languages both positively and negatively. However, as a matter of fact, children learn the new language(s) they are exposed to, eventually. Adults, on the other hand, find it difficult to learn new languages (Baker, 2006; Baker & Wright, 2021).

Steinberg & Sciarini (2013) opine that children are better at learning a second language because there are only two ways that a new language can be learnt: *explication* and *induction*. Explication means that the learners are taught the syntactic rules of the second language by teachers. It means that the learners are taught how a language works and then they, in turn, apply the newly learnt rules and conventions in order to learn the target language. In children's case it does not seem very probable. Partly because children are so young that explaining something as complex as the syntactic structure of a language can be quite difficult. Another important point in this regard is that language cannot be completely learnt only through explication. There is no language in the world whose syntactic structure and rules have been fully explained by linguists. Therefore, it does not matter how much a learner tries to learn a language via explication, there are certain areas which cannot be taught and learnt. Explication is a very useful method for teaching a second language to adults though. Usually, the rules and structure of the target language is explained to them in their first language and gradually they understand the rules and begin to use the second language.

Induction seems to be the only way through which young children learn a second language. Induction involves the learner's ability to not only understand the rules and conventions at play behind discursive practices but also their ability to apply the newly learnt rules in new situations. Children exhibit this ability by successfully learning their first language. It is *induction* with which they learn their first language. They can apply the same learning techniques (acquiring seems to be a better word here) to the second language they are exposed to. There are a few other factors that strengthen the belief that children exposed to the second language learn it through induction. These factors are memory and articulatory skills (Steinberg & Sciarini, 2013).

Memory plays a great role in learning of all types. A person with limited or impaired memory can never be an efficient learner. Memory is of central importance when it comes to language learning because words have an arbitrary relationship with their denotations. Learners have to memorize the words and definitions of various nouns and verbs in order to be able to use them proficiently. There is another aspect of memorization involved in language learning. This aspect pertains to memorizing the syntactic structures and rules of a language. Learners not only have to remember how, for example, questions are asked in a language, but also apply those rules in new situations as well. Children, again, have an edge here. They show exceptional abilities to memorize, and rote learn at an early age.

Learning a new language also requires a learner to be able to produce the sounds and sound patterns of the target language efficiently. The articulatory ability of the individual learning the second language should be good enough to cope with the challenges posed by the sound patterns of the target language. Sound articulation is one of the most important motor skills possessed by human beings. However, like other motor skills, speech articulation gradually declines with age. That is why, children seem to be at an advantage while learning the second language, yet again. Their motor skills in general, and articulatory skills in particular, are far better than the people of older age. Young children seem to be better than even the older children, in this regard.

There are two types of settings in which a second language can be learnt: natural setting and classroom setting. Natural setting means that the target language is used in the surroundings of the learner and the learner can use it in order to perform certain tasks. An example of this phenomenon would be a Punjabi speaking learner living in an area where Pashto is very common or is a general means of communication. The classroom setting means that the target language is only taught at schools/colleges/universities and does not get to be used outside the classroom. This phenomenon is sometimes referred to as foreign language. Research suggests that children perform better at language learning in a natural setting rather than in a classroom setting. The reason being their ability to learn the language via induction. Older learners, on the other hand, perform better in classroom settings because they are better when it comes to explication. However, the older child may perform better than adults in a classroom situation. The reason is that explication needs an efficient use of memory and motor skills, and older children possess better memory and motor skills compared to adults (Steinberg & Sciarini, 2013).

Bilingualism yields quite a lot of benefits in sociocultural and academic perspectives. However, as far as sociocultural benefits are concerned, there are two distinct categories of advantages being bilingual can yield. The first of these categories is regional bi/multilingualism. That means that if an individual can speak more than one language spoken in the region s/he belongs to, the person will definitely enjoy some socio-cultural advantages.

Pakistan is a multi-ethnic, and, therefore, a multilingual society. Various languages are spoken in Pakistan’s different regions. Urdu, being the national language, is spoken across the country while other major languages are Punjabi, Pashto, Sindhi, Balochi, Seraiki, Barahvi. These languages have multiple dialects which make the actual count quite high. There are many other languages too, in addition to these major languages that are spoken in the country. As a bi/multilingual individual in Pakistan, a person can understand the subcultures of other ethnicities. People of other subcultures are usually very welcoming to the individuals who understand and speak their language. This phenomenon not only increases cultural understanding and harmony but also has obvious benefits, both sociocultural and socioeconomic. As far as academic benefits of regional bilingualism are concerned, the following example should suffice. Sindhi students able to speak Punjabi will not come across any difficult situations studying at a university located in a city where Punjabi is spoken. Not only will they not face any problems, but they will be welcomed in the area by the local students/public. Academically, being bi/multilingual enables the individuals to understand books/literature written in other languages which eliminates the need for translation.

The other kind of bilingualism refers to international bilingualism in which the bi/multilingual individuals can speak languages spoken in different countries. For example, if an individual belonging to the United Kingdom can speak German and/or French, s/he can be called an international bilingual. This kind of bi/multilingualism offers a lot of advantages for obvious reasons. The United Kingdom's current High Commissioner to Pakistan can speak Urdu in a limited fashion, for which he is loved and respected in the social circles of the country. Many students travel to various parts of the world in order to get higher education. Knowing the language of the country can always be a great advantage.

2.1 English in Pakistan

In Pakistan, English is rarely, if never, spoken in family settings especially when it comes to Urdu speaking communities. Children in Pakistan are seldom exposed to English in their pre-school lives. Their first contact with English is at schools. Some schools admit children in play groups or nursery classes even at the age of three and a half years. However, English is rarely used in these classes. However, mixing English words into Urdu is a common phenomenon across Pakistani schools.

Pakistan is a multilingual and multiethnic society. More than 70 languages are spoken in Pakistan. However, the education system focuses on two major languages, namely, Urdu and English (Haidar, 2019; Haidar & Fang, 2019; Hossain & Tollefson, 2017; Manan et al., 2021). All the major regions of the country have at least one major language that is different from other regional languages. The country's constitution declares Urdu as the national language. However, English is considered to be very important and serves as Pakistan's official language despite many efforts at public and government levels to change it to Urdu (Mahboob, 2017; Raza & Coombe, 2022)

The English language enjoys social and economic importance in Pakistan. It is considered to be the language of upward social mobility as well as the key to success in the country at both the individual and societal levels(Mahboob, 2017). Pakistan, being a multilingual society, faced a lot of tribulations while deciding on its national language. However, the importance of English always held its grounds in the country (Mahboob, 2017). Today, English is used in bureaucracy, trade, commerce and all other power domains of the country. This has resulted in bifurcation of the education system of Pakistan into two main strands: English medium schools and Urdu medium schools at the government level. Whereas, at the societal level, there are many parallel education systems including *Madrassahs* (Religious Schools) and elite schools following Cambridge O/A Level System (Panezai & Channa, 2017). English is given so much importance that almost everybody in the country wants to learn the language. Therefore, all the parents in the country want to admit their children to English-medium schools. Sometimes, this phenomenon is termed as English-Medium Fever in Pakistan (Manan et al., 2017).

English language teaching and learning in Pakistan is also divided into many subsets. These include elite English-medium schools on one side and the low profile (and low fee) English-medium schools on the other. There are also hundreds of state-run English-medium schools in the country. In addition to that, there are thousands of public sector Urdu-medium schools where English is taught as a compulsory subject (Mahboob, 2017). Thus, all the students who attend school are introduced to English at some level. The tertiary education in Pakistan is English-medium so the students are exposed to the language once they finish their high schools and enter the universities/degree-awarding institutes.

English being the official language in Pakistan, the children in Pakistan get introduced to it quite early in their lives. As discussed above, the schools that focus on English are deemed to be the better schools and, therefore, earn more money. Parents get their children admitted to these English-medium schools to secure their future in the country. Even if a child is studying at an Urdu-medium school, English is taught as a compulsory subject there. In fact, English is a compulsory subject in Pakistan from Grade 1 to the 14th year of education in Pakistan. This means that Pakistani students somehow start learning English at a young age. Urdu, although being the national language, is not the mother tongue of the majority of the people living in Pakistan. There are many regional languages in Pakistan and most of the people use these regional languages. However, since it is the national language, Urdu serves as the lingua franca of Pakistan. Pakistani people must learn it to communicate with the people living in regions other than their own. The overwhelming majority of the educational institutions in Pakistan use Urdu as their medium of instructions (Irfan, 2019; Raza & Coombe, 2022). This means that most of the Pakistani students learn Urdu as their second language and English is introduced to them as their third!

The focus of this research is on the Urdu-English bilinguals. Therefore, I chose only those respondents who have Urdu as their mother tongue. Such bilinguals are not great in numbers among the Pakistani population. According to the 1998 census, only about 7 percent of the Pakistanis have Urdu as their first language. There are some families based in Karachi with their diaspora all over Pakistan who have Urdu as their mother tongue. Some families who migrated from northern India at the time of Partition in 1947 have Urdu as their first language. These families are settled in various (mostly urban) parts of the country.

2.2 English Morphology

Morphology, as the name suggests, is the study of how words change their forms in order to be used in different roles and contexts. For example, *work* cannot be used where *works* is required because if so, it would be a violation of grammatical rules in general and morphological rules in particular. Technically, morphology is the study of *morphemes*. Morphemes can be defined as the smallest bits of meaning-carrying written language. To illustrate this, let us go back to the example of *work* and *works.* Here we have two different forms of a word which carry almost the same meanings. We call them different *forms* as the word does not change from *work* to *works.* Only the meanings change, slightly (morphology also involves in completely changing the words and their meanings, but that will be discussed later). If *works* is taken into consideration, it can be seen that another bit of language, although consisting of one single letter *s* (a morpheme) is added to the already there, *work.* Thus, it becomes *work+s* involving two morphemes, *work* and *s.* Morpheme, as mentioned earlier, is a small bit of written language carrying some meanings. If that definition is kept in mind, *s* is also a morpheme because it changes the meaning of the word *work*. This change in meaning would not have been possible if *s* did not have some meanings of its own. Here, *works* is an interesting example because it can be used both as a verb and as a noun in a sentence. If we consider its role as a noun, the morpheme *s* makes it plural. On the other hand, when used as a verb, the *s* in *works* makes it an appropriate form to be used with a third person-singular subject. In both cases, however, we can clearly see that *s* does bring in some change in meanings when used as a suffix with *work* (Bauer et al., 2015; Bauer & Nation, 2020; Carstairs-McCarthy, 2018).

There are two kinds of morphemes known as *free morphemes* and *bound morphemes.* Free morphemes, as the name suggests, can stand on their own in a sentence. For example, each word in the sentence *he is a great doctor* is a free morpheme. As per the definition, a morpheme is the smallest unit of meaning-carrying written language. We can see that each of the words used in the sentence carries some sort of meanings and none of the words can be split apart into further meaningful units. If we change the sentence as *he is a great teacher*, now we have a word in this sentence, teacher, that is not made up of a single morpheme (teacher = teach + er). There are two morphemes in this word *teacher*, one is a free morpheme (teach) while the other one is a bound one (er). *Teach* is a free morpheme because it has two characteristics; one, it cannot be further divided into meaningful units and the other is that it can be used in a sentence independently. For example, *they teach at a college.* Interestingly, this sentence also consists of five free morphemes. However, there seems to be some differences among these free morphemes here. That is, *they, teach* and *college* have clear meanings whereas *at* and *a* do not. In fact, free morphemes have two different types called Open Class Words and Closed Class Words. Open Class Words, also termed as Lexical Morphemes, are the content words that we use in everyday life. They are the real meaning carriers for a language. Thus, nouns, verbs, adjectives and adverbs fall into this category. On the other hand, Closed Class Words, also known as Grammatical Morphemes, function as grammatical units. They are not autonomous as lexical morphemes and do not carry any conceptual meanings. Another difference between the two is that lexical morphemes can be inflected while grammatical morphemes cannot be inflected. Lexical morphemes include nouns, adjectives, verbs and adverbs whereas grammatical morphemes consist of article, prepositions, conjunctions and modals among others (Bauer et al., 2015; Bauer & Nation, 2020).

Bound morphemes cannot stand alone. They are bound to combine with another morpheme (mostly free morphemes) to either alter the meanings slightly or carve out an altogether new word. The former is called inflection whereas the latter phenomenon is called derivation. For example, if *s* (a bound morpheme) is added to *work*, it alters its meanings a bit. In case of *work* being a noun, the addition of the morpheme makes it plural. In case it is a verb, the bound morpheme makes it suitable for the third-person-singular subject. That is how bound morphemes change the meanings slightly. This phenomenon is called inflection. There are many morphemes that are used for inflection. For example *-ed* is a morpheme used in the past forms of regular verbs. Similarly, *s* is the most common bound morpheme for making plural nouns. There are many prefixes that change the meanings of words. To mention a few, *in-* changes the meanings (mostly to the opposite) when used with adjectives like *competent, capable, decent* etc. There are other prefixes like *un-, dis-, pre-, anti-, multi-* etc. that are present in everyday use of English (Bauer et al., 2015; Carstairs-McCarthy, 2018).

Consider the case that if another bound morpheme *-able* is added to *work,* the word it renders is *workable.* It can be noticed that from *work* to *workable* is not a slight change in meaning. In fact, it is a new word derived from the free morpheme *work,* and the new word is no longer a noun (or a verb for that matter). Rather, the new word is an adjective. This kind of derivation is called class-changing derivations. There are many suffixes that do their part in deriving new words from the already existing ones. For instance, *-ly* changes many adjectives into adverbs (beautiful becomes beautifully; happy becomes happily and so on), *-ness* creates nous out of adjectives (from cool to coolness; playful to playfulness), whereas *-able* and *-ful mostly* carve out adjectives from verbs (work becomes workable while play changes into playful) (Carstairs-McCarthy, 2018).

It would be pertinent to mention the difference between lexemes and word forms here. Abstract concepts represented by words are called lexemes whereas the words used in everyday language, related to those abstract concepts, are word forms that belong to those lexemes. For example, the word *play* represents an abstract concept so it can be called a lexeme. The words, *plays, played, playing* and even *play* itself that are present in everyday language are in fact various word-forms of the lexeme *play* (Haspelmath & Sims, 2015). That may be the reason why one can find the word *play* on a dictionary, but its various forms are not listed there.

2.2.1 Morphologically Complex Words in English

An important thing to discuss here is that most words used in English consist of more than one morpheme. The free morpheme, also termed as the core or root word, has, in most cases, another morpheme attached to it. It does not mean that free morphemes cannot exist independently. They certainly can. However, their numbers are low when it comes to the overall words English language has. There are two types of lexeme-formation: derivation and compounding. In derivation, as discussed earlier, certain bound morphemes are used to form new lexemes. For instance, combining *-ity* with *complex* creates a new lexeme, *complexity.* Compounding, on the other hand, involves two lexemes (that is, two free morphemes) to make a new lexeme. Thus, *classroom* is made up of two lexemes, *class* and *room.*

Lexemes mainly belong to three word classes; nouns, verbs and adjectives. Adding affixes to the already existing lexemes not only creates new lexemes but also changes their word classes in majority of cases. For example, adding *-ness* to *calm* creates a new lexeme, *calmness* which is a nouns as opposed to the adjective *calm.* However, there are certain class-maintaining derivations too. For instance, the prefix, *anti-* does not change the class of the lexeme. Thus, *anticlimax* is still a noun derived from another noun *climax,* and *prehistoric* remains an adjective although it was derived from another adjective *historic* by prefixing it with *pre-.* Derivation involves processes like adjectivization (creating adjectives), nominalization (creating nouns), verbalization (creating verbs) and adverbialization (creating adverbs) (Lieber, 2015; Plag, 2003).

English also contains a big number of compound words. Compound words in English belong to all types of lexical categories. The making of compound words is quite simple in English. It seems like placing one word next to another to create a compound word in English. For example, *brown* and *coloured* can occur together to form a compound adjective *brown-coloured*. Similarly, *screen* and *play* combine together to make *screenplay.*

2.3 Urdu Morphology

Urdu is a South Asian language spoken in most parts of Pakistan and some parts of India. Urdu has 55 million native speakers worldwide and the number of people who can speak the language easily exceeds 300 million. It is the national language of Pakistan with a population of 220 million. In Pakistan, Urdu is spoken nationwide as a lingua franca. It is also used as a medium of instruction in most Pakistani public sector schools and colleges. Urdu is also one of the 18 national languages in India as per the Indian constitution. There are parts of India where there are many native speakers of Urdu. Apart from Pakistan and India, Urdu is also spoken in some parts of Nepal, Bangladesh and Afghanistan. Urdu is also the language of communication used by the majority of Muslim diaspora outside the Indo-Pak subcontinent. Most of the Muslim immigrants of the subcontinental origin in the Middle East, Europe and America speak Urdu while communication with one another (Schmidt, 2005).

Urdu was developed as a pidgin and has words from four languages including Arabic, Persian, Sanskrit/Hindi and Turkish. Keeping in mind the inclusion of these four languages that have quite a few dissimilarities, it is not difficult to guess that Urdu has a complex grammar. In the following paragraphs the nature of three classes of Urdu lexemes, namely, nouns, adjectives and verbs is discussed briefly. During the discussion, various inflections and derivation patterns are also highlighted.

Urdu is a gendered language. It means that every single noun in the languages is either masculine or feminine. Gender is an essential part of nouns and in most cases, there are certain marks that help the user identify it. For example, here are a few suffixes that denote the masculinity of a noun:

- ا pronounced as /a/, as in لڑکا larka (boy), بکرا bakra (he-goat) and مرغا murgha (rooster). In some cases, this masculinizing suffix ends in a nasalized sound as well, as in کنواں kunwan (water-well) and دھواں dhunwan (smoke).
- ہ pronounced as /ah/ as in سلسلہ silsilah (sequence), حوصلہ hosla (courage) and بچہ bacha (child)
- یہ pronounced as /ya/ as in کرایہ kiraya (fare/rent), فدیہ fidya (price) and ہدیہ hadya (gift)

Similarly, there are certain feminizing suffixes in Urdu. Some of them are:

- ی pronounced as /i/, as in لڑکی larki (girl), بکری bakri (goat), and مرغی murgha (hen)
- یا pronounced as /yaa/ as in چڑیا chirriyaa (sparrow), گڑیا gurriya (doll), بٹیا bittiya (daughter)
- نی pronounced as /ni/ as in استانی ustaani (female teacher), شیرنی sheirni (lioness) and ہتھنی hathni (she-elephant).

As mentioned earlier, Urdu has a complex nature. There are many nouns that fall in line with the patterns discussed above. For instance, کھڑکی (khirrki/window) is a feminine noun as it ends with the feminizing suffix ی and دروازہ (darwazah/door) is masculine as it ends with ہ which is a masculinizing suffix. However, there are quite a few nouns that do not fall in line with these patterns. For example, although جگہ (jagah/space or room) ends with ہ which is a masculine-making suffix, it is feminine in Urdu. Similarly, ہاتھی (haathi/elephant) is masculine in Urdu albeit it ends in ی which is a feminizing suffix. All these examples are of nouns having unmarked gender. Learners must learn nouns with unmarked gender. These nouns create some difficulties for the learners as on one hand they are difficult to learn and on the other, they have orthographic similarity to the marked nouns which adds confusion in the learners' minds. A few more examples of nouns with unmarked gender are مکان (makaan/house), فرش (farsh/floor) and درخت (drakht/tree), which are masculine and کتاب (kitaab/book), چھت (chhat/roof) and میز (maiz/table) which are feminine with their gender unmarked (Schmidt, 2005).

In addition to the gendered Urdu nouns discussed above, there are some which have the biological gender and, therefore, add to the ones with the unmarked gender. For example, ماں (maan/mother) is feminine while باپ (baap/father) is masculine. The gender of some nouns in Urdu depends upon the context in which they are used. That is, they are a kind of neuter-gendered nouns which become masculine if used within the context of a man and feminine if used for a woman. Examples include ڈاکٹر (daakter/doctor) and دستکار (dastkaar/artisan) (Schmidt, 2005).

As mentioned earlier, Urdu evolved out of a mixture of languages like Arabic, Persian, Turkish and Hindi. These languages are quite different from one another and so are their morphologies. This means that the words coming from various languages follow certain morphological rules that are different than others. This also means that there are different morphologies at work parallely in Urdu. In the following sections of this chapter, the loan words of Arabic, Persian and Hindi will be discussed with special focus on nouns and their gender (Mangrio, 2016).

2.3.1 Arabic Words in Urdu

There are many nouns in Urdu ending in ت like صحت (sehat/health), قیمت (qeemat/price) and دولت (daulat/wealth). These nouns are the Urdu versions of the borrowed Arabic words ending in ة (called *taa marboot* in Arabic) like قيمة , صحة and دولة.

Taa Marboot is a femininizing suffix. Therefore, all the nouns ending in Taa Marboot in Arabic end in ت in Urdu and are feminine. Conversely, the Arabic loan words in Urdu ending in ہ like حملہ (hamlah/attack), جذیہ (jizyah/tax) and ہدیہ (hadiyah/reward) are all masculine in both Arabic and Urdu. Another interesting group of nouns originated from Arabic consists of words usually starting with ت and having ی between the last two consonants like تصویر (tasveer/image), تعمیل (ta'meel/compliance) and تقدیر (taqdeer/destiny). All nouns in Urdu borrowed from Arabic following this pattern are feminine (Mangrio, 2016; Schmidt, 2005)

2.3.2 Persian Words in Urdu

Urdu has quite a big number of nouns originally borrowed from Persian. Nouns like ہستی (hasti/living being) and دوستی (dosti/friendship) which end in the suffix ستی - (-sti) are feminine. Similarly, the Persian loanwords in Urdu ending in the suffix گاہ - (-gaah) like عبادت گاہ (ibadat gaah/prayer place) and گذر گاہ (guzer gaah/passage) are also feminine. On the other hand, the Persian loanwords in Urdu ending in the suffix ستان - (-staan) like قبرستان (qabristaan/graveyard) and ریگستان (registaan/desert) are masculine.

2.3.3 Morphologically Complex Words in Urdu

As discussed above, Urdu came into existence via pidginization of Arabic, Persian, Turkish and Hindi. All these languages are quite distinct in their syntactic and morphological structures, which, in turn, makes Urdu morphology a mixture of morphological rules borrowed from these languages. Persian words and phrases in Urdu follow Persian morphological structure whereas the Arabic words in Urdu follow the Arabic rules and conventions. In this section of the dissertation, the influence of the morphological structures of these languages is discussed.

2.3.3.1 Inflections:

There are two types of inflections involved in Urdu: plural inflections and verb form inflections. These two types of inflections are discussed in the following subsections.

2.3.3.2 Plural Inflections

Plural inflections in Urdu have further types as Urdu came into being via communities belonging to Arabic, Persian, Turkish, and Hindi. The nouns having origins in these languages follow the pluralization rules of the languages of their origin. That is why Urdu has various pluralizing patterns. There are some native pluralization patterns too. An example of indigenous Urdu plural inflection is adding *-on* وں or *-yan* یاں as in *doston* دوستوں and *dostiyan* دوستیاں (friends and friendships, respectively). Usually, the masculine nouns take *-on* for plural inflections while *-yan* is used for making the feminine nouns plural. *Dost* دوست (friend) is masculine while *dosti* دوستی (friendship) is feminine in Urdu.

Similarly, there are some words that came from the Persian language. These words follow the Persian constructions for pluralization. An example in this regard would be the use of *-aat* ات as in *haalaat* حالات, *alqabaat* القابات, and *muzafaat* مضافات(situations, titles, and suburbs, respectively).

There is another Persian construction used in plural inflections. This construction involves vowel changes inside the nouns while making them plurals. For example, *khaadim* خادم (servant) is changed into its plural inflection as *khuddaam* خدام (servants).

The words with Arabic origin are also abundant in Urdu. Most of the nouns of Arabic origin in Urdu follow the Arabic style of plural inflections. In Arabic, the concept of pluralization has three categories: singular, two, and more than two. The concept of *two plural* is also quite common in Urdu. Therefore, words like *fareeqain* فریقین (two parties) and *tarfain* طرفینِ (two sides) are frequently used. As it can be seen *-ain* ین is added to the singular word in order to make it the *two plural*.

In order to make plurals that are meant as more than two, Arabic has quite a few plural markers. Some of these plural markers are used in Urdu while making the words of Arabic origin plural. For example, *-een* ین is an Arabic plural maker quite common in Urdu as in *momineen* مومنین*, alameen* عالمین*, muhaqqiqeen* محققین*,* and *mudariseen* مدرسین (believers, worlds, researchers, and lecturers, respectively).

Similarly, there is another pluralization of Arabic origin quite common in Urdu. It involves making the second vowel longer than usual. For example, *hikayat* حکایت (tale) is made plural by making it *hikayaat* حکایات (tales). *Imarat* عمارت (building) changes into *imaraat* عمارات (buildings).

Some nouns of Arabic origin are made plural by inserting a vowel sound in them. The vowel sound in question is *-u:* و *(-oo)*. There are many such nouns present (and used) in Urdu. They follow the same Arabic pattern for pluralization. Thus, the plural of *ilm* علم

(knowledge) becomes *uloom* علوم. Similarly, *amr* امر (work/assignment) becomes *umoor* امور.

The above discussion leads us to conclude that Urdu follows many patterns for pluralization because the nouns in Urdu have their origins in Persian, Arabic, Turkish and Hindi. In addition to them, Urdu has some native pluralization patterns too.

2.3.3.3 Verb Form Inflections

Verbs in Urdu are gender specific. It means that the agreement between the subject and the verb also takes into account the gender of the subject. Urdu is a gendered language which means that every noun in Urdu is either masculine or feminine.

Unlike the plural inflections, verb form inflections are quite uniform in Urdu, in most cases. There is only one pattern that is followed across the board. However, as mentioned above, there is a difference between the verb form inflections meant for masculine subjects and those meant for feminine subjects. Apart from this difference, the patterns followed for inflecting the verbs are more or less the same irrespective of the origins of the verbs in Urdu.

Past tense inflections in Urdu follow a pattern in which a final vowel is added to the base form of the verb. For example, *daikh* دیکھ (look/see) turns into *daikha* دیکھا (looked/saw) and *soch* سوچ (think) transforms into *socha* سوچا (thought).

2.3.3.4 Derivations

There are many derivatives in Urdu that change the word classes. The most prominent ones are affixes. In this section only a couple of affixes are discussed. *Qaabil* قابل (similar to the English suffix *-able*) is one such prefix that turns nouns into adjectives. The examples are *qaabil-e-aitimad* قابل اعتماد (trustworthy)and *qabil-e-deed* قابل دید (worth-seeing) this derivative has Persian origins. Another derivative of Persian origin, which was used in the present study is the prefix, *pur* پر (meaning *full of* in English). It turns nouns into adjectives. *Pur-soz* پرسوز (melancholic/full of sadness) and *pur-nam* پرنم (moist/full of moisture) are the examples.

A suffix of native Urdu origin, *-i/-ee* ی was also used in the study. This suffix derives adjectives from nouns. Examples are *islami* اسلامی (Islamic) and *qaumi* قومی (national).

2.3.3.5 Compound Words in Urdu

Urdu has, for the most part, a procedure of coining compound words very similar to that of the English language. However, there is at least one distinct way in which Urdu is different from English in terms of creating compound words. This distinct procedure has its origin in Persian. It employs the use of *o* between two words to make them a compound word, for example, *tang-o-tareek* تنگ و تاریک (narrow and dark), *sehat-o-tandrusti* صحت و تندرستی (health and wellbeing).

There is another way of making compound words in Urdu. It also has its origin in the Persian language. It involves the use of a vowel *-e* at the end of the first of the two words making up the compound word. It is close to the English *of* in meanings. Examples include *dawat-e-haq* دعوت حق (invitation to the truth), *adaab-e-mehfil* آداب محفل (the etiquettes of the get-together), and *deevar-e-cheen* دیوار چین(the Great wall of China).

Other compound words in Urdu are formed in more or less similar patterns to those of the English language.

2.4 Psycholinguistics as a Field of Study

Psycholinguistics is a study of language and mind. It studies how language is learned, stored, retrieved, and produced by human beings. This portion of the chapter discusses Psycholinguistics as a discipline and its role in learning human language, processing of human language in the brain, role of the different parts of the brain in comprehending and producing language, how hindbrain receives the linguistic stimuli, how do other parts of brain coordinate with each other to comprehend and produce linguistic patterns. Moreover, psycholinguistics also provides scientific solutions to the challenges that people come across while learning the first and the second language. It provides scientific information as how language is stored and retrieved in human brain, what are different disorders that brain comes across in language reception and production, what is aphasia and dyslexia etc. what are the common syndromes that human brain come across and affect the human language causing language problems like stammering, stuttering etc. If the word Psycholinguistics is taken in a general and literary perspective. It is a compound noun made with the word psycho and linguistics in which the former is relevant to psyche or brain and the latter is the scientific study of language.

Psycholinguistics is a field in language studying the mental mechanisms that makes language use possible for people. It is a scientific field aiming to establish a coherent theory of the ways of language comprehension and production. Psycholinguistics answers two core questions: (i) what knowledge of language is necessary to use language? In a general sense, we should know a language to use it, but as language users we do not have awareness of knowledge about language. (ii) The other basic psycholinguistic inquiry is to know the cognitive processes involved in the ordinary use of language. The term ordinary use of language encompasses the premises like comprehending a lecture, being skillful to read a book, competent enough to write and to converse in that very language (Kucirkova, 2011).

In applied perspectives, Psycholinguistics is like computation and presentation of words, meanings, sentences, and discourse meanings in mind. Psycholinguistics also elaborates the process of composition of speech in the human mind and the process of decomposition in reading and listening activities. It has an interdisciplinary association in drawing ideas and getting knowledge from diverse fields like phonetics, pure linguistics, semantics, and pure linguistics (Christiansen & Turkina, 2018).

Psycholinguistics is different from linguistics in many respects. Linguistics is defined as the study of language. A language can be studied in various ways. For example, an individual can study Shakespearean English and the change that has occurred in the English language since that time. Linguistics can deal with the internal structure of a language and how, for example, that language is similar to or different from other language(s) in terms of its structure, morphology, phonetics, and so on. Psycholinguistics, on the other hand deals with how humans understand and use language. It deals with the understanding of how a string of sounds become meaningful for an individual speaking one language but are completely meaningless for another individual who does not understand that language. For example, if somebody speaks in Russian in front of a group of people where only two individuals understand the Russian language. For those who speak Russian, the sound string would be perfectly understandable. However, it would not make any sense for the other people in that group. Psycholinguistics tries to find out the processes behind these phenomena. How a sentence spoken in a matter of three seconds and containing more than 10 words is so quickly understood by the listeners. How are the listeners able to recognize the spoken words and quickly look for their meanings inside their minds in a matter of split seconds, although there might be hundreds of thousands of words stored in their mental dictionaries. Yet they can quickly recognize and understand the 10 words spoken to them in three seconds.

Psycholinguistics also tries to explain how words after words come out of a speaking individual's mouth making perfect sense to the listeners (Kucirkova, 2011; Menn & Dronkers, 2016).

The main focus, as far as psycholinguistics is concerned, is on how individuals process a language. What is meant by *process* is that the language users need to store the words of the language along with their meanings. They also have to retrieve these words at the time of speaking or listening in order to convey or understand meanings. Processing also involves the underlying syntactic rules and conventions of a language. The users need to not only remember the syntactic rules for, say, questions, but also use these rules and conventions in new situations. The ability of an individual to differentiate between the meanings of *he danced and sang,* and *he danced and then sang* is one of the key focus areas for psycholinguistics (Fernández & Cairns, 2020; Smyth, 2005).

Processing of language is central to Psycholinguistics. Word processing has received a lot of focus and attention in Psycholinguistics among other things. There are many theories about how words are represented in the lexicon and how they are processed therein. Jarema and Libben (2007) opine that whenever there is research on the mental lexicon, it is not a mental dictionary (a thing) that can be seen. Rather the existence of such a thing is inferred by recording some mental and lexical activities. However, the researchers believe that it would not be appropriate to define mental lexicon in terms of processing only, as there are words that are learned, memorized, retrieved and used by individuals which suggests the existence of a mental dictionary of sorts. The researchers go on to refer to it as a cognitive system that constitutes both conscious and unconscious lexical activities.

According to Baayen (2007), in the past the mental lexicon was believed to possess only the stems of words along with the morphological rules to combine these words into complex ones. The scholar states that the assumption meant that the mental lexicon contained no derivations of any sort. He compares this view of mental lexicon to a simple calculator which contains the digits and is programmed with a few arithmetic rules. It can calculate, say 10x15, many times but does not store the outcome of the calculation in its memory. Baayen (2007) further argues that the calculator analogy is flawed as research in the last two decades of the twentieth century proved that the past tense forms of the irregular verbs were also stored in the mental lexicon. Pinker studied the processing of inflected regular verbs versus irregular verbs and concluded that the irregular verb forms are stored in an associative memory inside the mental lexicon. He said that the inflected forms of regular verbs are not stored in the memory at all. Instead, they are always produced by applying the inflection-based rules. Roelofs (1997) suggested the WEAVER (Word-from Encoding by Activation and VERification) model of the mental lexicon. The WEAVER model also suggests that the mental lexicon combines stems and inflections at the time of retrieval and processing (Roelofs, 1997) . However, it accommodates Pinker's (1991) point of view (of associative memory for the irregular verb forms) by saying that irregular verb forms get their own lexemes in the lexicon. However, complex forms of verbs or other complex words do not have their own lexemes (Pinker, 1991).

Later research suggests that inflected forms also get stored in the lexicon. If a complex word is more frequently used than its constituents, it is highly likely that it takes lesser processing time than its constituents, which suggests that it may be stored as a separate word in the lexicon (Chuang et al., 2021; Nagarajan et al., 2016). It is interesting that in his later study Pinker admitted that regular inflections can be stored in the lexicon (Pinker & Ullman, 2002). However, they added that the phenomenon surfaces only under extreme experimental conditions. Under normal circumstances, the inflected forms do not get stored in the lexicon.

According to Traxler (2011), words are stored in the lexicon in two ways, in their orthographic and phonological forms. The orthographical form of words pertains to how they look in their written forms while the phonological form is linked to the sounds associated with the words when it is spoken. The semantic code, that is, the meanings of the words, is the third strand which is represented in the lexicon. Traxler (2011) further discusses that the way word representations are organized in the lexicon depends upon both the orthographic and phonological similarities along with the similarity of meanings. He states that words like *mule* and *horse* may be represented near one another because they are similar in meanings, and *bowl* and *howl* may be so because they look similar. Similarly, *tame* and *lame* may be represented near one another because they sound similar. Word forms are stored in a lexical network which includes both the orthographic and phonetic/phonological forms of the words (Traxler, 2011). The meanings of the words have a separate network which may be called a semantic store. However, the semantic network is linked to the lexical network in the lexicon (Balota et al., 2007; Hutchison, 2003).

2.5 Bilingual Memory

Bilingual individuals must remember lexical items of both the languages they speak. The phenomenon seems quite simple but is far from it in fact. Theoretically speaking, lexical items are signifiers that signify some semantic concepts. For example, *chair* represents a furniture item used for sitting. It does not represent the actual furniture item but the concept of the item in an individual's mind. For bilinguals it becomes complex when they have to remember two signifiers that denote one concept being signified.

Heredia (2011) suggests that there are three possibilities in which bilingual individuals store the signifiers and the signified in their memories. First of the three is that they store separate sets of lexical items and their meanings and then remember that both the meanings are the same. For example, an Urdu-English bilingual will store *book* and the concept associated with the word separately from *kitaab* (book) and its concept in their memory. In this scenario, they keep both these pairs of the signifiers and the signified separate from one another. In the second scenario, they somehow keep in mind that both these concepts are exactly the same, keeping the pairs of the signifiers and signified separate, however. In the third scenario, the bilingual individuals use one concept as the signified using two different signifiers for the two languages realizing that both these signifiers signify one and the same concept.

French & Jacquet (2004) proposed four models of bilingual memory. They call it the Hierarchical Models. The first stage of bilingual memory is what they call Word Association Model. This model proposes a direct link between the concepts and the first language. The first and the second languages do have a lexical link between them. However, there is no concept link available to the second language. This means that the concepts in the second language are only accessed via the first language. The second model, which can also be called the second stage in the progress of an L2 learner, is the Conceptual Mediation Model. This model states that there are concept links available for both the first and the second languages. However, there is no direct lexical link between the two languages. This means that both the native and non-native languages do not influence one another while processing as both are directly linked to the concepts. As the proficiency in the second language gradually increases, the bilingual moves from Word Association Model towards Conceptual Mediation Model.

The third model is called the Mixed Model. This model seems to be an improved version of the Conceptual Mediation Model. The Mixed Model proposes direct concept links for both the native and the non-native languages (L1 and L2) which is the same as the Conceptual Mediation Model. However, the Mixed Model suggests a direct lexical link between the two languages which was not there in the Conceptual Mediation Model. Thus, both the native and the non-native languages are directly linked to the concepts while there is a lexical link between the two which means that there is some sort of influence that these two languages exercise on each other. The fourth model is called the Revised Hierarchical Model in which it is proposed that there are bidirectional links between all the three entities, namely, concept, L1, and L2. However, the conceptual link for the first language has more weighting, according to this model. The bidirectional links in the model stand for the linguistic influence on the concepts and vice versa. It also proposes the impacts both languages have on each other (French & Jacquet, 2004).

There are two types of memory aspects that bilinguals have to deal with. These are long-term memory and short-term memory. The long-term memory is further divided into two facets: explicit memory and implicit memory. The explicit memory deals with the things and events witnessed in one's life. For example, narrating an event would require an individual to use their explicit memory. Similarly, naming things (nouns) and activities (verbs) also requires the use of explicit memory. The implicit memory, on the other hand, has to do with the (silent) acquisition of certain skills. The implicit memory does not display itself in an explicit manner but can be seen via an improved behaviour or habit. Thus, improved grammar use during language learning pertains to the implicit memory whereas the correct use of vocabulary would fall into the category of improved explicit vocabulary (Bartolotti & Marian, 2012).

The explicit memory can be further divided into semantic memory and episodic memory. Semantic memory, as the word suggests, pertains to the language related memory and is used to name things and activities. Episodic memory, on the other hand, is used to recall and relate events. There is a hypothesis that these two memories are stored separately and are not linked with one another. If the hypothesis is considered as true, as it seems worthwhile, the episodic memory is free of any linguistic connection and can be used by any of the languages a bilingual speaks (Bartolotti & Marian, 2012).

The short-term memory, in contrast to the long-term memory, is what caters to the present situation. For example, an individual has to recall an event from a distant past, the short-term memory will have to come up with appropriate lexis to deal with the situation. The short-term memory is always related to the current situation and events. There is a difference of opinion among the researchers as whether the short-term memory uses the same neural structure or a different one. However, they agree that it has a limited structure and can only contain a certain amount of information that are generally related to the recent past or current situations (Bartolotti & Marian, 2012).

2.6 Theories of Word Processing

The storage and processing of language in the human mind has always been a point of interest in psycholinguistics. Researchers are divided in terms of the representational models of the mental lexicon. There are researchers who believe that mental lexicon is represented in the mind as a single associative model whereby all the words stored in the lexicon are lexically, phonologically, semantically and/or orthographically associated with each other. The inflected and derived words, according to the single associative model, are all stored in their full form in the mental lexicon. Considering this, in single associative model, language speakers will have to store and retrieve a huge number of words individually, making the mental lexicon a large entity. This means that, all the inflected and derived forms of the word *work* are stored in the mind which not only are linked to each other in terms of being inflected or derived from the same root, but also are linked to other words that are lexically, phonologically, semantically and/or orthographically similar. This network of words inside the mind makes the single associative model of the mental lexicon (Cortese, 2011; Meylan & Bergelson, 2022; Stevens & Plaut, 2022).

The dual mechanism model of lexicon, on the other hand, proposes that human beings do not store all the words of their native language. Instead, they breakdown the words that involve more than one morpheme before storing them in their mental dictionaries. Therefore, according to the dual mechanism model, all the inflections and derivations of the root *work* are not stored in the mental lexicon. Instead, the inflectional and derivational affixes are stored at a different place in the mind. This model of the mental lexicon proposes that whenever the native speakers of English want to say the word *workable*, for example, they pick the root *work* and join it with the affix *able*, at the time of the retrieval. This not only makes the processing time lesser but also requires less storage capacity inside the brain because there is a limited number of affixes that account for a huge number of inflections and derivations. It is called *dual* mechanism model of mental lexicon because there are words that cannot be broken down and still need to be stored in the lexicon. For example, the word *went* is not a root word/morpheme. It is the past tense form of an irregular verb *go*. We know that there are many irregular verbs in English that do not use the inflectional morpheme *-ed* for their past tense forms. The dual mechanism model proposes that these irregular forms of verb are stored in the lexicon in associative links with their base form. This is what makes this mechanism dual.

In the past, most researchers used offline methods for research on language processing. Today, however, almost all the research has shifted to online methods such as brain imaging, eye movement, and priming. These techniques are used to measure the brain activity and/or response times when the subjects are asked to make some linguistic/lexical decision (Leminen et al., 2016).

This discussion becomes interesting when the focus shifts towards more than one language. There are questions like how language users store more than one language in their minds, how they process them, whether there are any connections and/or dependencies between the two (or more) language systems at work in a single mind, become highly significant. What is more significant is how language users process their second language (L2) and whether this processing has anything to do with their first language (L1) or not. There are two views in this regard. Some linguists believe that the processing of L2 uses the same processing structure that is used by L1. This means that the processing of L2 gets affected by L1. There is evidence that the phonological, lexical, and semantic properties of L1 affect the processing of L2. This phenomenon results in L1 transfer, low memory capacity and reduced automaticity in individuals when they process their second language (L2).

The alternative view suggests that the second language (L2) does not share the processing system with L1. Many linguists believe that L2 processing differs in many ways as compared to L1. One such view is that the L2 speakers can only process the language like L1 speakers only in the areas they are highly proficient in. In this regard, Shallow Structure Hypothesis (Clahsen & Felser, 2006) discusses that L2 learners do not process sentences as efficiently as L1 speakers because they depend more on the declarative memory as compared to the procedural memory system (Clahsen & Felser, 2018; Ullman, 2006). This means that the L2 speakers rely more on their lexical and syntactic memory of the language rather than being able to use the language in a natural way as L1 speakers do. According to the Shallow Structure Hypothesis, no matter how proficient the users become in their second language, they are unable to process the morpho-syntactic information attached to morphologically complex words as well as the native speakers do. The L2 users, according to this hypothesis, always rely, to some extent, on the superficial and surface information while processing morphologically complex words. The scholars added that an efficient and fast use of these semantic, pragmatic, and other surface level information may enable the highly proficient second language users to act as fast as the native speakers which may result in reduced response times matching those of the native speakers.

In 2018, however, Clahsen and Felser revised their originally presented hypothesis. Stating that at the time of proposition of the hypothesis there was not enough research present on the non-native processing, the scholars proposed that since the non-native users of a language are generally more concerned about the grammar and the syntax of the target language, they usually try to use this information while processing. They further proposed that there are many routes available at the time of processing and the non-native users usually adopt the ones near to the surface level information. They further suggest that the first language information affects the second language processing only partially and is limited to a few aspects (Clahsen & Felser, 2018).

2.7 Studies on Processing of Morphologically Complex Words

In this section of this chapter, the past studies similar to the present study are reviewed. This section is divided into three sub-sections. In the first of these sub-sections, I shall discuss the research focusing only on the native speakers of English irrespective of their age and proficiency level. The second subsection focuses on the research that took learners' L2 proficiency level into consideration. The third subsection will be about the research focusing on languages other than English.

2.7.1 Studies focusing on native English Speakers

Silva and Clahsen (2008) investigated the processing of morphologically complex words by the native speakers of English vis-à-vis two groups of adult L2 learners whose first language was either Chinese (Mandarin) or German. The researchers focused on inflected words such as regular past forms of verbs as well as deadjectival derivations. They used masked priming experiments and the respondents' response times (RTs) were analyzed via ANOVA test. The results showed clear and efficient priming effects for both inflections and derivations by the native English speakers. The L2 learners of English, however, showed little priming effects for derivations and no priming effects for the inflections. The researchers went on to conclude that this difference in priming between the native and the non-native users of English indicates the L2 learners store inflections and derivations as separate entries in their lexicon and do not combine morphemes at the time of retrieval.

Voga et al. (2014) conducted a similar study and compared the results to those from Silva and Clahsen (2008). The study involved advanced learners of English studying at Aristotle University of Thessaloniki. All the participants were native speakers of Greek. The participants went through two priming experiments (like those used in Silva and Clahsen's study) involving regular verb inflections and '-ness' derivations. The researchers compared the obtained results with the study conducted by Silva and Clahsen (2008). The results showed that the L2 learners of English did show robust priming for derivations and inflections. This indicated that contrary to the results obtained by Silva and Clahsen, the Greek L2 learners of English did adopt morphological decomposition of morphologically complex words (MCWs) while storing them in their lexicons (Voga et al., 2014).

Rabin and Deacon (2008) investigated the priming effects of inflections and derivations as well as orthographically and phonologically similar words involving a group of school children. The students were studying in grades 1-5. The researchers employed very interesting priming experiments. The words used for the experiments were very carefully selected. I shall mention one such group here; need, needed, needy and needle (identity, inflection, derivation and unrelated but orthographically and phonologically similar words respectively). Thirty such groups of words were used in the experiments. The children both saw and heard the primes following which they were given fragment completion tasks. The results showed that children rely more on morphological representations for their lexical decisions, as no priming effects for the controlled words were observed. The researchers also observed that the quantity of priming between the morphologically related and the controlled conditions remained consistent across the children irrespective of their age or grade which, according to the researchers, indicates that their lexical representations do not change across the elementary years.

Beyersmann et al. (2011) conducted priming experiments with 48 undergraduate and graduate students who were all native speakers of English. The researchers employed transposition and substitution of letters within and across the morpheme boundaries in morphologically complex words (MCWs). In addition to the truly suffixed words (i.e., darkest) the researchers used some pseudo suffixed words (i.e., glossary) to investigate whether semantics affect the decomposition in the lexicon.

The researchers came up with two conclusions. The first was the irrelevance of the position of transposed letters. That is, the respondents showed good priming effects irrespective of whether the transposed letters in an MCW were within a morpheme or across its boundary shared with another morpheme. The researchers got almost similar results for substituted letters in morphologically complex words. This, according to the researchers, indicates that the respondents recognized the words as a whole rather than the decomposed morphemes separately. The second observation/conclusion the researchers came up with is that in addition to the truly suffixed words, even the pseudo suffixed words showed good priming effects (i.e., *glossary* showed prime effects for *gloss*). This phenomenon, according to the researchers, indicates that the decomposition taking place while processing morphologically complex words is not always rule-based. Sometimes it can be done based on orthographic similarity as well (De Rosa & Crepaldi, 2022).

Sereno & Jongman (1997) conducted a series of priming experiments engaging native English-speaking students studying at Brown University. The researchers focused on the frequency of the words used in the tests. In one of these experiments, disyllabic nouns and verbs, very similar in length, were carefully selected. The researchers also made sure that the selected nouns were not used as verbs in English and vice versa. Since the experiment was based on word/nonword items, the exact number of nonwords with similar spellings and lengths were also selected. The results showed faster latency for nouns than verbs. In another experiment, the researchers used only plural nouns. These nouns were selected in such a way that if a noun’s base/stem was low in frequency, the plural inflection was frequently used and vice versa. The researchers concluded that frequency played an important role in the response times for an MCW and it was not limited solely to rule based decomposition.

In order to validate Sereno and Jongman's (1997) research, Carlisle & Fleming (2003) involved school-going children in grade one and three with an aim to investigate whether children's processing of morphologically complex words improved over time. The researchers employed a Word Analysis Test which was adapted from Braun & Rubin (1998) along with some definition activities. The researchers also interviewed the students briefly about three words; *knotless*, *stillness* and *treelet*. The results showed that third graders were good at decomposing morphologically complex words. The research also indicated that early access to full forms of words, affixes and base morphemes leads to improvement in the processing of morphologically complex words in elementary years (Braun & Rubin, 1998; Carlisle & Fleming, 2003).

Earlier, Carlisle (2000) had involved some third and fifth graders attending a private school in some definition, reading and writing tasks containing morphologically complex words. The researcher selected some morphologically and phonologically transparent bimorphemic words (i.e., movement, powerful) and some others which had no transparent morphological or phonological relationship (i.e., natural, easily). The respondents were given various tests including definition, word reading, word writing and test of morphological structure. The collected data was compared between the two groups (grade 3 vs grade 5). The researcher concluded that morphological awareness greatly affected the processing of morphologically complex words.

Crepaldi et.al. (2010) conducted a series of experiments with native English-speakers studying at Royal Holloway, University of London. The focus of the research was on irregular inflections (fell-fall, bought-buy). A variety of priming experiments were done, and the collected data was processed via the ANOVA test. The results showed priming evidence for irregularly inflected words like fell and fall. However, there was no priming for orthographic similarity (fill-fall). The researchers conclude that the processing of these words does not solely depend upon the morphological structure. They suggest that there is another source of priming that is located at the lemma level. It provides the priming for irregular inflections irrespective of orthographic dissimilarities.

Bergmann, Hudson and Eling (1988) conducted some lexical decision experiments involving students studying at University of Nimegen, the Netherlands. The researchers investigated various variables (prefixes vs suffixes; Germanic vs Latinate root; free vs bound stem and the currency of the stem) and concluded that decomposition takes place very rapidly for prefixed and non-prefixed items. The researchers also hinted at some role played by the root of the words (Germanic/Latinate) in the time taken for processing.

Meunier and Longtin (2007) engaged some students studying at the Institut d'e´tudes politiques de Lyon (France) in a series of unmasked priming experiments. The focus of the researchers was on morphologically complex pseudowords. A variety of such pseudowords was used including non-interpretable root-suffix combinations, semantically interpretable morphologically complex pseudowords and single morpheme pseudo words. Some words used in the experiments were not only semantically interpretable, but they also had synonymous existing derived words. The results showed that only the interpretable words were primed including those which had synonymous existing derivations. The researchers went on to conclude that there are two levels of morphological decomposition of morphologically complex words; morphological decomposition based on form and semantic integration based on the semantic capability of the morphemes.

Dawson et al. (2021) investigated orthographically related priming effects in children between 9 and 18 years of age. They found that the children showed some priming effects in orthography-related primes and targets at younger ages. The children of older ages (closer to 19 years) did not show any such priming effects for orthographically related primes and targets. The researchers concluded that children rely on surface level information at younger ages and their automatic processing of morphologically complex words develops with age.

De Rosa and Crepaldi (2022) investigated a combination of non-words and frequently used suffixes. The focus of the study was on whether the frequency of certain morphemes affects the processing of morphologically complex words. The combination contained non-words like *bulbment*. The researchers also used some frequently used non-morphemic endings like *-idge* and some non-frequent non-morphological endings like *-ickle*. The study did not witness any priming effects for either the non-words with proper suffixes or the pseudo-endings used in the study. The researchers concluded that the frequency of the word endings does not affect morphological priming response times.

2.7.2 Studies investigating the role of proficiency in L2

Zeng et al. (2019) investigated the processing of morphologically complex words by 40 undergraduate students at Huan University, China. All these students were studying in their second year at the university and none of them were doing majors in English. All the participants had English as their second language. These participants were divided into two groups based on their proficiency in English. The researchers used masked transposed letter priming experiments to collect data. Two types of transposition were employed: one within the boundaries of the morphemes and the other across their boundaries. The data was processed via the ANOVA test. The results of the research show considerable variation in the processing of morphologically complex words according to the level of proficiency in L2.

Liang and Chen (2014) investigated the processing of morphologically complex words by a group of Chinese English learners studying at Beijing Normal University. The respondents had never been to an English-speaking country before and had begun attending English language classes during their middle school. The researchers divided the participants (48 in total) into two groups based on their higher and lower proficiency in English language. The research involved three types of masked priming; morphologically related/unrelated pairs, semantically related/unrelated pairs and form related/unrelated pairs. Event-related Brain Potentials (ERPs) were used to collect the data. The collected data went through the ANOVA test. The results showed that the high-proficiency group exhibited higher priming effects while the low-proficiency respondents showed little or no priming effects. The researchers concluded that the highly proficient L2 learners of English decompose the MCW's while storing them in their lexicon while the low proficiency learners rely more on the separate lexical storage.

Li, Jiang and Gor (2017) conducted a series of masked priming experiments involving 50 native speakers of English and 46 Chinese learners of English. All the respondents were undergraduates studying at the University of Maryland. The study aimed at finding out the processing of bimorphemic compound nouns by both the native and the nonnative speakers of English. The experiments involved compound nouns as primes with their initial or final words as targets. For example, *toothbrush* when used as a prime had *tooth* as target in one experiment while *brush* in another. All the primes and the targets had a semantically transparent relationship. Another experiment focused on the semantically opaque relationships between the primes and the targets, *honeymoon* and *honey*, for instance. In yet another type of experiment, the researchers employed orthographically related primes and targets with no morphological or semantic relationship. For example, *tomorrow* and *row* were used as prime and target respectively for final word overlap position priming. Similarly, *restaurant* and *rest* were used as prime and target for initial word overlap position priming. These experiments were separately done with the native and nonnative speakers of English (Li et al., 2017).

The collected data was processed via ANOVA analyses. The results showed robust priming for both semantically transparent and opaque relationships between the bimorphemic compound primes and their targets. The Chinese respondents also showed clear and consistent priming effects for both these categories. However, the Chinese learners of English did show some priming for the orthographically overlapping targets at the word-initial position. However, no such priming for the overlaps at the word-final position was observed. The native speakers, however, did not show any priming effects for these orthographically overlapping targets. This led the researchers to conclude that nonnative priming is not limited to form priming. It, according to the researchers, has some other origin too (Li et al., 2017).

Gao et al. (2022) used repetition priming experiments to investigate the representation of morphological units in the mental lexicons of native Chinese speakers and non-native Chinese L2 learners. The researchers used free and bound morphemes in the experiments in order to find out whether the Chinese language users rely on morphemes or whole words. The results showed that the highly proficient advanced learners of Chinese adopt the whole word strategy while processing the language which is similar to the native Chinese users' processing. However, the intermediate level L2 learners of Chinese rely more on morphemes while processing the language. The study concluded that proficiency in the language is a critical factor in native like processing of a language.

Festman and Clahsen (2016) engaged 24 students studying at the University of Potsdam. The participants were all native speakers of German and had begun learning English late in their lives. The study investigated the participants' silent production of the past tense of both regular and irregular verbs. The data was collected via EEGs using an Event Related Potential (ERP) paradigm. The participants were also given the grammar part of the Oxford Placement Test (Allan, 2004) to see their level of proficiency in English grammar.

The collected data was compared to the data collected from 19 native speakers of English from an earlier study conducted in the same way. The results showed great similarity in the EEGs obtained from both the native and the nonnative speakers. The researchers concluded that processing of morphologically complex words involved decomposition while processed by native speakers and advanced learners of English (Festman & Clahsen, 2016).

Ciaccio and Jacob (2019) involved native and highly proficient non-native German users in an experiment employing overt priming. The researchers used two types of primes and targets. One of these types consisted of morphologically related primes and targets involving both inflections and derivations. The other type consisted of only orthographically related primes and targets. The research concluded that there was no difference in the onset of priming as far as morphologically related primes and targets were concerned. Both the native and the non-native users of German responded alike in the experiment. However, the non-native users did show some priming effects for the items that were only orthographically related. The researchers concluded that the non-native users of a language may be relying on surface level information more than the native users of the language.

Kaan and Chun (2018) employed a writing task in order to investigate structure adaptation among native and non-native speakers of English. The study involved students who were native speakers of English along with students who were native Koreans and were advanced learners of English. The respondents were primed with a dative structure of sentences containing double objects. The researchers observed that during the writing task both native and non-native users of English adapted to the newly shown structures to them. The researchers concluded that there was no difference among the natives and the non-natives (L2 learners of English) in this regard (Kaan & Chun, 2018).

Veríssimo et al. (2018) investigated the role of age (or critical period) in attaining native-like proficiency in the second language. The study started with a hypothesis that the individuals who start learning a second language late in their lives find it difficult to acquire inflectional rules. However, derivational rules of the second language can be acquired quite late in life. The study involved 93 Turkish-German bilinguals including 55 male and 38 female respondents. The participants were classified into three groups according to their age of acquisition of the second language (German, in this case). One of the three groups consisted of the individuals who started learning German below three years of age. The second group had those participants who started learning German between 3 and 10 years of age, while the third group comprised of the individuals who started learning the second language after they were 10 years old. A masked priming paradigm was used to collect the data in terms of response times to a word recognition format. The study found the individuals greater in the age of acquisition of the second language (the third group) to be quite at a loss while processing the inflections. However, there was no problem for the third group while processing derivations. The study concluded that the age of acquisition is a critical factor towards attaining the native-like processing of the second language.

In a similar study, Bosch et al. (2019) investigated the effects of the age of acquisition of the second language learning on the grammatical processing in terms of inflectional morphology. The study involved 105 Russian-German bilinguals with various ages of the start of acquiring the German language. The participants went through a German language proficiency test in order to prove their high-level proficiency in the second language (German). The study used variations in German verbs as the items for the experiments involving word recognition. The study concluded that the age of onset of second language acquisition is a factor and that it greatly affects the automatic processing of the language being learnt.

Felser and Roberts (2007) investigated real-time processing of wh-dependencies among native and non-native learners and advanced learners of English. The learners and the advanced learners of English were native speakers of Greek. The study used cross modal priming involving images as primes. The targets were presented to the participants at structurally defined gaps. The participants were made to listen to clauses containing indirect objects at the same time. The study results showed marked differences among all the three groups of participants. The L2 learners of English responded to the task differently as compared to both the native speakers and the advanced learners of English. The learners' response was not marked by any individual memory-based differences, according to the researchers. There was a difference between the responses given by the native speakers and the advanced learners of English as a second language. The advanced learners were markedly slower in responding to the items as compared to the native speakers of English. The study concluded in support of the hypothesis that movement traces in memory lack if the mental representations are built during non-native representations.

2.7.3 Studies investigating languages other than English

Ansarin & Manesh, (2017) conducted a study involving sixty undergraduate students studying at a university in Iran. The main objective of the researchers was to find out whether semantics influence the storage and retrieval of words in the lexicon. The study was designed in such a way that semantically related primes were used for targets instead of orthographically related primes. They conducted two masked priming experiments; in the first one the primes were presented in Persian while the targets were in English. In the second experiment, the primes and targets were both in English, but only semantically and not orthographically related. The results showed no priming evidence which led the researchers to conclude that semantics (both inter- and intra-linguistic) does not play a vital role in processing the words. Earlier, a similar study was done by Javadi (2014) who investigated cross-linguistic priming effects with Persian native-speakers studying English. She used exact translation equivalents, semantically related words and associatively related pairs of words. She failed to achieve any priming effects in her study.

De Grauwe et al. (2014) found non-native users to be decomposing complex and derived verbs via functional magnetic resonance imaging (fMRI) evidence. The study involved native and non-native users of Dutch language. The study witnessed robust priming effects for both inflections and derivations by the native as well as non-native users of the language. The researchers concluded that non-native users of a language show strong priming effects while processing inflected and derived verbs.

Jacob et al. (2018) investigated processing of morphologically complex words in native and non-native German. Two types of morphologically complex words were investigated in the study: derivations and inflections. The study involved 40 native speakers of German and 36 highly proficient non-native speakers of German with Russian as their mother tongue. The study is quite innovative in respect of the prime and target pair selection. The primes were carefully selected and the targets for both inflections and derivations were the same. The study found significant evidence of priming for inflections and derivations among the native speakers of German. The non-native speakers, however, did not show any priming effects for inflections, although priming effects in case of derivations were present.

2.8 Research Gap

There are many studies conducted on a variety of languages involving participants belonging to various backgrounds and cultures, as discussed above. However, the primary focus of all these studies is one language. The studies involve two sets of participants, one native and the other one nonnative, and investigate the similarities and differences in their processing of the one language under the focus. There is not a single study that involves one group of bilingual participants and carries out investigation on how they process their first and second languages. The present study aims at filling this gap. The study focuses on one 'bilingual mind' and tries to find out how this mind processes its first and second languages, Urdu and English in this case.

There is a dearth of research in the area of processing morphologically complex words in the Pakistani context. There are a few studies in this regard. However, there is no online/real-time investigation into processing of Urdu and English or any other regional language spoken in Pakistan. The present research intends to fill that gap.

2.9 The Present Study

The present study aims at investigating the processing of morphologically complex words in English and Urdu by Urdu-English bilinguals. It not only involves how the Urdu-English bilinguals process both the languages but also compares their performance in these languages. The study also investigates whether there is any link between proficiency and efficient processing of morphologically complex words in a language.

The outcomes of this research will help English language teaching and learning in general and such practices in Pakistan in particular where the usual focus is on grammar and vocabulary, but no specific morphology related courses are put on the syllabi lists.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter starts with an overview of various psycholinguistic experiments employed for gauging the processing of morphologically complex words. Since the present study involved masked priming experiments for data collection, an overview of various priming experiments in general and masked priming experiments in particular is also presented. The chapter also discusses the research design of the present study and explains both the experiments conducted in the study in detail. The chapter also briefly discusses the test used for classifying the participants into three groups according to their proficiency levels in English. Towards the end, the chapter discusses the procedure adopted for the data analysis.

The purpose of this research is to determine whether the Pakistani English language learners process the morphologically complex words like the native speakers of English, or if there are any discrepancies in this regard. Since the present study involved native Urdu speakers who know the English language at some level, it was decided to find out how they process the morphologically complex words in Urdu which is their native language. In order to achieve this purpose, it was necessary to conduct an experiment that determined their processing of morphologically complex words in Urdu. The results of both the Urdu and the English experiments were later to be compared in order to find out the similarities and/or differences between these participants' processing of morphologically complex words in their native language, Urdu, and English.

3.1 Psycholinguistic Experiments for Processing of Language

There are many types of experiments adopted by psycholinguists in order to map language processing. They are usually divided into two groups: offline experiments and online experiments.

The offline experiments do not involve time as a variable. The respondents/participants of the offline experiment can take as long as they like in order to respond to the questions. One of the major offline experiments in psycholinguistics is memory test.

As the name suggests, memory tests involve the remembering ability of the respondents. The respondents are shown some language structures which can be words, phrases, or sentences. After some time, they are asked to reproduce those structures in either written or spoken form. The reproduced structures are then analyzed.

Memory tests can be suggestive of how individuals store or retrieve language in their minds. While preparing the proposal for this research project, a memory test was carried out which involved derivations. The respondents were given a list of 20 derived words in English and Urdu separately and were asked to say those words after a gap of ten minutes. Many of the participants remembered nearly half of the words on the lists. The significant outcome, however, was that many participants produced a few derived words that were not on the list but contained the same derivative affixes. This served as an indication that they broke down the derived words before storing them.

There are other offline techniques used by psycholinguists for investigating the mental processes involved in language processing. These include direct questions to the participants about how they perceive various aspects of language and its processing. Another offline technique in psycholinguistic experimentation is matching linguistic items with nonlinguistic items or other linguistic items. For example, the participants can be asked to match words or sentences with pictures. They can also be asked to sort various words or sentences depending upon the results the researcher(s) want to achieve.

The offline techniques in psycholinguistic experimentation do not count the response time. This allows the participants to focus more on accuracy and grammatical correctness.

Online experiments, on the other hand involve time as one of the main variables. In recent psycholinguistic research, online experiments have been used far more often than the offline ones. There are three main categories of online experimental techniques used in psycholinguistic research: response time measurement, eye movement tracking, and brain imaging.

In response time measurement, the respondents are asked to perform tasks as quickly and accurately as possible and their response times are measured. These response times are later analyzed to find the results. The present study involved response time measurement for data collection in the masked priming experiments.

Eye movement tracking is used in order to find out the responses given by the participants in the experiments. For example, the participants can be given a paragraph to read while their eye movements can be tracked in order to find out how much they stop at each word and whether there is any difference in their eye movement while processing easy versus difficult words. Eye fixations, movements and saccades are the main sources of data collection in this technique. There is modern equipment available that provides millisecond level precision in tracking these movements.

Brain imaging involves some state-of-the-art equipment to study the activities taking place inside the brain. Brain imaging can also be used for response time measurement. There are three main types of brain imaging technology used for online experimentation in psycholinguistics: Electroencephalography (EEG), Magnetic Resonance Imaging (MRI) and Functional Magnetic Resonance Imaging (fMRI) and Computed Tomography (CT scan). There are certain electrodes attached to the scalp during an EEG scan. These devices can detect brain activity. MRI can detect brain activity in response to stimuli presented to the individual undergoing the scan. fMRI is the most modern technology that not only detects brain activity but can also record oxygen flow in various parts of the brain. Thus, it can detect the parts of the brain that are most active during a given activity.

These brain imaging techniques are used to record precise response times. They can also detect various parts of the brain that are active while doing a particular task. These devices also detect event-related brain potentials during an experiment.

3.2 Priming

Priming is a psychological phenomenon wherein a stimulus affects an individual's response to a subsequent stimulus. It is used as a technique in experimental psycholinguistics in order to investigate quite a few psycholinguistic processes. Typically, a stimulus is presented to the participant which affects the individual's response to another stimulus that is presented after the first one. The first stimulus is called *prime* and the second one is called *target*. The prime's effect on the individual's response to the target can be either negative or positive. That is why priming can be both positive and negative.

In positive priming, the prime is somehow related to the target which facilitates the partaking individual in responding to the target. For example, showing *careful* to the individual before asking them to respond to *care* makes the individual recognize the target faster. This assistance of the prime in making the individual recognize the target faster makes it positive Priming.

Negative priming, on the other hand is a phenomenon that hinders the individual's ability to recognize the target quickly. For example, presenting *olive* as a prime and *live* as the target will make it difficult for the participant to recognize the target quickly. That is why it is considered negative priming because it affects the individual's cognitive process in a negative manner. Priming has many types. In the following lines, I shall define them briefly.

3.2.1 Positive or Negative Priming

As discussed above, positive priming is the one in which the prime positively facilitates the recognition of the target. For example, showing an orange-colored object as a prime will facilitate the responding individual in recognizing the word *orange*. This is positive priming. On the contrary, using a picture of an orange and asking about banana will negatively affect the individual's ability to recognize the word quickly. This is an example of negative priming.

3.2.2 Semantic Priming

Semantic priming involves the logical or linguistic associations between words or objects. For example, mentioning *money* before asking somebody for the meaning of *bank* will more likely result in the person responding as the *financial institution* rather than the *coast/bank of a river* one.

3.2.3 Associative Priming

Associative Priming involves the primes and target that are usually associated with each other. For example, books and readers, cat and mouse, or teacher and student etc. Since these words are usually associated with one another, one used as a stimulus facilitates the response to the other.

3.2.4 Perceptual Priming

This type of priming involves the form of the primes and targets. For example, the word bat is more likely to facilitate the word rat because of their similarity in form both in writing and sounds.

3.2.5 Conceptual Priming

Conceptual Priming involves primes and targets that are related to the same/similar concept. For example, *chair* and *seat* belong to the same concept so one should facilitate the recognition of the other.

3.2.6 Repetition Priming

In repetition priming, both the primes and targets are exactly the same. For example, orange is used both as the prime and the target. Usually, repetition priming is employed to ensure that the phenomenon of priming is taking place among the partaking individuals.

First three items in each experiment (both Urdu and English experiments) in the current study involved repetition priming. The response times to these items when compared to other related/unrelated pairs of primes and targets will show whether the priming took place or not.

3.2.7 Cross-Modal Priming

The Cross Modal priming involves the primes and the targets belonging to different modal categories. An image used as a prime and a word (text) as the target is an example of cross modal priming. Cross modal priming is used very widely in the current research both in Psychology and Psycholinguistics.

3.2.8 Masked Priming

Masked priming is a type of priming where the prime is shown to the partaking individual in a controlled manner and for a very limited time. Typically, the prime in masked priming is preceded by a series of symbols (like hashtags, for example), which make the subsequent show of the prime almost impossible to perceive consciously. The prime is shown for less than 80 milliseconds which makes it almost impossible for the participant to visually perceive it. Masked priming is considered to be very effective because it reduces any conscious decision making on the part of the individual partaking in the experiment.

Masked priming experiments can have many variations. These variations depend upon the way the primes are masked. For example, a prime can be partially masked so that the respondents can see some part of the prime. It can be fully masked, leaving a series of hashtags or dollar signs on the screen while hiding the prime completely. The time duration for which the primes and targets are shown in the experiment can also be varied. These variations affect the decision making greatly on the part of the individuals participating in the experiment.

The present research employed masked priming experiments in both Urdu and English languages. The respondents were asked to make lexical decisions by choosing between words and nonwords. The details of how the experiments were carried out are presented in the following section of this chapter.

3.3 Research Design

As discussed earlier, the participants had to go through two experiments: one in Urdu and the other one in English. However, since the main objective of the study was to find out the processing of morphologically complex words in *Urdu* and *English* by the Urdu-English bilinguals, both the experiments had to be very similar so that the data obtained via these experiments were comparable. That is why the English experiment was designed and developed first of all, followed by the Urdu experiment which was technically an Urdu variant of the English experiment. This similarity will be discussed in the following pages.

In the following lines, both the experiments are discussed in detail, starting with the English Experiment.

3.3.1 Experiment 1: English

The English experiment, as mentioned earlier, was one of the two main sources of data collection for this study. It was a masked priming experiment in which participants had to make lexical decisions.

In this section various aspects of this experiment will be discussed including the purpose, the participants, the linguistic items used in it, and the method in which it was carried out. Let us start with the purpose or rationale behind the experiment.

3.3.1.1 Purpose

As discussed in the previous chapter, there are many theories about how language users store and process words in their mental lexicons. The present study, and the experiments, are based on *dual mechanism theory*, put forth by Pinker, Ullman and Clahsen in various research studies of theirs. The dual mechanism theory states that the words (here I shall discuss morphologically complex words) are stored in the mental lexicon in two ways by the language users. One, they break down the words containing more than one morpheme and store these morphemes in different sections of the lexicon. For example, the word *worked* is stored in two pieces as *work* and *ed* in the lexicon (Pinker et al., 2002; Ullman, 2001). The other way of storing the words is used for words that are inseparably linked to other words. For example, *went* is stored in the lexicon in a way that it is linked to its present form *go* (Pinker et al., 2002).

The dual mechanism theory holds a lot of water because there are a number of studies that have established that at least native speakers do store the words by breaking them down (Clahsen, 2006; Penke, 2012). There are quite a few other studies that show that even non-native speakers of English break words down into morphemes while storing them in their lexicons. However, non-native speakers of English can do so only after achieving a higher level of proficiency in the language (Zeng et al., 2019). Many of these studies involved masked priming experiments in order to record response times of the participants and showed that the response times of the native speakers as well as highly proficient non-native speakers of English were comparatively shorter than others.

This experiment aimed at finding out the performance of native Urdu speakers while processing morphologically complex words in English. The participants of this experiment were also given an English language placement test in order to determine whether achieving higher language proficiency had any connection with their processing of language. A detailed discussion about the placement test can be found in the following sections of this chapter.

3.3.1.2 Participants

Forty-two native Urdu speakers took part in this experiment. All these participants were matriculates (at least 10 years of education). All these participants live either in the twin cities of Rawalpindi and Islamabad or in Attock City (a comparatively smaller city situated 85 kilometers away from Rawalpindi/Islamabad). *Snowball Technique* for finding the participants was adopted. Applying this technique means that the researchers ask the participating individuals whether they know any other individuals qualifying for the current research/experiment. Since Urdu speaking families are scattered across Rawalpindi/Islamabad and Attock, the participating individuals provided great help in providing contact information of other potential participants. All the participants belonged to families who migrated from India at the time of partition between India and Pakistan.

The participants belonged to different walks of life. Some of them were teachers (some even English teachers), some working as bank officers, and some were unemployed graduates. Around half of these respondents were students pursuing their higher studies in various disciplines. The participants' ages ranged between 18 and 50 years.

Out of the total 42 respondents, 25 were females and 17 were males. Three out of the 25 female respondents were housewives while seven of them were working women. There were five unemployed graduates among the female respondents. The remaining 11 female respondents were studying at different levels pursuing various disciplines.

There were two bankers among the male respondents. An army officer (Major) was also there among the participants. Three teachers were also among the male participants. Four unemployed graduates also took part in the experiments. The remaining seven male participants were studying at different colleges/universities.

Most of these participants were introduced to the English language at the age of 3-5 years. English being the official language in Pakistan, most households expose their children to the language in one way or another at quite an early age. In the English medium schools in Pakistan, students get exposure to the language right from day one of their schooling in playgroup or prep classes. The rest, studying at Urdu medium schools were introduced to English at the age of 10-11 years when they started their sixth-grade schooling. In Pakistani Urdu medium schools in the past, English was introduced in the sixth-grade syllabus.

3.3.1.3 Test Items

The data collection in this masked priming experiment was carried out by using DmDx software discussed above. The coding for this software requires placing the primes and the target words in a specific sequence while allotting display times according to the requirements of the experiment. Therefore, by using the word *item*, the whole sequence of the hashtags, prime words, and target words is meant. A detailed overview of the procedure is given in the Method section below.

The test consisted of 54 items. The first ten items were meant for practice and the data obtained against these items were not included for the analysis. These items included five words and five nonwords. All the five words included in this part were displayed both as primes and target words. However, in the nonword items, the target words were nonwords while the primes were words.

The actual experiment, excluding the practice session, had 44 items. Out of these 44, 22 were nonwords. Again, in these nonwords, the primes were words while the target words were nonwords. In the following part of this subsection, I shall only discuss the items that had words as their targets. Since the data obtained from the nonword targets were not analyzed, these will not be discussed in detail. However, it must be kept in mind that in masked priming experiments, it is a general requirement to include at least as many nonword targets as the word ones, because it urges the respondents to concentrate and focus on their lexical decision-making and not just randomly press the buttons assigned for the experiment. For example, if a respondent somehow realizes that 75% of the items displayed on screen are words, they might decide to press the button assigned to the *word* item after item without consciously recognizing it.

The first three of the 22 items with words as their targets were *face*, *global*, and *child*. All the three words were used as both primes and targets. The purpose of these items was to see the extent of the priming effects on the respondents. Usually, items like these exhibit full priming effects on the respondents.

The next item with a word as the target was completely unrelated. The prime in this item was *truck* and the target was *become*. The purpose behind placing this item was to see the difference between the response times in identical and unrelated primes.

The fifth item on the list was an orthographically related prime, *cooker*, to the target *cook*. There is also a slight semantic relatability between the two. However, the main aim of including this item on the list was to see whether there was any priming effect present between orthographically related primes and targets. There were two more items of similar nature; *corner/corn* and *honeymoon/moon*. These items were included for the same reason as to find out any orthography-related priming effects.

There were two items that involved plural inflections of nouns, namely, *years/year* and *deserts/desert.* The plural forms were used as primes while the singular forms served as the targets. These items were included to investigate the priming effects of plural inflections.

Two past tense inflections were also presented as primes while their present forms were used as targets. These inflections were *impressed/impress* and *worked/work*. The purpose was, as explained in the case of plural inflections of nouns, to investigate the priming effects of the past tense inflections of verbs.

There was an unrelated pair of prime and target involving a past tense inflection, *provided*, used as the prime, and a completely unrelated target, *summary*. The rationale behind using this unrelated pair of words in an item was to investigate the expected absence of priming because of no semantic or orthographic similarity between the two words.

The plural and past tense inflections were followed by four derivations. Two of these derivations involved forming adverbs from adjectives using *-ly*. These included *slowly/slow* and *politely/polite*. The other two derivations were nouns derived from verbs using *-ment*, including *treatment/treat* and *adjustment/adjust.* In all four items involving derivations, the derived forms were presented as primes while the actual words served as targets.

In this section of the experiment, there was an unrelated pair of prime and target included which was supposed to gauge the absence of a priming effect due to being completely unrelated to one another. This item included *new* as prime and *kind* as target.

There were three items in the experiment which involved compound nouns. These compound nouns were *grandmother*, *doorbell,* and *driveway*. *mother, bell,* and *way* acted as their targets, respectively. These compound nouns were included to find out the (partial) priming effects of the primes on their respective targets. Two unrelated pairs were also used in this section of the experiment. These were *well-built/known* and *building/term.* These unrelated pairs of primes and targets were used to gauge the absence of priming as compared to the partial priming expected in the related pairs mentioned above.

It would be worthwhile to mention that all the related primes and targets used in this experiment with a purpose of mapping priming effects were semantically related and orthographically transparent. However, there were three pairs that were orthographically related with little or no semantic relationship. These included *cooker/cook, corner/corn,* and *honeymoon/moon.* The logic behind including these items was to find out whether there were any priming effects present due to orthographic similarity in absence of semantic relatability. It must be reiterated here that masked priming technique used in this experiment minimizes the orthography related priming effects. However, it was necessary that a few parameters were put in the experiment in order to be absolutely sure about it.

3.3.1.4 Procedure

The participants had to go through these experiments by sitting in front of a laptop computer. Almost half of these experiments were conducted in a quiet airconditioned room. The other half had to be at different places because of the suitability of time and place to the participating individuals. In this section, I shall talk about the English experiment only while the procedure of the Urdu experiment will be discussed later. However, it must be kept in mind that each participant went through both the experiments one after another within approximately 30 minutes.

The first thing visible to each participant was 'Welcome to the lexical decision-making experiment'. Upon pressing the spacebar on the keyboard, the participants could see the following instructions displayed in Times New Roman font, size 24, black color and white background:

> Decide whether the displayed letters form an English word
> Press **RIGHT Shift** if it is an English word
> Press **LEFT Shift** if it is **NOT** an English word
> Respond as quickly and accurately as possible
> Press the space bar to begin practice

These instructions were also verbally explained to each participant. The participants were also instructed to keep their fingers right above the Shift buttons on each side of the keyboard so that they could decide and press them as quickly as possible.

There were ten practice items that followed the instruction screen. As discussed in the Items section, five of these items were words whereas the other five were nonwords.

The sequence of displaying each item was:

1. #### (4 hashtags) for 2500 milliseconds
2. Prime word for 50 milliseconds (in lowercase letters)
3. Blank screen for 33 milliseconds
4. Target word for 2500 milliseconds (in uppercase letters)

All these items were displayed in Times New Roman, Size 36, black color with white background. The clock set to measure the response times started as soon as the target word appeared on the screen. The target word remained on the screen for 2500 milliseconds even if the respondent had made their decision in the first 500 milliseconds. There is a setting in the DmDx software that shows feedback to the respondents in terms of whether they are making correct or incorrect decisions. However, this feedback providing setting was turned off keeping in mind the anxiety of the respondents in case they made an error.

The participants were given a break at the end of the practice session as the following instructions were displayed on the screen in Times New Roman Size 24, black color, and white background:

End of practice. Press spacebar to begin the test

Upon pressing the spacebar, the respondents could see the experiment items and respond to them one by one. These items were displayed in the same manner and style as the practice items described above. However, the sequence of the items was not the same as displayed on the items list. The DmDx software has a setting that jumbles up the items in the experiment. There were 44 items in the list excluding the ten items meant for practice. These items were divided into four blocks of 11 items each. The DmDx software shuffled these blocks and then shuffled all the 11 items in each block before displaying them on the screen. Thus, the items shown to each participant were never in the same sequence as shown to the participants earlier. The rationale behind the shuffling of items had two considerations; one, the participants might figure out the display sequence of words and nonwords and start responding without applying their minds, and two, they might get tired towards the end of the experiment and do not give proper attention to the items placed towards the end of the items list. Therefore, the shuffling was set in order to randomly sequence the items of the experiment so that it is not the last item on the items list that are always displayed towards the end of the experiment. This shuffling ensured that all the test items got displayed at different times in the experiment undergone by each individual participant. However, the practice items were not set to shuffle. Therefore, they appeared in the same sequence to each and every participant. Since the practice items were not included for the analysis, their sequence of appearance did not matter.

There was a break after every 11 items in the experiment. The following message was displayed on the screen after the participant had responded to 11 items, in Times New Roman, size 24, black color with white background:

Take a break. Press spacebar when ready to continue.

The rationale behind giving the respondents a break was that they should be able to look around. Constantly looking at the screen and focusing/recalling/recognizing words can take its toll on the mind. That is why they were given three breaks between four blocks of 11 items they were processing. During the break, an individual was free to take as much time as they wanted before resuming.

Upon processing the last (44^{th}) item of the experiment, the following message would appear on the screen in Times New Roman, size 24, in black color with white background:

End of the experiment. Thank you for participating.

The display of the above message marked the end of the experiment. After this, the respondents were requested to take their time to relax before undergoing the Urdu experiment, if they had not done it earlier.

3.3.2 Experiment 2: Urdu

The Urdu experiment was used to find out how the respondents processed morphologically complex words in their mother tongue. Since the objective was to find out how the Urdu native speakers process the morphologically complex words both in Urdu and English, the Urdu experiment had to be conducted. As mentioned earlier, both these experiments were very similar in the selection of items and the ways they were conducted because data obtained from these experiments were to be compared to each other. However, it would not be impertinent to mention that both these experiments were completely independent of each other. Since there was no interdependence, the respondents were given a choice to decide whether they wanted to do the Urdu experiment first or otherwise.

In the following subsections, various aspects of this experiment shall be discussed, including the purpose, the items, the respondents, and the method with which it was carried out.

3.3.2.1 Purpose

The purpose of this experiment was to see how the respondents process morphologically complex words in their mother tongue. As discussed above, the native speakers of a language break down morphologically complex words while storing them in their mental lexicon (acquisition & 2017, n.d.; Clahsen et al., 2011). This experiment served two purposes; one, to verify the notion of dual mechanism of storage and processing and two, provide a set of data that is comparable to the data set obtained via the English experiment.

3.3.2.2 Participants

The participants of this experiment were the same people who participated in the English experiment. Since the study required comparison and contrast between the processing of morphologically complex words in Urdu and processing of morphologically complex words in English, it was necessary to engage the same individuals in both the experiments. The purpose was to obtain a data set that showed the similarities and differences between how the individuals processed their native language and how they processed English. That is why, all the participants were requested to take part in two experiments, one in English and another one in Urdu. Only those individuals who consented to participate in both the experiments were involved in the process.

There was an English proficiency/placement test taken by all the participants after they were done with the experiment. However, there was no need to give them an Urdu proficiency/placement test because of the obvious reason that all the individuals were native Urdu Speakers.

3.3.2.3 Test Items

The purpose of this study was to gauge the similarities and differences between how native Urdu speakers process morphologically complex words in both Urdu and English. Therefore, both the experiments needed to be designed very similarly to one another. No two languages in the world work with exact similarity. However, at word level there are quite a few similarities between Urdu and English. Especially, the way morphologically complex words are formed in both languages seems strikingly similar.

The Urdu experiment had exactly the same number of items. There were 54 items in total. In addition to that there were 54 items which had nonwords as their targets. The items with nonwords as their targets were included to prevent the participants from making predetermined decisions.

All the words used as primes or targets in this experiment were selected from the book prescribed for the 9th grade students in the government schools of Punjab. The book is published by the Punjab Textbook Board, Lahore.

Like the English experiment, the Urdu experiment started with 10 practice items: 5 of them having words as targets and the other 5 having nonwords as their targets. The items with words as their targets were all identical, having the same words as the primes and the targets.

From here on in, I shall only discuss the items with words as targets, since the data obtained via the items having nonwords as targets was not included in the analysis.

The five words used as both primes and targets used in the experiment were پرچہ, ملک, کفن, صاحب, and دوپہر (*parcha/*paper*, mulk/*country*, kafn/*shroud*, sahib/*companion*,* and *dupehr/*noon, respectively) All these words are nouns in Urdu.

The first three items of the experiment, excluding the practice items were identity primes and targets. All three of them are nouns in Urdu: چہرہ (*chehra*/face), امتحان (imtehan/test or examination), and بچہ (*bacha*/child). In order to determine whether full priming would or would not take place, there were two other items included in this part of the experiment having unrelated primes and targets. One of the items had برسات (*barsaat*/rain) as its prime and جانور (*janwar*/animal) as its target. The other item with unrelated prime and target had خلاصہ (*khulasa*/summary) as its prime and بلبل (*bulbul*/name of a bird) as its target. This section of the experiment was designed to measure the full priming effects and, therefore, three items with identical primes and targets were used in it.

The next section of the experiment involved plural inflections of nouns. There were four such items involving two types of plural noun inflections. One of the two types of inflections were native Urdu inflections, not borrowed from any other language, involving وں-(*--on)* as suffix. The primes in this case were دوستوں (*doston*/friends) and باتوں (*baton*/news), and the targets were دوست (*dost*/friend) and بات (*baat*/news) respectively. The other type of plural noun inflection has its origin in Persian language. As discussed in the literature review section, Urdu came into being as a pidgin among many languages including Arabic, Persian, Turkish and Hindi. These types of plural noun inflections take ات-- (*--aat*) as a pluralizing suffix. The two items involving such inflections had موضوعات (*mozuaat*/topics) and احسانات (*ihsanaat*/favors) as primes and موضوع (*mozoo*/topic) and احسان (*ihsaan*/favor) as their targets. There were two items with unrelated primes and targets in this section of the experiment also. These included سنتا (*sunta*/heard) and سوچتا (*sochta*/thought) as primes and کھانا (*khana*/meal) and چلنا(*chalna*/to walk) as their targets respectively. The inclusion of these items with unrelated primes and targets was done with the purpose to provide a contrast between the response times of the related and unrelated primes and targets, which, in turn, would help to find out whether partial priming took place or not.

In the next section of the experiment, four items were included that involved derivations. Two of these derivations took the adjectival derivative ی- (*-ee*) that joins with nouns to make them adjectives. These items had عقلی (*aqlee*/rational) and اسلامی (*islamee*/Islamic) as primes and عقل (*aqal*/wisdom) and اسلام (*islam*/Islam) as their targets, respectively. The other pair of adjectival derivations were the ones formed by using a suffix -پر (*pur-*/full of) that turns nouns into adjectives. The two items had پرنم (*pur-nam*/moist) and پر لطف (*pur-lutf*/enjoyable) as their targets and نم (*nam*/moisture) and لطف (*lutf*/pleasure) as their targets, respectively. There were two items with unrelated primes and targets used in this section also. These items were used to provide comparable data to analyze whether any priming took place in this section or not. The primes in these two items were فلاحی (*falahi*/welfare) and پرسوز (*pur-soz*/sorrowful) and the targets were سایہ (*saaya*/shadow) and رشتہ (*rishta*/relationship), respectively.

The final section of the experiment involved compound words. There were three items in the experiment that involved compound words. Two of them were nouns having شوروغل (*shor-o-ghul*/noise) and بول چال (*bol-chaal*/speech) as primes and شور (*shor*/noise) and بول (*bol*/utterances) as targets. It can be observed that the second of these is not as semantically transparent as the first one. The third compound word was a compound adjective تنگ و تاریک (*tang-o-tareek*/narrow and dark). The compound adjective served as the prime whereas the target was تاریک (*tareek*/dark). Again, there were two items with unrelated primes and targets used in this section of the experiment as well. The primes in these items were compound words whereas the targets were simple nouns. The primes in these two items were سلام دعا (*salam-dua*/hello hi) and کھلونا گاڑی (*khilona-gaari*/toy car) while their respective targets were درد (*dard*/pain) and بہار (*bahaar*/spring).

All the related items used in this experiment were orthographically related. Although the masked priming techniques minimize if not eliminate altogether the orthographic priming, different fonts were used for primes and targets in order to further minimize the orthographic effects. The Dubai font was used for primes while the Jameel Noori Nastaleeq font was used for all the target words in this experiment.

3.3.2.4 Procedure

The Urdu experiment was conducted in exactly the same way as the English experiment. The respondents sat in front of the same laptop computer in the same settings. The Urdu experiment had exactly the same number of items displayed in exactly the same way for exactly the same time. The hashtags were displayed for 2500 milliseconds followed by the prime which were displayed for 50 milliseconds. The primes were followed by a blank screen for 50 milliseconds which was in turn followed by the targets displayed for 2500ms.

The experiment, like the English experiment, started with the same number of practice items. These practice items were followed by the section involving repetition priming. The subsequent sections of the experiment contained prime-target pairs involving inflections, derivations, and compound words. Half of the items in this experiment, like the English experiment, contained non-words as their targets which were placed there to make the lexical decision making more pragmatic and meaningful.

All the items appeared at exactly the same sequence as was the case in the English experiment:

1. #### (4 hashtags) for 2500 milliseconds
2. Prime word for 50 milliseconds (in Dubai font)
3. Blank screen for 33 milliseconds
4. Target word for 2500 milliseconds (in Jameel Noori Nastaleeq font)

The only difference between the two experiments was the linguistic one. The primes in Urdu experiment were displayed in Dubai font, size 28 whereas the targets were displayed in Jameel Noori Nastaleeq font, size 28.

All the instructions in Urdu experiment were given in English. The same buttons were used for decision making by the participants: Right Shift for word and Left Shift for nonword.

The participants were given the same number of breaks during the experiment. The breaks seemed to be necessary as sitting fully alert in front of a screen can be quite tiresome.

3.4 The English Language Proficiency Test

One of the premises of this study was to investigate whether there was any difference in processing of morphologically complex words in English between individuals differing in proficiency in English language. There was only one way to see that; giving the participants a proficiency test in English language and then seeing whether there was any difference in the processing according to their level of proficiency.

All the participants took an English language proficiency test after they were done with both English and Urdu experiments. Initially, it was suggested that the participants go through the placement test developed by the University of Oxford containing 60 multiple choice questions. During the pilot testing, however, it was realized that the test was too lengthy, and the participants lost interest in it and chose to randomly tick the various choices given against each question. In order to come up with a solution to the problem, another proficiency test was adapted from New Headway Placement Test, developed by Oxford University Press. The actual test contains 100 items, but it was carefully adapted and reduced to 45 test items. Unfortunately, it met the same fate. It was too long and boring for the participants. Both the psycholinguistic experiments combined took less time than the placement test. The disinterested participants endangered the reliability of the proficiency test. Therefore, LexTALE test was adopted in order to cope with the situation.

3.4.1 LexTALE Test

LexTALE test is an effective and reliable test to judge English vocabulary knowledge (Nakata et al., 2020). Since the present study involved vocabulary items in terms of morphologically complex words, LexTALE test seemed to be the best suited option. Another reason behind opting for this test was that it takes 5 minutes to complete. The respondents gladly did the test, and they were excited to see their scores as well.

LexTALE test consists of 60 items. Forty of these items are words whereas the remaining 20 are non-words. The developers believe that this ratio between words and nonwords does not matter much because the items are very carefully selected according to their frequency. They believe that for most of the respondents, there are items that are so less frequent that they also act (practically) as nonwords. Therefore, the ratio between words and nonwords technically equalizes (Lemhöfer & Broersma, 2012)

Nakata et. al. (2020) conducted a study involving 111 Japanese learners of English in order to judge the validity of the LexTALE test. The researchers used other testing methods to judge the proficiency levels of the students to see how different tests correlated with LexTALE test. They concluded that LexTALE was highly valid and reliable, and the results closely correlated with those of the TOEFL ITP (Nakata et. al., 2020).

The test operates on a yes/no method rather than giving multiple choices to the respondents. There is no time limit for responding to each item. An item appears on the screen along with two buttons. The *yes* button is green in color while the *no* button is red. The respondents can take as long as they like to respond to the items in either yes or no.

The respondents in the current study did the LexTALE test on a smartphone provided to them by the researcher. The phone was connected to a stable and fast internet connection because the test is online, although it can be downloaded and used offline as well. All the respondents took the test without any problems with the gadget or the internet connection.

LexTALE is a free resource, and it can be downloaded and/or used online at www.lextale.com

3.5 Data Analysis

Since the items in each experiment were presented to each individual in a shuffled manner, using the block shuffle utility provided in the DMDX software package, the output data was in a random shape. It had to be in sequence with reference to the items being experimented upon and also against each partaking individual. Moreover, the output file that the DMDX software generates is in *AZK* format (.azk). This format can be opened via Microsoft Notepad and does not open in Microsoft Word or Microsoft Excel. Thus, copying the data from the AZK file and shifting it to MS Excel seemed to be quite a hectic process. Thankfully, the University of Arizona had already presented a solution. There is a small program (freeware) called 'AZK to CSV' in the downloads section of the university in a folder called DMDX Utilities. What this program does is that it changes the AZK file into a CSV (Comma Separated Values) one which can be opened in MS Excel. Then the data can be sorted in ascending order and placed in the relevant columns and rows for analysis via the Statistical Package for Social Sciences (SPSS).

SPSS does not process Unicode data. Therefore, instead of placing the pairs of primes and targets in the data sheet being prepared for SPSS, there were certain codes given to each of them. The Urdu items (pairs of primes and targets) were given the code names starting with PTU (Prime and Target in Urdu) whereas the English items were codenamed as PTE (Prime and Target in English). The following tables show the codes and actual words used in each pair of primes and targets in both the experiments.

Table 1

Primes and Targets for the English Experiment

Code	Item No.	Prime	Target
PTE1	31	face	FACE
PTE2	32	global	GLOBAL
PTE3	33	child	CHILD
PTE4	34	truck	BECOME
PTE5	35	cooker	COOK
PTE6	41	deserts	DESERT
PTE7	42	years	YEAR
PTE8	43	impressed	IMPRESS
PTE9	44	worked	WORK

PTE10	45	corner	CORN
PTE11	46	provided	SUMMARY
PTE12	51	slowly	SLOW
PTE13	52	politely	POLITE
PTE14	53	treatment	TREAT
PTE15	54	adjustment	ADJUST
PTE16	55	honeymoon	MOON
PTE17	56	new	KIND
PTE18	61	grandmother	MOTHER
PTE19	62	doorbell	BELL
PTE20	63	driveway	WAY
PTE21	64	Well-built	KNOWN
PTE22	65	Building	TERM

The above table shows the code numbers given to the items in the English experiment. The first column shows the allotted codes while the second one shows the item number in the experiment. There were 54 items in the experiment which included the practice and the nonword items. These 22 items were the ones supposed to be analyzed later. The next two columns on the table show the primes in small letters and the targets in capital letters. This is exactly how they appeared on the screen during the experiment. The size was different, however.

Table 2

Primes and Targets for the Urdu Experiment

Code	Item No.	Prime	Target
PTU1	31	چہرہ	چہرہ
PTU2	32	امتحان	امتحان
PTU3	33	بچہ	بچہ
PTU4	34	برسات	جانور
PTU5	35	خلاصہ	بلبل
PTU6	41	باتوں	بات
PTU7	42	دوستوں	دوست
PTU8	43	موضوعات	موضوع

PTU9	44	احسانات	احسان
PTU10	45	سنتا	کھانا
PTU11	46	سوچتا	چلنا
PTU12	51	اسلامی	اسلام
PTU13	52	عقلی	عقل
PTU14	53	پرلطف	لطف
PTU15	54	پرنم	نم
PTU16	55	پرسوز	رشتہ
PTU17	56	فلاحی	سایہ
PTU18	61	شوروغل	شور
PTU19	62	بول چال	بول
PTU20	63	تنگ و تاریک	تاریک
PTU21	64	سلام دعا	درد
PTU22	65	کھلونا گاڑی	بہار

The above table shows the codes along with the items picked from the Urdu experiment for the analysis. The first column on the table shows the codes given to the items in order to be analyzed via SPSS. The next three columns show the item numbers, the prime words and the target words respectively. It might be noteworthy here that the primes can be seen in the Dubai Arabic font whereas the targets are shown in Jameel Noori Nastaleeq font. These are the fonts that were used in the actual experiment, with bigger sizes.

There is a remarkable similarity between the codes and the item numbers in both these tables. This similarity was kept on purpose so that the similarity or difference between the processing of similar classes of morphologically complex words by the partaking individuals could be seen.

3.5.1 Independent and Dependent Variables

The respondents were divided into three groups based on their proficiency in English. The three groups, the Low Proficiency Group, the Medium Proficiency Group, and the High Proficiency Group, were the independent variables, since the study expected the English language proficiency to be affecting the responses of the partaking individuals. The study involved 44 items (22 each in the Urdu and English experiments) wherein the responses (response times) were expected to be affected by the individuals' proficiency levels. That means that these 44 items were the dependent variables.

Since the study contained a big number of dependent variables, it was decided to go for multivariate analysis of variance.

3.5.2 MANOVA Analysis

The data was analyzed via multivariate analysis of variance via SPSS. Each item of both the experiments was compared in terms of their means, standard deviation, and standard error. Since the number of comparisons was predetermined and the study wanted to investigate the variation, the Bonferroni method was used for the Post Hoc analysis. Bonferroni method is the most pertinent method for analyzing the significance of variation/difference when the number of comparisons is already determined (Cangur et. al., 2016; Lee & Lee, 2018).

However, before selecting MANOVA, there are certain conditions and presumptions that need to be met/considered which are discussed in the following section.

3.5.3 Conditions and Assumptions for MANOVA

Multivariate analysis of variance (MANOVA) is an extension of analysis of variance (ANOVA) to accommodate more than one dependent variable. It is a dependence technique that measures the differences for two or more metric dependent variables based on a set of categorical (nonmetric) variables acting as independent variables.

MANOVA was considered suitable for analyzing the data gathered in this study because it meets the conditions stated above:

1. **The variables are in a dependence relationship**. The participants' responses are dependent upon the group to which they belong. Thus, the participants belonging to the low, medium, and high proficiency group are supposed to be responding differently (i.e., based on their proficiency in English language)
2. **Several dependent variables in a single relationship exist in this study**. There are 44 independent variables in the study, 22 each from both the Urdu and the English experiment.

3. **Measurement scale of the dependent variable is metric**. The variables are measured in milliseconds which is metric.
4. **Measurement scale of the independent variable is non-metric**. The groups are predetermined and the criteria for the classification has nothing to do with the dependent variables.

In addition to the conditions discussed above, MANOVA also has some assumptions that should be considered before going ahead with the analysis. They are discussed below:

1. **Independence of Observations**:

Observations from all the groups are considered to be independent, even if they have some common characteristics. This study has three groups, the low proficiency, the medium proficiency, and the high proficiency groups, and all the responses taken from these three groups were independent from each other. According to Hair et. al. (2019) there is no statistical test which can purely examine the dependence of the observations, and it is based on the research strategy that all the observations should be independent. In this research all the responses are independent from each other and there is no evidence of any dependence of responses in all three groups.

2. **Equality of Variance–Covariance Matrices**

The second assumption of MANOVA is the equivalence of covariance matrices across the groups (low proficiency, medium proficiency, and high proficiency). Here we are concerned with substantial differences in the amount of variance of one group versus another for the dependent variables, but if the numbers of respondents in all groups are equal then the equality of variance can be mitigated (Hair et. al., 2019). The current study had three groups all containing 13 participants which, in a way, answers the question of equality of variance and covariance.

3. **Multivariate Normality**

The last assumption for MANOVA concerns normality of the dependent measures. In the strictest sense, the assumption is that all the variables are multivariate normal. A multivariate normal distribution assumes that the joint effect of two or more variables is normally distributed. Even though this assumption underlies most multivariate techniques, no direct test is available for multivariate normality. Therefore, most researchers test the univariate normality of each variable. Although univariate normality does not guarantee multivariate normality. But according to Hair et. al. (2019), with moderate sample sizes, modest violations can be accommodated.

The current study met all the conditions and assumptions for MANOVA, and that is why it was decided to be the mode of analysis for the study.

CHAPTER 4

DATA ANALYSIS

In this chapter, the data generated by the two experiments is examined and analyzed. The chapter begins with an overview of the obtained data. It then moves on to the discussion on the missing values as a result of incorrect responses. Descriptive statistics of the data are also presented in the chapter. The chapter also includes a detailed description and discussion on the analyzed data in two different ways. It includes item-by-item comparison between the Urdu and English items, followed by a section-wise analysis of both the experiments separately.

4.1 Data Examination

The two experiments yielded a lot of data. There were 56 items in each experiment and the number of individuals taking part in them was 42 each. This means that there were 56 response times (RTs) recorded against each individual which makes the total RTs of the experiment 2352 (42x56=2352). Since there were two experiments, the number of the total RTs becomes 4704.

However, as described in the previous chapter in detail, there were nonword and practice items in each experiment which needed to be excluded from the analysis. Therefore, 22 items were picked from the data sheet yielded by the English experiment and their corresponding RTs were listed against each respondent. The corresponding data from the Urdu experiment data sheet was also placed in front of each respondent since the same individuals partook in both the English and the Urdu experiments. The respondents were represented by the Respondent Numbers rather than their actual names on the data sheet.

The mean and standard deviation were calculated for all the RTs against each item in both English and Urdu experiment. The detailed statistics of these items are presented and discussed in the following sections of this chapter.

All the respondents were sorted according to their score in the LexTALE test. There were three categories of the respondents according to this score. The individual scoring between 65% and 75% were placed in the *Medium Proficiency* group keeping in mind the average score (70%) of the advanced learners of English according to LexTALE. The individuals scoring lower than 65% were placed in the *Low Proficiency* group and those scoring more than 75% were placed into the *High Proficiency* group.

The data sheet contained some negative values as well because DMDX assigns negative value to incorrect responses in the resultant data set. Some of these negative values were incorrect responses whereas some respondents failed to even respond to some of the items. The items to which the respondents failed to respond were also recorded as negative values by DMDX. However, these items had the value of -2500 because the target words were displayed for 2500 milliseconds (2.5 seconds) before they automatically disappeared and gave way to the next item in the experiment. The incorrect responses were removed. Later the resultant empty slots on the data sheet were filled using automatic imputations using a tool provided in the Statistical Package for Social Sciences (SPSS).

4.2 Incorrect Responses (Missing Values)

There were some incorrect responses by the participants. The software used for recording these response times (DMDX) assigns negative values to the incorrect responses. For example, if an incorrect response was given in 755.77 milliseconds, DMDX will record '-755.77' against that target. There were two respondents whose responses were more than 50 percent incorrect. Therefore, their correct responses could not have been relied upon. That is why all the data obtained against these respondents, in both Urdu and English experiments, were removed from the final datasheet prepared for the analysis via SPSS.

There was another interesting case of a respondent who got it all wrong. This participant responded correctly to the whole Urdu experiment. However, his responses to all the items in the corresponding English experiment were all incorrect. The values were, although in negative, seemed very logical and it was concluded that the respondent may have used the wrong button (Left Shift button on the keyboard) for the responses because of some misunderstanding. The data obtained from the mentioned respondent was included in the data sheet after changing the negative values to positive ones.

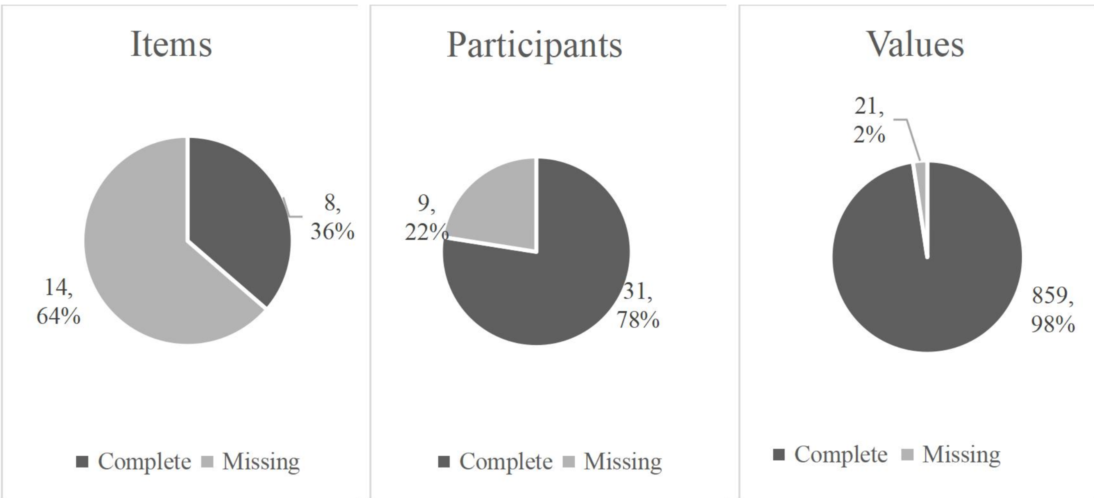
In all other cases where each respondent made mistakes and provided incorrect responses, which were very few, the incorrect responses were deleted, and the data fields were left blank. In the following subsections, an analysis of these missing values will be presented:

4.2.1 Missing Values in the English Experiment

In the English experiment, 2.24% of responses were incorrect. The following charts present a summary of the missing values in terms of the prime-target pairs (items), in terms of the respondents, and the overall missing values in the datasheet. The missing values represent the empty slots on the datasheet. They are empty because the data in these slots were recorded because of incorrect responses by the respondents. That is why the data were deleted, and the slots were rendered empty. Hence, they were given the name of missing values.

Figure 1

Missing Values in the English Experiment



This set of pie charts shows the missing values from three different angles. The first of the three shows how many items (that is, prime-target pairs) involved incorrect responses. The chart shows that the respondents provided incorrect responses in 14 items (out of 22) which makes 63.64% of the total items. On the other hand, there were 8 items in which not a single respondent made any mistake. The items which were correctly responded to constitute 36.36% of the total variables in the English Experiment.

The second (middle) pie chart shows incorrect responses with reference to the participants/respondents. The chart shows that there were 31 individuals who did not make any mistake in responding to the primes and targets. This means that 77.5% of the respondents made no mistake in the English experiment. On the other hand, there were 9 participants who made mistakes in responding to the items in the experiment, which means that 22.5% of the partaking individuals made one or more mistakes during the experiment.

The last (rightmost) pie chart shows the overall data values compared to the missing ones. The chart shows that there were 880 total values on the datasheet. Out of these 880, only 21 were missing as a result of incorrect responses. This makes the missing values 2.39% of the total number of values on the datasheet. The chart also shows that 97.61% of the values on the datasheet were correct as there were 559 values on the datasheet.

4.2.1.1 Missing Values in Each Item (English Experiment)

The following charts depicts incorrect responses in each item in the English experiment:

Table 3

Missing Values in Each Item (English Experiment)

	N	Mean	Std. Deviation	Missing		No.of Extremes	
				Count	Percent	Low	High
PTE1	40	591.94	87.78	0	0	0	0
PTE2	39	618.71	82.27	1	2.5	0	2
PTE3	39	602.98	88.42	1	2.5	0	1
PTE4	39	914.28	236.15	1	2.5	0	2
PTE5	40	838.56	130.00	0	.0	1	4
PTE6	39	993.53	390.68	1	2.5	0	3
PTE7	40	774.30	122.95	0	.0	0	2
PTE8	38	905.36	275.10	2	5.0	0	1
PTE9	38	836.43	219.11	2	5.0	1	2
PTE10	38	972.70	296.24	2	5.0	0	2
PTE11	40	953.00	202.62	0	.0	0	1
PTE12	39	796.95	150.13	1	2.5	0	3
PTE13	40	874.34	265.34	0	.0	0	7
PTE14	38	955.95	358.72	2	5.0	0	6
PTE15	40	918.87	253.52	0	.0	0	4

PTE16	39	945.61	340.05	1	2.5	0	3
PTE17	39	878.99	164.43	1	2.5	1	5
PTE18	40	914.37	366.08	0	.0	0	5
PTE19	39	912.13	342.85	1	2.5	0	6
PTE20	38	857.85	164.42	2	5.0	0	2
PTE21	40	917.45	208.61	0	.0	0	6
PTE22	37	969.04	258.41	3	7.5	0	6

The above table shows the number of incorrect responses in case of each item (prime-target pair) in the English experiment. Since data for this project was analyzed via Statistical Package for the Social Sciences (SPSS), there are many terms that the software adds to the graphs. *Case* is one such term here that stands for the items in the experiment.

The table shows that there were 8 items in which not a single respondent made any mistake. There were 8 items in response to which only one respondent made a mistake rendering the incorrect responses a mere 2.5% of the total responses against each item. There were 5 items in which 2 respondents made mistakes which made the incorrect responses 5% of the total in each item. There was one item (PTE22) in which three mistakes were made making the incorrect responses 7.5% of the total responses against this item.

The *N* column of the table shows the number of correct responses against each item. The next two columns show the mean and standard deviation of the response times against each item. The *Missing* pair of columns shows the count and percentage of the missing items (i.e., incorrect responses).

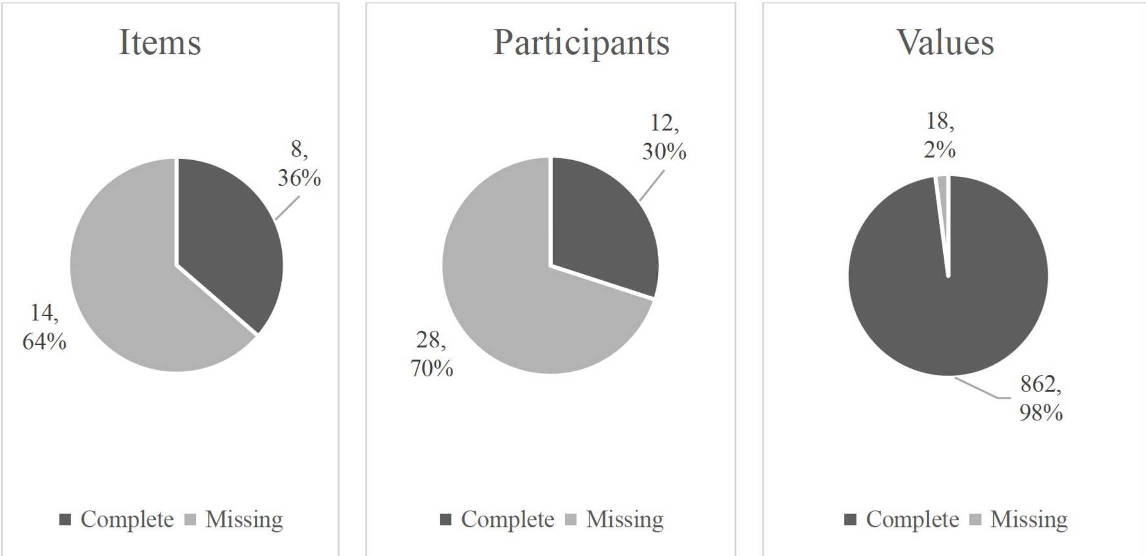
The last pair of columns on the chart shows the number of **extreme values** in the responses against each item. The extreme values are those which are outside the range of normal responses. These cases affect the statistical calculations of the data in a negative way. In the next stages of the analysis, it will be decided whether to retain these values or normalize them using automatic treatment by SPSS included in the software package for the very same purpose.

4.2.2 Missing Values in the Urdu Experiment

There were missing data values in the datasheet corresponding to the Urdu experiment as well. The following set of pie charts depicts the situation.

Figure 2

Missing Values in the Urdu Experiment



The above set of pie charts shows the missing values which were deleted because of incorrect responses by the participating individuals. The chart provides the information in three angles.

The first (leftmost) pie chart shows that there were 8 items in the Urdu experiment in response to which, not a single participant made any mistake. This makes the mistake-free items 36.36% of the total number. The chart also shows that there were 14 items in which one or more respondents made mistakes. Thus, the items in which mistakes were made is 63.64% of the total items.

The second (middle) pie chart in this set shows that there were 28 participants (70%) who did not make any mistake during the experiment. On the other hand, there were 12 individuals (30%) who made one or more mistakes while responding to the primes and targets in the Urdu experiment.

The last (rightmost) pie chart in this set shows the overall values in the datasheet generated as a result of the Urdu experiment. It shows that there were 862 correct responses out of 880 which makes the correct responses 97.95% of the total values. However, there were 18 mistakes made in the Urdu experiment in total which makes the missing values 2.05% of the total values on the data sheet.

4.2.2.1 Missing Values in Each Item (Urdu Experiment)

The following table shows the data of missing values (incorrect responses) against each individual item in the Urdu experiment.

Table 4

Missing Values in Each Item (Urdu Experiment)

	N	Mean	Std. Deviation	Missing		No. of Extremes	
				Count	Percent	Low	High
PTU1	39	578.36	50.28	1	2.5	0	0
PTU2	40	574.62	72.78	0	0	1	0
PTU3	39	592.96	61.51	1	2.5	0	0
PTU4	40	827.85	142.07	0	0	1	4
PTU5	40	1005.87	393.31	0	0	0	4
PTU6	39	710.59	110.98	1	2.5	1	0
PTU7	38	684.23	92.50	2	5	0	0
PTU8	39	786.55	266.06	1	2.5	0	2
PTU9	39	719.80	105.87	1	2.5	0	1
PTU10	39	907.39	270.16	1	2.5	1	5
PTU11	40	944.21	263.96	0	0	0	7
PTU12	39	703.06	76.44	1	2.5	0	0
PTU13	39	716.18	74.54	1	2.5	1	0
PTU14	40	776.90	189.22	0	0	0	2
PTU15	36	844.52	244.21	4	10	0	3
PTU16	40	845.57	109.73	0	0	1	1
PTU17	40	951.02	256.96	0	0	0	3
PTU18	40	745.91	99.52	0	0	0	2
PTU19	39	711.30	71.24	1	2.5	0	0
PTU20	39	775.11	143.07	1	2.5	0	3
PTU21	39	922.04	270.93	1	2.5	0	4
PTU22	39	951.34	285.99	1	2.5	2	4

The above table shows the number of incorrect responses recorded against each item in the Urdu experiment. The first column shows the item number in the experiment. The *N* column shows the number of respondents who responded to the item correctly.

The next two columns show the means and standard deviations of the response times against each item respectively.

The *Missing* pair of columns shows the count and percentage of the incorrect responses against each item. It shows that there were 8 items in which not a single respondent made a mistake, making each of these items an error free one. It further shows that there were 12 items wherein one mistake each was made. Thus, the error percentage in these items was 2.5% each. There was one item (PTU7) in which the error percentage was 5% because two respondents made mistakes while responding to it. There was another one (PTU15) with a 10% error rate because 4 respondents responded to it incorrectly. In the next stages of data analysis, it will be decided whether to keep these values or treat them via SPSS's automatic procedure of dealing with erratic data.

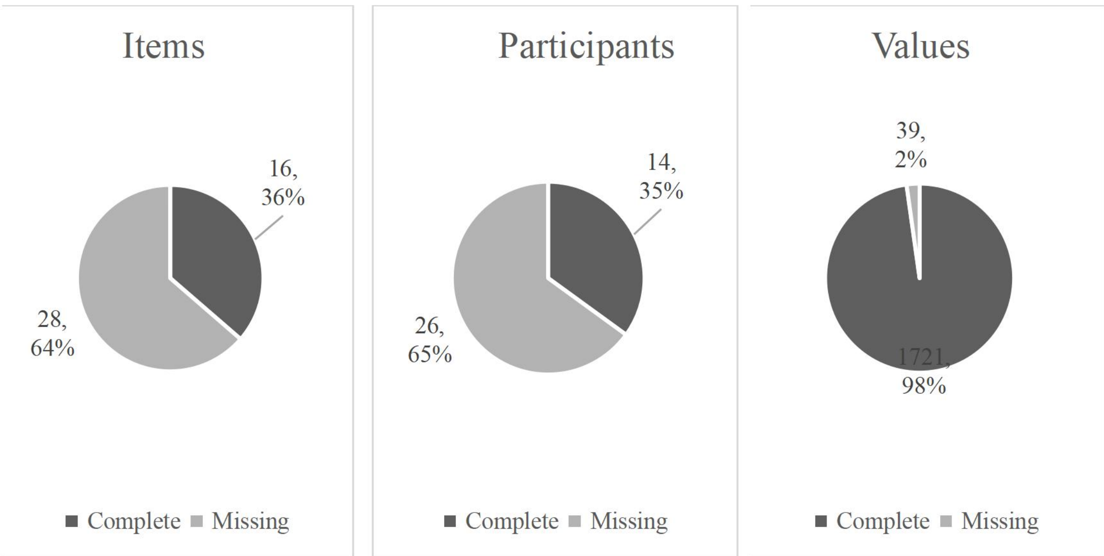
The rightmost pair of columns on the table shows the number of extreme values (both low and high) against each item. These extreme values affect the dataset in a way that makes the whole data look unnatural (Chang et al. 2021). In the next stages of the analysis, it will be decided whether to keep these values as they are or treat them via SPSS's procedures that are part of the package for dealing with extreme values.

4.2.3 English & Urdu Combined

The following set of pie chart depicts the overall missing values (incorrect responses) in the combined data sheet containing data from the Urdu and English experiments.

Figure 3

Overall Summary of Missing Values



The above figure shows the missing values (incorrect responses) in the overall data sheet containing all the data of both the English and Urdu experiments. The first (leftmost) pie chart shows that there were 44 items in total (22 from each experiment), out of which 16 items (36.36%) were responded to without any mistake by any of the partaking individuals. On the other hand, there were 28 items (63.64%) in response to which one or more respondents made mistakes.

As far as the individual respondents were concerned, the second (middle) pie chart shows that there were 26 out of 40 (65%) participants who did not make any mistakes while responding to the items in both Urdu and English experiments. There were 14 individuals (35%), on the other hand, who made mistakes responding to one or more items in the experiments.

The last (rightmost) pie chart shows the overall values on the data sheet. It shows that there were 1760 responses in total, out of which, 1721 were correct, making the correct responses 97.78% of the total responses. The chart further shows that there were 39 incorrect responses on the combined data sheet which means that 2.22% of the total responses were incorrect.

4.2.3 Automatic Data Imputation by SPSS

The Statistical Package for Social Sciences has a feature that automatically supplies the probable values to replace the missing data. This feature was used to replace the missing values on both the data sheets belonging to the Urdu and English experiments. This was necessary as carrying out the analysis with missing data can yield incorrect results (Graham, 2012; Larson-Hall, 2015).

4.3 Descriptive Statistics

In this section of the chapter, the data sets of both the experiments are described in terms of mean and standard deviation. The comparison between the corresponding items in English and Urdu experiments is discussed in the next section.

4.3.1 English Data Sheet

The following table shows the item codes, the number of respondents against each item (N), the minimum response time (RT) taken by a partaking individual, the maximum response time, the mean, and the standard deviation of the response times against each item.

Table 5

Data Sheet for the English Experiment

	N	Minimum	Maximum	Mean	Std. Deviation
PTE1	40	420.97	797.71	591.94	87.78
PTE2	40	501.98	848.3	618.29	81.25
PTE3	40	460.43	849.48	602.62	87.31
PTE4	40	467.66	1800.55	914.37	233.10
PTE5	40	543.04	1294.01	838.56	130.00
PTE6	40	555.17	2185.68	992.95	385.66
PTE7	40	561.66	1201.21	774.30	122.95
PTE8	40	527.3	1594.76	904.69	267.97
PTE9	40	539.72	1844.18	836.34	213.41
PTE10	40	548.47	1833.32	971.22	288.62
PTE11	40	590.19	1612.09	953.00	202.62
PTE12	40	526.6	1228.84	796.84	148.19
PTE13	40	569.6	1593.74	874.34	265.34
PTE14	40	553.84	2102.63	956.30	349.41
PTE15	40	627.24	1789.43	918.87	253.52
PTE16	40	446.09	2145.1	945.40	335.66
PTE17	40	675.45	1436.27	879.67	162.37
PTE18	40	564.64	2320.54	914.37	366.08
PTE19	40	629.13	2055.96	912.00	338.43
PTE20	40	582.27	1385.56	858.12	160.16
PTE21	40	618.74	1510.02	917.45	208.61
PTE22	40	726.18	1760.71	970.05	248.31

The above table shows the data set obtained via the English experiment. Please note that the number of responses (N) is 40 against each item, which means that there is no missing data in this sheet. The missing values were replaced using automatic imputation via SPSS.

4.3.2 Urdu Data Sheet

Similar to the data received through the English experiment, there was a data set generated as a result of the Urdu Experiment. There is a great similarity between the two data sets because the experiments were very similar.

Table 6 shows the item codes and other relevant information of the Urdu data sheet.

Table 6

Data Sheet for the Urdu Experiment

	N	Minimum	Maximum	Mean	Std. Deviation
PTU1	40	462.43	694.68	578.25	49.64
PTU2	40	415.63	720.25	574.62	72.78
PTU3	40	482.60	753.66	593.11	60.73
PTU4	40	557.46	1275.72	827.85	142.07
PTU5	40	646.12	2193.69	1005.87	393.31
PTU6	40	394.82	987.74	710.51	109.55
PTU7	40	503.41	882.76	684.25	90.10
PTU8	40	557.39	2087.10	786.91	262.63
PTU9	40	586.77	1111.81	719.62	104.51
PTU10	40	585.09	1949.12	907.45	266.68
PTU11	40	700.77	1945.31	944.21	263.96
PTU12	40	546.77	883.75	703.09	75.45
PTU13	40	517.92	884.49	716.48	73.60
PTU14	40	603.24	1541.75	776.90	189.22
PTU15	40	633.42	1946.95	843.45	231.49
PTU16	40	528.22	1271.60	845.57	109.73
PTU17	40	609.26	1949.85	951.02	256.96
PTU18	40	565.66	1146.80	745.91	99.52
PTU19	40	588.92	873.92	711.24	70.32
PTU20	40	601.19	1439.06	774.91	141.23
PTU21	40	642.75	2319.09	922.39	267.44
PTU22	40	538.29	1909.20	951.56	282.30

The table above shows the number of responses against each item (N), the instances of minimum and maximum time taken for responses (RTs) and the mean and standard deviation of the response times against each and every item. Earlier in the chapter it was mentioned that there were some missing values in the data sheet. However, there are exactly 40 RTs against each item which is the result of the automatic imputation done via the SPSS.

4.3.3 Test Score

As mentioned in the previous chapter, and also earlier in this chapter, the respondents went through the LexTALE test of proficiency in English language. Based on their scores in the test, three groups were formed. The participants scoring below 65% in the test were placed in *the low proficiency group*. Those who scored between 65% and 75% were placed in the *medium proficiency group*, whereas the participants who scored more than 75% in the test constituted *the high proficiency group.* There were 13 members in each group as Respondent Number 19 was excluded due to the high number of extreme values.

In the next section of this chapter, the multivariate analysis of variance is presented in case of each item of the Urdu and English experiments. Items belonging to both the experiments are analyzed side by side in order to throw light upon the similarities and/or differences in the responses given by the partaking individuals.

4.4 Item by Item MANOVA

This section of the chapter deals with the item-wise MANOVA analysis of the data. As discussed in the previous chapter, the respondents were divided into three groups according to their proficiency levels in English (based on the LexTALE scores). The analysis was performed in a way that group-wise response times were compared both in English and Urdu. In the following subsections, each item is analyzed in detail describing the differences and their significance if any.

Since there were two sets of data to be compared together. There were three groups in each data set and the resultant data was to be grouped according to the three groups in both the data sets; a simple analysis of variance (ANOVA) was not suitable for the analysis. That is why Multivariate Analysis of Variance (MANOVA) was adopted. (c.f. 3.5.3)

In the following subsections, the data generated by each item in the English experiment are compared (and contrasted) with the data obtained via the corresponding item in the Urdu experiment. The comparison is a detailed one and shows how each of the three groups of respondents performed in an item in one experiment compared to the same group's performance in the other experiment in the corresponding item.

Let us begin by analyzing the first items in both the experiments.

4.4.1 PTU1 vs. PTE1

The first items in both the experiments were identity primes and targets. That means that both the primes and targets were identical. In the Urdu experiment, it was *chehra* (face)

Table 7

Prime and Target for PTU1

Code	Item No.	Prime	Target
PTU1	31	چہرہ	چہرہ

while in the English experiment, it was *face*. Both are nouns in their respective languages.

Table 8

Prime and Target for PTE1

Code	Item No.	Prime	Target
PTE1	31	face	FACE

The first three items in both the experiments were identical in terms of primes and targets. This was included to judge whether priming was taking place. Here is the analysis:

Table 9

Descriptive Statistics for PTE1 and PTU1

	Group	Mean	Std. Error	95% Confidence Interval

				Lower Bound	Upper Bound
PTE1	Low Proficiency	595.11	23.36	547.74	642.48
	Medium Proficiency	597.01	23.36	549.64	644.38
	High Proficiency	565.49	23.36	518.12	612.86
PTU1	Low Proficiency	602.35	12.79	576.40	628.30
	Medium Proficiency	578.30	12.79	552.36	604.25
	High Proficiency	550.63	12.79	524.68	576.57

The table shows that in the English item (face/FACE), all the three groups responded in more or less similar response times. For the English item, PTE1, the mean score for the low proficiency group is 636.43 (M = 636.43, SE = 14.97), with a 95% confidence interval ranging from 606.08 to 666.79. Similarly, the mean score for the medium proficiency group is 604.64 (M = 604.64, SE = 14.97), with a 95% confidence interval spanning from 574.29 to 635.00. The high proficiency group exhibited a mean score of 573.55 (M = 573.55, SE = 14.97), and its 95% confidence interval extends from 543.20 to 603.91.

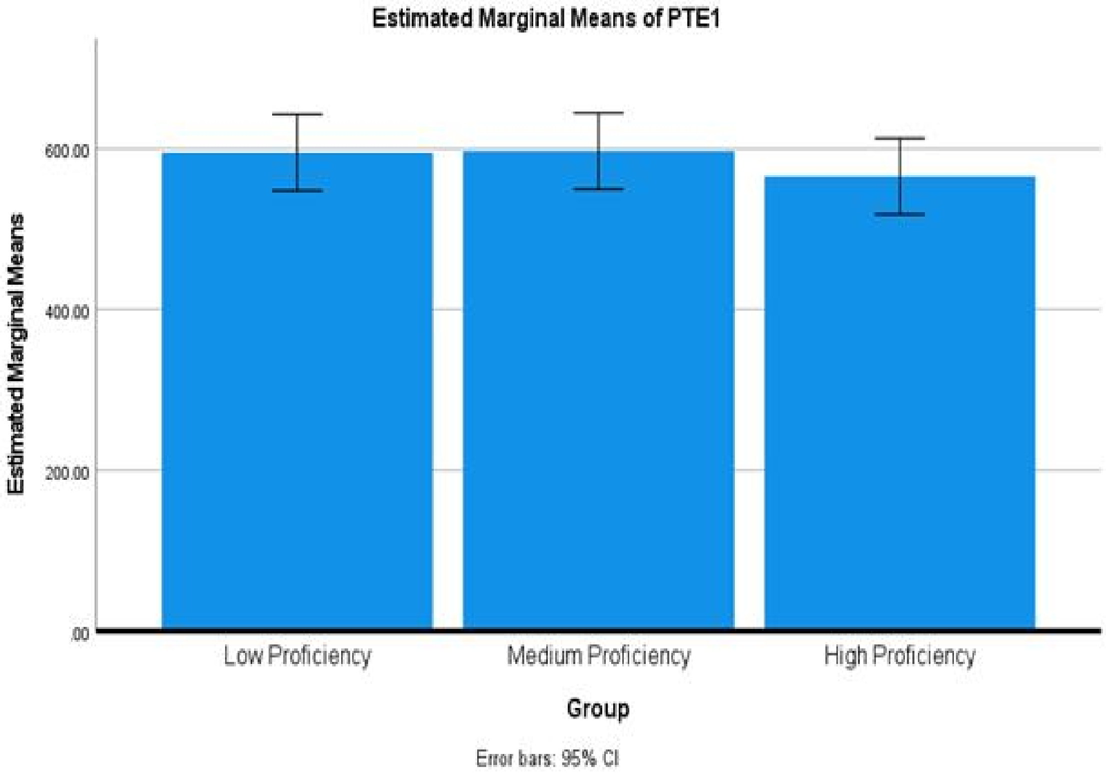
The Urdu item (چہرہ /چہرہ) got a similar response to that of the English item in focus. For the PTU1 context, the low proficiency group displayed a mean score of 578.25 (M = 578.25, SE = 20.90), accompanied by a 95% confidence interval ranging from 535.86 to 620.64. The medium proficiency group demonstrated a mean score of 578.07 (M = 578.07, SE = 20.90), with a 95% confidence interval of 535.67 to 620.46. Lastly, the high proficiency group yielded a mean score of 565.49 (M = 565.49, SE = 20.90), with a 95% confidence interval from 523.10 to 607.89.

Respondents belonging to all the three proficiency groups showed more or less similar response times. This, again, was expected because of two reasons. One, the item had identical primes and targets, and the other reason was that Urdu being the respondents' native language, they all had high proficiency levels.

The following figures further explain the situation.

Figure 4

Estimated Marginal Means for PTE1

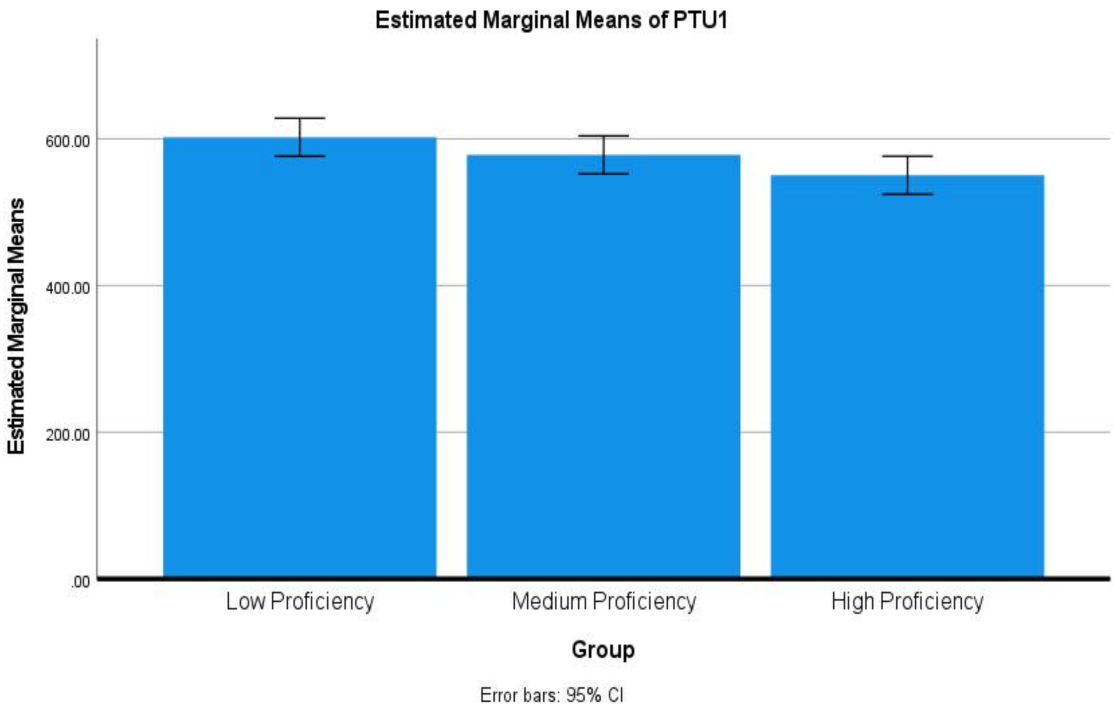


The chart shows how all the groups processed the English prime and target being discussed in this section. It shows that both the low proficiency and the medium proficiency groups responded to the target in fractionally more time compared to the higher proficiency group. The high proficiency group processed the item in marginally quicker time. The error bars of all the groups overlap indicating that the difference in the response times is not statistically significant. However, the statistical significance of the variation is determined by the post hoc tests conducted via Bonferroni method and described below.

Let us consider the case of the Urdu item:

Figure 5

Estimated Marginal Means for PTU1



This figure represents the response times of the three groups while responding to the Urdu item (PTU1). The figure shows that the low proficiency group's response time is the highest of all. The medium proficiency group were quicker in their response as compared to the low proficiency group. However, the high proficiency group were the quickest of the three groups and had the lowest response time.

It is pertinent to mention that the three groups were made according to their proficiency in English language. Their proficiency levels do not matter in their response to Urdu items/experiment because it is their first language and all of them are presumed to be highly proficient in Urdu.

All the groups responded in a very similar way to the items in both the experiments. As far as the mean scores and the standard error statistics are concerned, there seems to be no significant difference between the groups on one side and their performance in both the languages on the other. However, there seems to be some difference between the response times of the low proficiency group and the high proficiency group while responding to the Urdu item (PTU1). In order to determine the statistical significance of the seemingly different response times, the post hoc analysis results are shown in the table below:

Table 10

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE1 and PTU1

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PTE1	Low Proficiency	Medium Proficiency	-1.90	33.03	1.000	-84.85	81.05
		High Proficiency	29.62	33.03	1.000	-53.33	112.57
	Medium Proficiency	Low Proficiency	1.90	33.03	1.000	-81.05	84.85
		High Proficiency	31.52	33.03	1.000	-51.43	114.47
	High Proficiency	Low Proficiency	-29.62	33.03	1.000	-112.57	53.33
		Medium Proficiency	-31.52	33.03	1.000	-114.47	51.43
PTU1	Low Proficiency	Medium Proficiency	24.05	18.09	0.576	-21.38	69.48
		High Proficiency	51.7248*	18.09	0.021	6.29	97.16
	Medium Proficiency	Low Proficiency	-24.05	18.09	0.576	-69.48	21.38
		High Proficiency	27.68	18.09	0.405	-17.76	73.11
	High Proficiency	Low Proficiency	-51.7248*	18.09	0.021	-97.16	-6.29
		Medium Proficiency	-27.68	18.09	0.405	-73.11	17.76

Note. *Significant at $p < 0.05$.

The Bonferroni-corrected post hoc analysis revealed the following results:

For PTE1, no statistically significant mean differences were found between the low proficiency group and the medium proficiency group ($p = 1.000$), the low proficiency group and the high proficiency group ($p = 1.000$), and the medium proficiency group and the high proficiency group ($p = 1.000$). These findings indicate that in the PTE1 context, the mean scores for these proficiency groups did not significantly differ from each other. This was expected because all the three groups were supposed to respond similarly to the item that contained identical prime and target.

In PTU1, the analysis indicated that there were no statistically significant mean differences between the low proficiency group and the medium proficiency group (p =

0.576), or between the medium proficiency group and the high proficiency group (p = 0.405). These results suggest that, in the PTU1 group, the mean scores between these proficiency groups were not significantly different. However, a significant mean difference was observed between the low proficiency group and the high proficiency group in the PTU1 context (p = 0.021). This finding indicates that individuals in the low proficiency group and the high proficiency group exhibited significantly different mean scores. This is totally unexpected as all the participants were expected to respond to all the Urdu items in a similar fashion. The classification of the three groups is based on their proficiency in English rather than in Urdu---the respondents' first language.

The above table shows that there was no significant difference among all the three groups while processing the English identity prime and target. On the other hand, evidence suggests that there was a statistically significant difference between how the high proficiency group and the low proficiency group processed the Urdu identity prime and target. There was no significant difference between how the medium proficiency and the high proficiency groups processed the Urdu identical primes and targets.

4.4.2 PTE2 vs. PTU2

The second item in the Urdu experiment had the following prime and target:

Table 11

Prime and Target for PTU2

Code	Item No.	Prime	Target
PTU2	32	امتحان	امتحان

It is evident that both the prime and the target were identical. *Imtehan* in Urdu means *test/examination*. It is used as noun predominantly.

The item used in the English experiment was:

Table 12

Prime and Target for PTE2

Code	Item No.	Prime	Target

PTE2	32	global	GLOBAL

The second item in the English experiment was also identical. These identical items were used to see whether the priming took place in the experiment.

The second set of items and targets in both the experiments involved the same number of participants. There were 39 participants whose response times were included in the data analysis. These participants were divided into three groups as already discussed. Each of these groups, namely, low proficiency group, medium proficiency group and high proficiency group had 13 participants. The following table shows how all these groups responded to the items in both the experiments.

Table 13

Descriptive Statistics for PTE2 and PTU2

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE2	Low Proficiency	636.43	14.97	606.08	666.79
	Medium Proficiency	604.64	14.97	574.29	635.00
	High Proficiency	573.55	14.97	543.20	603.91
PTU2	Low Proficiency	578.25	20.90	535.86	620.64
	Medium Proficiency	578.07	20.90	535.67	620.46
	High Proficiency	565.49	20.90	523.10	607.89

The above table describes how the respondents belonging to the three levels of proficiency in English responded to the items in both Urdu and English experiments. In responding to the English item, the low proficiency group had a mean of 636.43 (M = 636.43, SE = 14.97) with a 95% confidence interval ranging from 606.08 to 666.79.

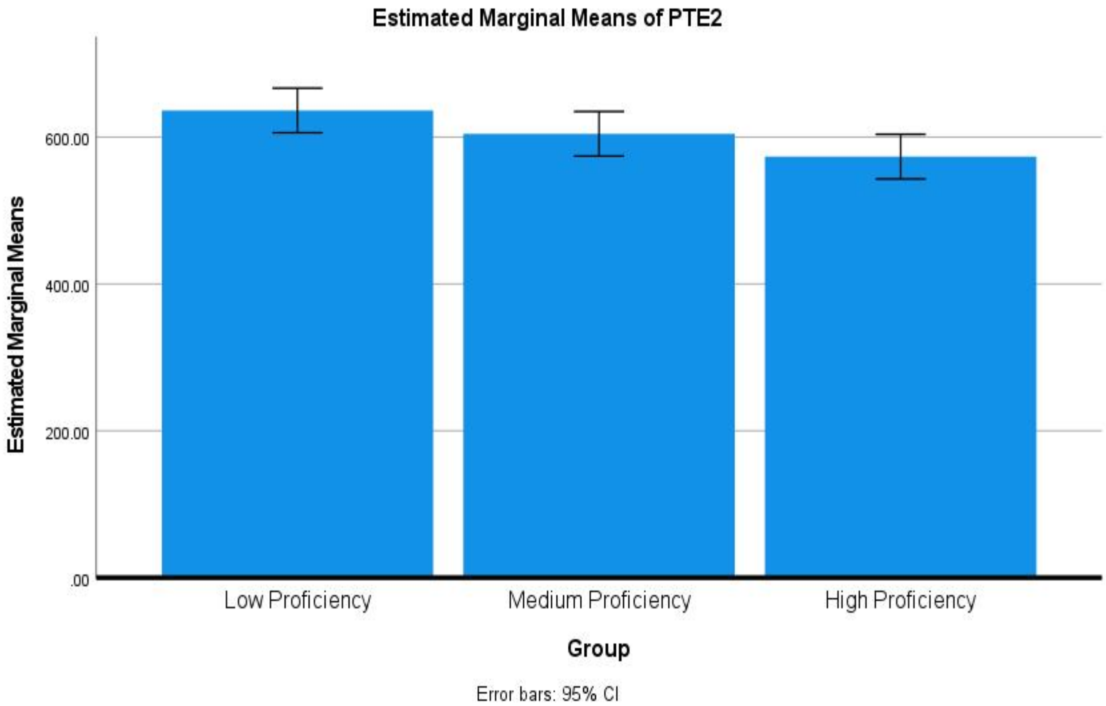
. The medium proficiency group took a little less time as compared to the low proficiency group of respondents. The medium proficiency group exhibited a mean of 604.64 (M = 604.64, SE = 14.97) with a 95% confidence interval extending from 574.29 to 635.00. The high proficiency group responded a bit quicker than the medium proficiency group which makes them the best performers in terms of response time. The high proficiency group showed a mean of 573.55 (M = 573.55, SE = 14.97) and a 95% confidence interval ranging from 543.20 to 603.91.

As far as the Urdu item is concerned, the low proficiency group displayed a mean of 578.25 (M = 578.25, SE = 20.90) with a 95% confidence interval from 535.86 to 620.64. The medium proficiency group took almost the same time as the low proficiency group. The group yielded a mean of 578.07 (M = 578.07, SE = 20.90) and a 95% confidence interval of 535.67 to 620.46. The high proficiency group responded to this item with a mean of 565.49 (M = 565.49, SE = 20.90)

The following figures will further clarify the above discussion.

Figure 6

Estimated Marginal Means for PTE2



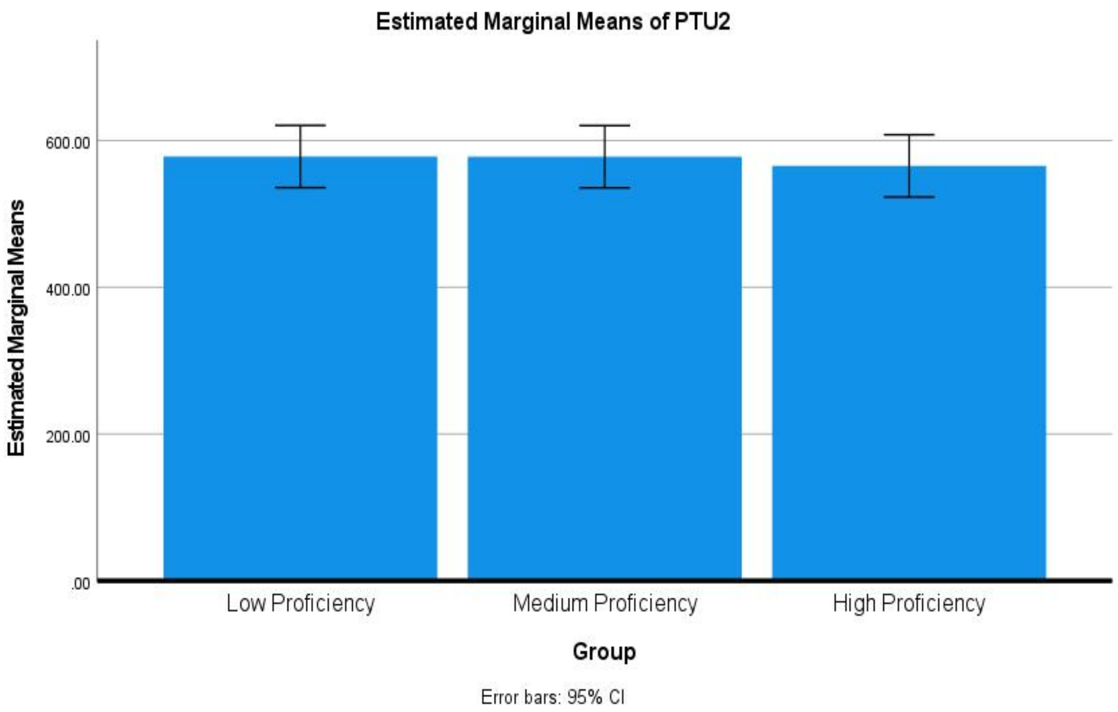
The above figure indicates visibly clear (but minor) differences between how the three groups responded to the second item in the English experiment. The low proficiency group took the longest time, on average, to respond (636.43ms). The medium proficiency group took 604.64ms on average to respond to the item which is marginally higher than the response time taken by the high proficiency group. The high proficiency group was the quickest to respond as they took 573.55ms on average.

However, these differences are not statistically significant because the error bars of each group overlap with one another. The overlapping of the upper error bar on the high proficiency group is only marginal with the lower error bar of the low proficiency group. That is why the contrast results on the post hoc analysis table indicates not to be statistically significant.

Compared to the response times to this English item, the respondents' reaction times to the second item in the Urdu experiment were as follows:

Figure 7

Estimated Marginal Means for PTU2



As far as the Urdu item is concerned, the figure indicates that there is no significant difference among the way all the groups responded. All the bars have a similar height that is also very close to the line indicating the observed grand mean. The error bars also overlap with those of other groups as well as with the observed grand mean. The low proficiency group took 578.25ms in response to the item which is almost the same as the medium proficiency group's response time of 578.07ms. The high proficiency group responded to this item a bit quicker than the other two groups with an average of 565.49ms. It can be seen that all the three groups responded quite close to one another, which indicates that the difference between the response times of the groups is quite insignificant.

We can see that there is some difference in the response times of these three groups both in response to the English and Urdu items. In the following table, we will see whether these differences are significant or not.

Table 14

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE2 and PTU2

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PTE2	Low Proficiency	Medium Proficiency	31.79	21.17	.426	-21.36	84.94
		High Proficiency	62.8823*	21.17	.016	9.73	116.03
	Medium Proficiency	Low Proficiency	-31.79	21.17	.426	-84.94	21.36
		High Proficiency	31.09	21.17	.452	-22.06	84.24
	High Proficiency	Low Proficiency	-62.8823*	21.17	.016	-116.03	-9.73
		Medium Proficiency	-31.09	21.17	.452	-84.24	22.06
PTU2	Low Proficiency	Medium Proficiency	0.18	29.56	1.000	-74.05	74.41
		High Proficiency	12.76	29.56	1.000	-61.47	86.99
	Medium Proficiency	Low Proficiency	-0.18	29.56	1.000	-74.41	74.05
		High Proficiency	12.58	29.56	1.000	-61.65	86.80
	High Proficiency	Low Proficiency	-12.76	29.56	1.000	-86.99	61.47
		Medium Proficiency	-12.58	29.56	1.000	-86.80	61.65

The above table indicates that as far as the second item of the English experiment is concerned there seems to be quite significant difference between the high proficiency and the low proficiency (Level 1 and Level 2, respectively) groups.

The mean difference between the Low Proficiency group and the Medium Proficiency group was not statistically significant (Mean Difference = 31.79, SE = 21.17, p = .426, 95% CI [-21.36, 84.94]). However, the High Proficiency group demonstrated a statistically significant mean difference when compared to the Low Proficiency group (Mean Difference = 62.8823, SE = 21.17, p = .016, 95% CI [9.73, 116.03]). This indicates that the High Proficiency group responded significantly quicker to the target in PTE2 compared to the Low Proficiency group.

There was no statistically significant difference in mean scores between the Medium Proficiency and Low Proficiency groups (p = .426, 95% CI [-84.94, 21.36]). Similarly, there was no statistically significant difference between the Medium Proficiency and High Proficiency groups (p = .452, 95% CI [-22.06, 84.24]).

As far as the Urdu item is concerned, there seems to be no significant difference in the way all groups responded to it. No statistically significant differences in mean scores were observed in any of the pairwise comparisons for the PTU2 test. All p-values were above the significance level of 0.05, indicating that the Proficiency groups (Low, Medium, and High) scored similarly on the PTU2 test.

The high proficiency group being able to respond to this English item (PTE2) is quite unexpected. However, it can be interpreted in terms of their ability to recognize English words quicklier than the respondents who have low or medium proficiency levels in the language.

4.4.3 PTE3 vs. PTU3

As discussed earlier, the first three items in both the experiments were identical. The first two have been discussed earlier and these two items in both the experiments make them to be the third and last case. Both PTE3 and PTU3 had identical primes and targets.

Table 15

Prime and Target for PTU3

Code	Item No.	Prime	Target
PTU3	33	بچہ	بچہ

Bacha in Urdu means *Child/kid*. It is a noun in Urdu.

Table 16

Prime and Target for PTE3

Code	Item No.	Prime	Target
PTE3	33	child	CHILD

The third item in the English experiment was also identical. It was, in fact, the English equivalent of the corresponding Urdu item. These identical items were used to see whether the priming took place in the experiment.

The third set of items and targets in both the experiments involved the same number of participants. There were 39 participants whose response times were included in the data analysis. These participants were divided into three groups as already discussed. Each of these groups, namely, low proficiency group, medium proficiency group and high proficiency group had 13 participants (*N=13*). The following table shows how all these groups responded to item number three in both the experiments.

Table 17

Descriptive Statistics for PTE3 and PTU3

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE3	Low Proficiency	622.70	21.63	578.83	666.56
	Medium Proficiency	592.48	21.63	548.61	636.34
	High Proficiency	573.68	21.63	529.82	617.55
PTU3	Low Proficiency	617.10	16.71	583.21	651.00
	Medium Proficiency	572.63	16.71	538.73	606.52
	High Proficiency	590.14	16.71	556.24	624.03

The table provides descriptive statistics for mean response times, standard errors, and 95% confidence intervals for three proficiency groups (the Low Proficiency group, the Medium Proficiency group, and the High Proficiency group) for the two items, PTE3 and PTU3. In PTE3, the mean response time for the Low Proficiency group was 622.70 (SE = 21.63), with a 95% confidence interval ranging from 578.83 to 666.56. The Medium Proficiency group had a mean response time of 592.48 (SE = 21.63), with a 95% confidence interval ranging from 548.61 to 636.34. The High Proficiency group had a mean response time of 573.68 (SE = 21.63), with a 95% confidence interval ranging from 529.82 to 617.55.

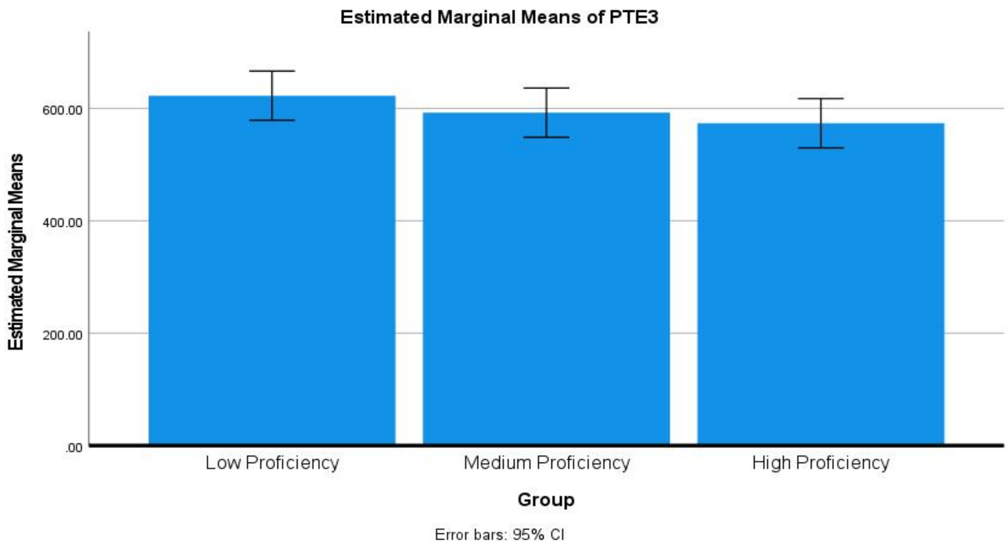
In PTE3, the Low Proficiency group had the highest mean response time (622.70), followed by the Medium Proficiency group (592.48) and the High Proficiency group (573.68).

For PTU, the mean response time for the Low Proficiency group was 617.10 (SE = 16.71), with a 95% confidence interval ranging from 583.21 to 651.00. The Medium Proficiency group had a mean response time of 572.63 (SE = 16.71), with a 95% confidence interval ranging from 538.73 to 606.52. The High Proficiency group had a mean response time of 590.14 (SE = 16.71), with a 95% confidence interval ranging from 556.24 to 624.03. Thus, responding to PTU3, the Low Proficiency group had the highest mean response time (617.10), followed by the High Proficiency group (590.14) and the Medium Proficiency group (572.63).

The situation is further illustrated by the following figure.

Figure 8

Estimated Marginal Means for PTE3

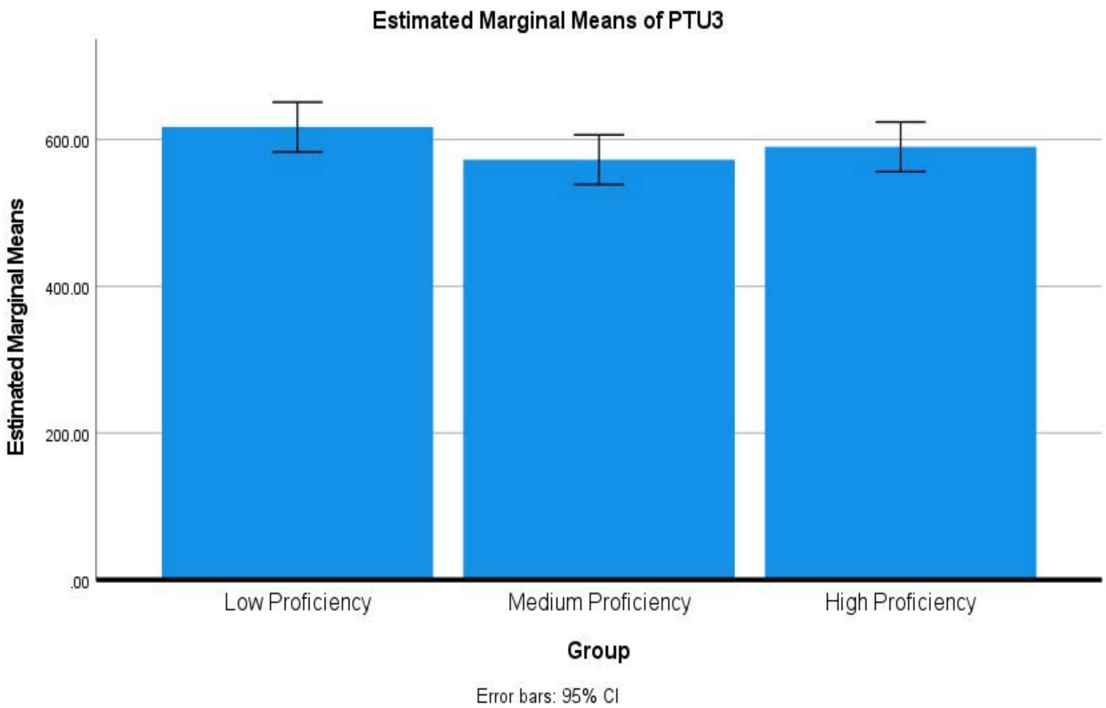


The above figure shows that there is no significant difference among the groups' response times in the third item of the English experiment. The low proficiency group took 622.70 milliseconds on average while the medium proficiency group took a little less time by responding to the item in 592.48ms. The high proficiency group responded a bit more quickly to the item by taking 573.68ms which is less than that of the other two groups. However, all the three groups responded very similar response times to the overall mean time of all the 39 participants which was 596.29ms. The bars seem quite equal in size with very little variations which indicates the insignificance of the difference in response times. The error bars pertaining to all the three groups are also overlapping with one another and with the line indicating the observed grand mean.

Similar is the case with the response times in the Urdu item under discussion here. The following figure pertains to the third item in the Urdu experiment.

Figure 9

Estimated Marginal Means for PTU3



The figure clearly indicates that there is no significant difference between the groups' response times. While responding to the Urdu item being discussed in this section, the low proficiency group's mean response time was 617.10ms which is quite similar to the way the high proficiency group responded to the item whose mean response time was 590.14 milliseconds. The medium proficiency group responded to the item with a group average (mean) of 572.63ms which is less time than that of both the low proficiency and the high proficiency groups. The similar height of all the three bars indicates the insignificant difference in the magnitude of the mean response times of all the three groups. The error bars corresponding to the three groups also overlap with one another and with the overall observed grand mean which also testifies that there is no significant difference in the response times across the groups.

In order to find out whether the differences between the response times of these groups were significant as described in the table below.

Table 18

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE3 and PTU3

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower	Upper

						Bound	Bound
PTE3	Low Proficiency	Medium Proficiency	30.22	30.59	.989	-46.59	107.02
		High Proficiency	49.01	30.59	.353	-27.80	125.82
	Medium Proficiency	Low Proficiency	-30.22	30.59	.989	-107.02	46.59
		High Proficiency	18.79	30.59	1.000	-58.01	95.60
	High Proficiency	Low Proficiency	-49.01	30.59	.353	-125.82	27.80
		Medium Proficiency	-18.79	30.59	1.000	-95.60	58.01
PTU3	Low Proficiency	Medium Proficiency	44.48	23.64	.204	-14.87	103.83
		High Proficiency	26.97	23.64	.784	-32.38	86.32
	Medium Proficiency	Low Proficiency	-44.48	23.64	.204	-103.83	14.87
		High Proficiency	-17.51	23.64	1.000	-76.86	41.84
	High Proficiency	Low Proficiency	-26.97	23.64	.784	-86.32	32.38
		Medium Proficiency	17.51	23.64	1.000	-41.84	76.86

The above Bonferroni post hoc analysis table provides information about the mean differences, standard errors, p-values, and 95% confidence intervals for pairwise comparisons of response times between three proficiency groups (Low Proficiency, Medium Proficiency, and High Proficiency) for the two items, PTE3 and PTU3.

In response to the English item, PTE3, all the groups responded similarly and there was no statistically significant difference between the responses. Comparison between the Low Proficiency and Medium Proficiency groups yielded a non-significant mean difference of 30.22 (SE = 30.59, p = .989), with a 95% confidence interval from -46.59 to 107.02. The comparison between the Low Proficiency and High Proficiency groups also showed a non-significant mean difference of 49.01 (SE = 30.59, p = .353), with a 95% confidence interval from -27.80 to 125.82. There were no significant mean differences between the Medium Proficiency and Low Proficiency groups (p = .989) or between the Medium Proficiency and High Proficiency groups (p = 1.000). The High Proficiency group did not exhibit significant differences in mean response time when compared to the Low Proficiency (p = .353) or Medium Proficiency groups (p = 1.000).

Similarly, responding to the Urdu item, PTU3, all the respondents took very similar time as per the expectations. Comparing the Low Proficiency and Medium Proficiency groups, the analysis showed a non-significant mean difference of 44.48 (SE = 23.64, p = .204), with a 95% confidence interval from -14.87 to 103.83. The Low Proficiency and High Proficiency groups had a non-significant mean difference of 26.97 (SE = 23.64, p = .784), with a 95% confidence interval from -32.38 to 86.32. No significant mean differences were found between the Medium Proficiency and Low Proficiency groups (p = .204) or between the Medium Proficiency and High Proficiency groups (p = 1.000). The High Proficiency group did not show significant mean differences when compared to the Low Proficiency (p = .784) or Medium Proficiency groups (p = 1.000).

All the three groups were expected to behave very similarly to both these items in the two experiments. Since the primes and targets of both the items were identical, all the respondents took similar time in their response and no unexpected patterns emerged.

All the three pairs of items discussed so far were identity primes (and targets). These items were added in the experiment to find out the existence of priming effects. Usually, full priming effects take place when the prime and the target are the same. However, the extent of this ‘full priming’ can only be testified once these response times are compared with the response times of other items wherein the primes and targets were either partially related or completely unrelated.

4.4.4 PTE4 vs. PTU4

The fourth item in the Urdu experiment was the first one in the experiment with completely unrelated prime and target.

Table 19

Prime and Target for PTU4

Code	Item No.	Prime	Target
PTU4	34	برسات	جانور

The prime in this item was *Barsaat* meaning *rain* in English. It is a noun in Urdu. The target word in this item was *Janvar* which means *animal* in English. It is also a noun in Urdu.

The prime and target in the fourth item in the English experiment were also completely unrelated. The prime in the item was *truck* which is a noun. The target was *become* which is a verb in English.

Table 20

Prime and Target for PTE4

Code	Item No.	Prime	Target
PTE4	34	truck	BECOME

As in all other items, there were the same three groups consisting of 13 members each responding to these items as well. The following table illustrates how the three groups responded to these items.

Table 21

Descriptive Statistics for PTE4 and PTU4

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE4	Low Proficiency	909.51	39.69	829.01	990.01
	Medium Proficiency	897.68	39.69	817.19	978.18
	High Proficiency	853.22	39.69	772.72	933.71
PTU4	Low Proficiency	752.58	29.00	693.77	811.38
	Medium Proficiency	814.60	29.00	755.80	873.41
	High Proficiency	841.44	29.00	782.64	900.25

This table displays the descriptive statistics of response times, including mean response times, standard errors, and 95% confidence intervals, for three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, in two different tests, in the Urdu item, PTU4, and in the English item, PTE4.

The mean response time for the Low Proficiency group was 909.51 (SE = 39.69), with a 95% confidence interval ranging from 829.01 to 990.01. The Medium Proficiency group had a mean response time of 897.68 (SE = 39.69), with a 95% confidence interval ranging from 817.19 to 978.18. The High Proficiency group exhibited a mean response time of 853.22 (SE = 39.69), with a 95% confidence interval ranging from 772.72 to 933.71.

In the English item, PTE4, the Low Proficiency group had the highest mean response time (909.51), followed by the Medium Proficiency group (897.68) and the High Proficiency group (853.22).

This pair of prime and target was not related to one another. Hypothetically, it was expected that no priming effect would take place in this item. The response time patterns confirm that the respondents did not get facilitated by the prime and took a lot of time recognizing the target word. The variation in the response times that makes the standard deviation high also indicates the same.

Responding to the Urdu item, PTU4, the mean response time for the Low Proficiency group was 752.58 (SE = 29.00), with a 95% confidence interval ranging from 693.77 to 811.38. The Medium Proficiency group had a mean response time of 814.60 (SE = 29.00), with a 95% confidence interval ranging from 755.80 to 873.41. The High Proficiency group displayed a mean response time of 841.44 (SE = 29.00), with a 95% confidence interval ranging from 782.64 to 900.25.

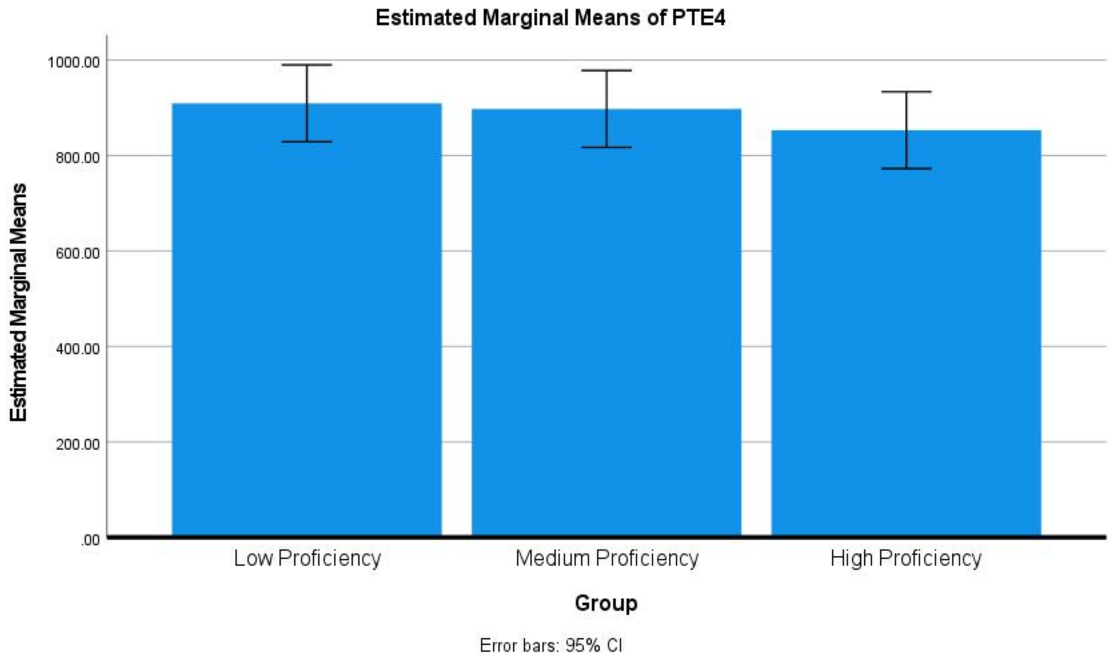
In response to the Urdu item PTU4, the Low Proficiency group had the lowest mean response time (752.58), followed by the High Proficiency group (841.44) and the Medium Proficiency group (814.60).

Urdu being the first language of the respondents, there are two noteworthy points here. First, the respondents took comparatively less time to respond to the target word that had an unrelated prime, and the second, the overall standard deviation in the Urdu item was remarkably lower than that of the English item.

This situation is further illustrated by the following bar charts.

Figure 10

Estimated Marginal Means for PTE4



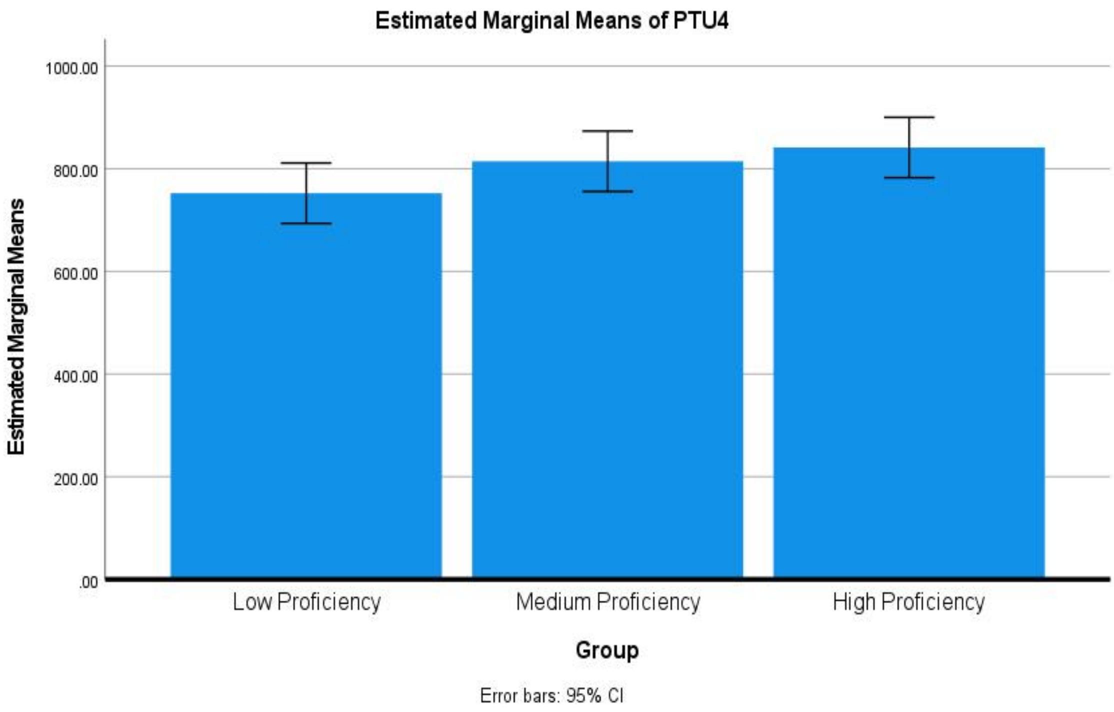
The above figure shows that all the three groups responded in a very similar way to this item (PTE4). It can be seen that the sizes of the bars are very close to one another. The error bars of all the groups overlap with those of other groups. The error bars in the case of this item are quite big in sizes which indicates the variation in the response times of the respondents of each group. If the bars and the error bars are seen together, there is a lot of overlapping and that is why the analysis shows that there is no significant difference in the mean response times of the three groups.

The low proficiency group responded in 909.51 milliseconds, on average. The respondents in the medium proficiency group took 897.68 milliseconds on average to respond to the item. The high proficiency group responded to the item in 853.22 milliseconds.

Let us now consider the figure pertaining to the Urdu item (PTU4).

Figure 11

Estimated Marginal Means for PTU4



The participants responded quite similarly to this Urdu item, PTU4. The low proficiency group responded in 752.58 milliseconds, on average. The respondents in the medium proficiency group took 814.60 milliseconds on average to respond to the item. The high proficiency group responded to the item in 841.44 milliseconds.

This figure confirms the earlier discussion that there is no significant difference between the mean response times between the groups. The low proficiency group responded to this Urdu item relatively quicklier than the other two groups but if the variation (indicated by the error bars) is brought into account, the mean responses of this group still overlap the observed grand mean of the response times. That is why the analysis indicates that there is no difference in the response times between the groups as far as PTU4 is concerned. The error bars on this chart (PTU4) are smaller than the corresponding figure pertaining to PTE4 discussed above.

Both these items (PTE4 and PTU4) had unrelated primes and targets. Therefore, it was expected that the respondents would take similar time to respond to them as there was no facilitation possible because of the unrelated primes.

There seems to be no significant difference in the mean response times as per the above table. In order to confirm this prima facie hypothesis, let us take a look at the table below.

Table 22

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE4 and PTU4

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PTE4	Low Proficiency	Medium Proficiency	11.83	56.13	1.000	-129.12	152.78
		High Proficiency	56.30	56.13	.968	-84.65	197.25
	Medium Proficiency	Low Proficiency	-11.83	56.13	1.000	-152.78	129.12
		High Proficiency	44.47	56.13	1.000	-96.48	185.42
	High Proficiency	Low Proficiency	-56.30	56.13	.968	-197.25	84.65
		Medium Proficiency	-44.47	56.13	1.000	-185.42	96.48
PTU4	Low Proficiency	Medium Proficiency	-62.03	41.00	.417	-164.99	40.94
		High Proficiency	-88.87	41.00	.111	-191.83	14.10
	Medium Proficiency	Low Proficiency	62.03	41.00	.417	-40.94	164.99
		High Proficiency	-26.84	41.00	1.000	-129.81	76.12
	High Proficiency	Low Proficiency	88.87	41.00	.111	-14.10	191.83
		Medium Proficiency	26.84	41.00	1.000	-76.12	129.81

This table presents the results of the Bonferroni post hoc analysis for the response times, including the mean differences, standard errors, p-values, and 95% confidence intervals for pairwise comparisons between three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, in the two items under discussion, PTE4 and PTU4.

As far as the English item, PTE4 is concerned, the analysis reveals that there is no significant difference between the response times of the three groups. The comparison between the Low Proficiency and Medium Proficiency groups showed a non-significant mean difference of 11.83 (SE = 56.13, p = 1.000), with a 95% confidence interval from -

129.12 to 152.78. Similarly, the Low Proficiency and High Proficiency groups exhibited a non-significant mean difference of 56.30 (SE = 56.13, p = .968), with a 95% confidence interval from -84.65 to 197.25. There were no statistically significant mean differences between the Medium Proficiency and Low Proficiency groups (p = 1.000) or between the Medium Proficiency and High Proficiency groups (p = 1.000). The High Proficiency group did not demonstrate a significant difference in mean response times when compared to the Low Proficiency group (p = .968) or the Medium Proficiency group (p = 1.000).

The table confirms that all the three groups responded similarly to the English item, PTE4. Since the target of the item was a non-word, the three groups were expected to respond in a similar manner to this item.

The case of the corresponding Urdu item, PTU4, is the same. It also had a non-word target, and the participants were expected to respond to it similarly across all the three groups. Comparing the Low Proficiency and Medium Proficiency groups, a non-significant mean difference of -62.03 (SE = 41.00, p = .417) was observed, with a 95% confidence interval from -164.99 to 40.94. The Low Proficiency and High Proficiency groups also displayed a non-significant mean difference of -88.87 (SE = 41.00, p = .111), with a 95% confidence interval from -191.83 to 14.10. No statistically significant mean differences were found between the Medium Proficiency and Low Proficiency groups (p = .417) or between the Medium Proficiency and High Proficiency groups (p = 1.000). The High Proficiency group did not exhibit significant mean differences when compared to the Low Proficiency group (p = .111) or the Medium Proficiency group (p = 1.000).

This table provides information about the statistical significance of mean differences in response times between the proficiency groups. In both the items, PTE4 and PTU4, the analysis reveals that most comparisons did not result in statistically significant differences in response times between the proficiency groups.

4.4.5 PTE5 vs. PTU5

The fifth item in the Urdu experiment (PTU5), like the fourth one, had completely unrelated prime and target.

Table 23

Prime and Target for PTU5

Code	Item No.	Prime	Target
PTU5	35	خلاصہ	بلبل

The prime in this item was *khulasa* meaning *summary* in English. It is a noun in Urdu. The target word in this item was *bulbul* which is the name of a bird close to *nightingale* in English. It is also a noun in Urdu.

The prime in the corresponding English item was *cooker* which is a noun. The target was *cook* which is both a noun and a verb in English.

Table 24

Prime and Target for PTE5

Code	Item No.	Prime	Target
PTE5	35	cooker	COOK

The prime and target in this English item was not completely unrelated as it might seem in the first look. Although there is very little semantic relationship between the two, there is a lot of orthographic similarity between them. *Cooker* is orthographically *cook+er* which might facilitate some of the respondents in recognizing the target word in this item. This was intentionally done in order to find out whether any orthography-related priming takes place or not.

Let us examine the table below.

Table 25

Descriptive Statistics for PTE5 and PTU5

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE5	Low Proficiency	853.44	27.36	797.95	908.94
	Medium Proficiency	857.62	27.36	802.12	913.11

	High Proficiency	795.55	27.36	740.05	851.04
PTU5	Low Proficiency	852.33	22.80	806.10	898.56
	Medium Proficiency	832.22	22.80	785.99	878.45
	High Proficiency	809.71	22.80	763.48	855.94

This table presents the descriptive statistics of response times, including mean response times, standard errors, and 95% confidence intervals, for three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, for the two items, PTE5 and PTU5.

The participants took similar time to respond to the English item, PTE5. The mean response time for the Low Proficiency group was 853.44 (SE = 27.36), with a 95% confidence interval ranging from 797.95 to 908.94. The Medium Proficiency group had a mean response time of 857.62 (SE = 27.36), with a 95% confidence interval ranging from 802.12 to 913.11. The High Proficiency group exhibited a mean response time of 795.55 (SE = 27.36), with a 95% confidence interval ranging from 740.05 to 851.04. In the English item, PTE5, the Medium Proficiency group had the highest mean response time (857.62), followed by the Low Proficiency group (853.44) and the High Proficiency group (795.55).

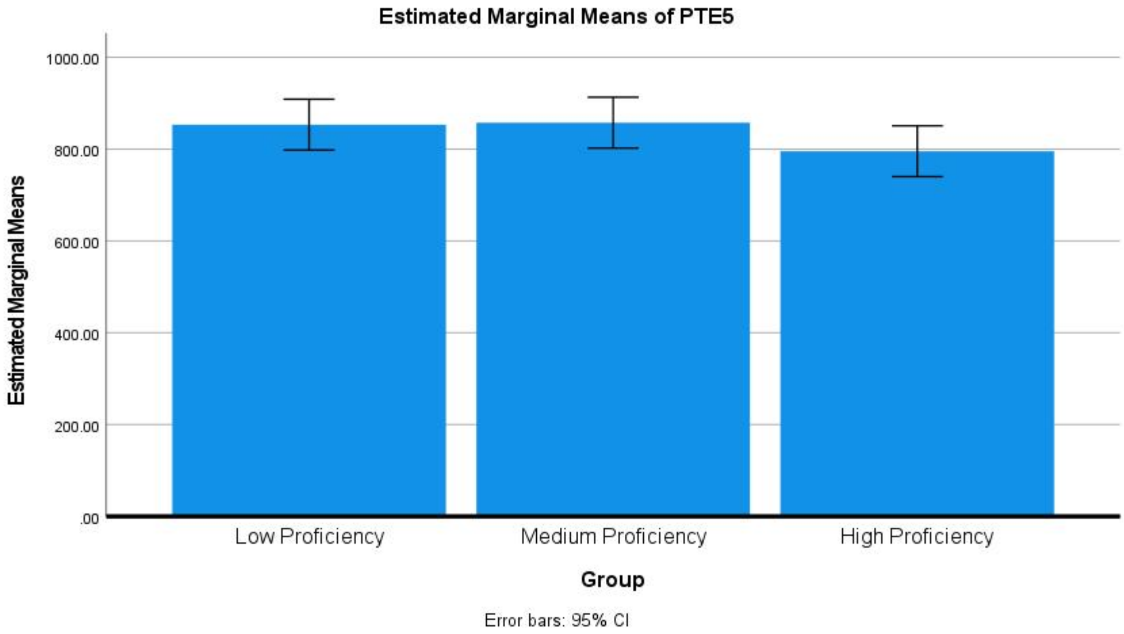
Response to the corresponding Urdu item, PTU5 was also quite similar. The mean response time for the Low Proficiency group was 852.33 (SE = 22.80), with a 95% confidence interval ranging from 806.10 to 898.56. The Medium Proficiency group had a mean response time of 832.22 (SE = 22.80), with a 95% confidence interval ranging from 785.99 to 878.45. The High Proficiency group displayed a mean response time of 809.71 (SE = 22.80), with a 95% confidence interval ranging from 763.48 to 855.94.

The Low Proficiency group had the highest mean response time (852.33), followed by the Medium Proficiency group (832.22) and the High Proficiency group (809.71) in the Urdu item, PTU5.

The following bar charts further illustrate the situation. Take a look at the bar chart pertaining to the English item (PTE5) first.

Figure 12

Estimated Marginal Means for PTE5



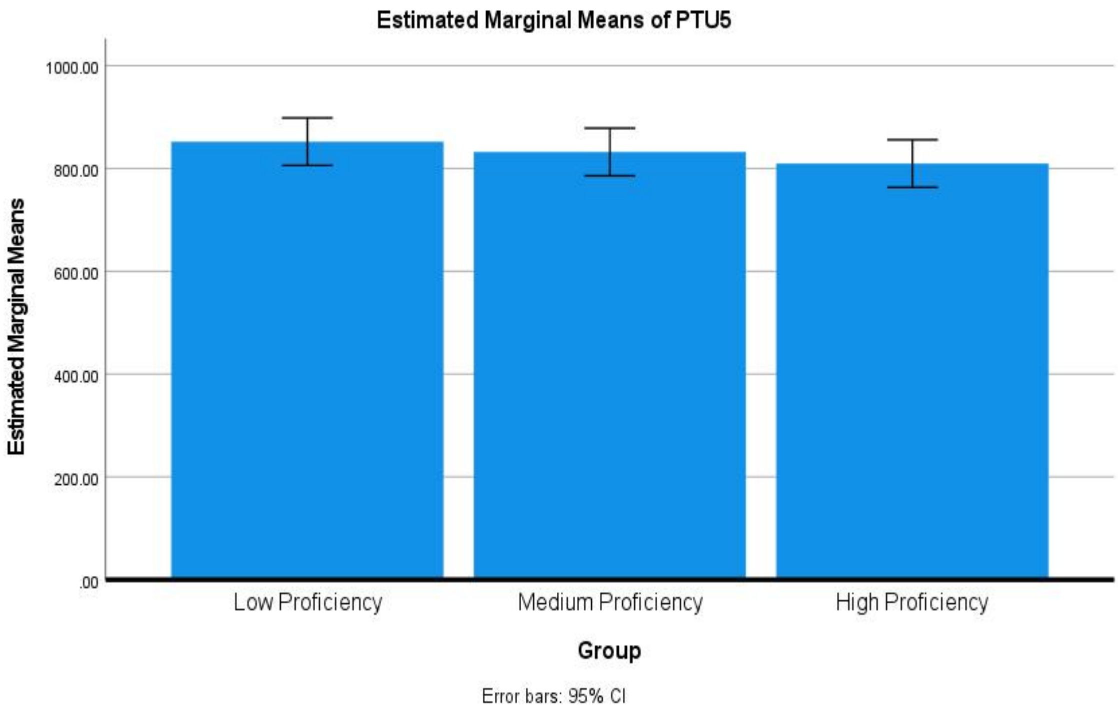
This figure shows that the low and the medium proficiency groups performed almost identically in response to PTE5. Not only is the bar size very similar but the error bars also seem to be of very similar sizes. Both the groups responded in a mean response time that was a bit greater than the observed grand mean time. The high proficiency group responded to the item a bit faster. As evident from the bar, they responded to the item in the proximity of 800 milliseconds. However, the error bars of the high proficiency group overlap with those of the other two groups as well as the line indicating the observed grand mean. That is why, the differences between the response times cannot be termed as significant.

The response times are generally high in this item and there is no significant difference between the high proficiency group and the other two groups. This indicates that no orthography related priming took place although the prime and the target in this item (PTE5) had great orthographic similarity.

Let us take a look at the bar chart pertaining to the corresponding Urdu item (PTU5):

Figure 13

Estimated Marginal Means for PTU5



The figure above shows that there is no significant difference between the responses given by the three groups to the Urdu item, PTU5. This was expected to happen because the target in the item was a non-word to which similar response times were expected.

Here is the table containing contrast results between the high proficiency group and the other two groups.

Table 26

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE5 and PTU5

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
PTE5	Low Proficiency	Medium Proficiency	-4.17	38.70	1.000	-101.34	93.00
		High Proficiency	57.90	38.70	.430	-39.27	155.07
	Medium	Low Proficiency	4.17	38.70	1.000	-93.00	101.34

	Proficiency	High Proficiency	62.07	38.70	.352	-35.10	159.24
	High Proficiency	Low Proficiency	-57.90	38.70	.430	-155.07	39.27
		Medium Proficiency	-62.07	38.70	.352	-159.24	35.10
PTU5	Low Proficiency	Medium Proficiency	20.11	32.24	1.000	-60.84	101.06
		High Proficiency	42.62	32.24	.583	-38.33	123.57
	Medium Proficiency	Low Proficiency	-20.11	32.24	1.000	-101.06	60.84
		High Proficiency	22.51	32.24	1.000	-58.44	103.46
	High Proficiency	Low Proficiency	-42.62	32.24	.583	-123.57	38.33
		Medium Proficiency	-22.51	32.24	1.000	-103.46	58.44

This table presents the results of the Bonferroni post hoc analysis for response times, including the mean differences, standard errors, p-values, and 95% confidence intervals for pairwise comparisons between three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, for the two items, PTE5 and PTU5.

In case of the English item, PTE5, all the groups responded quite similarly. Comparing the Low Proficiency and Medium Proficiency groups yielded a non-significant mean difference of -4.17 (SE = 38.70, p = 1.000), with a 95% confidence interval from -101.34 to 93.00. Similarly, the Low Proficiency and High Proficiency groups also showed a non-significant mean difference of 57.90 (SE = 38.70, p = .430), with a 95% confidence interval from -39.27 to 155.07. There were no statistically significant mean differences between the Medium Proficiency and Low Proficiency groups (p = 1.000) or between the Medium Proficiency and High Proficiency groups (p = .352). Similarly, the High Proficiency group did not demonstrate a significant difference in mean response times when compared to the Low Proficiency group (p = .430) or the Medium Proficiency group (p = .352).

Results pertaining to the corresponding Urdu item, PTU5, indicate patterns similar to those of the English item, PTE5. Comparing the Low Proficiency and Medium Proficiency groups, a non-significant mean difference of 20.11 (SE = 32.24, p = 1.000) was observed, with a 95% confidence interval from -60.84 to 101.06. The Low Proficiency and High Proficiency groups also displayed a non-significant mean difference of 42.62 (SE = 32.24, p = .583), with a 95% confidence interval from -38.33 to

123.57. No statistically significant mean differences were found between the Medium Proficiency and Low Proficiency groups (p = 1.000) or between the Medium Proficiency and High Proficiency groups (p = 1.000). The High Proficiency group did not exhibit significant mean differences when compared to the Low Proficiency group (p = .583) or the Medium Proficiency group (p = 1.000).

In both the cases of PTE5 and PTU5, the analysis indicates that most comparisons did not result in statistically significant differences in response times between the proficiency groups. The p-values for most comparisons were greater than the typical significance level of 0.05, indicating no significant differences between groups.

4.4.6 PTE6 vs. PTU6

This part of the experiment dealt with partial priming. The primes and targets were not the same, but they were semantically related. In fact, the primes were the plural inflections of the targets.

Table 27

Prime and Target for PTU6

Code	Item No.	Prime	Target
PTU6	41	باتوں	بات

The prime in the Urdu item was *baaton* meaning *news* in English. It is a noun in Urdu and is the plural inflection of the target word in this item which was *baat* which is the singular form of the prime.

This item was included to determine whether partial priming take place among the respondents or not. Ideally, there should be some partial priming for this Urdu item because as per the hypothesis of this study, native speakers of a language do show priming effects on the inflected forms of verbs and nouns.

The prime in the English item was *deserts* which is a noun. The target was *desert* which is the singular form of the word used as prime in this item.

Table 28

Prime and Target for PTE6

Code	Item No.	Prime	Target
PTE6	41	deserts	DESERT

The prime is the plural inflection of the target word in this item. This item (with a few more to come) was included in the list of items to observe whether the non-native users of the language show some priming effects taking place. As per the hypothesis of this study, the highly proficient non-native users of a language show priming effects in such situations.

In order to further investigate whether any partial priming effects took place, let us examine the data presented in the table below.

Table 29

Descriptive Statistics for PTE6 and PTU6

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE6	Low Proficiency	1018.97	75.27	866.31	1171.63
	Medium Proficiency	1038.62	75.27	885.96	1191.29
	High Proficiency	775.63	75.27	622.97	928.29
PTU6	Low Proficiency	692.92	24.31	643.61	742.23
	Medium Proficiency	718.31	24.31	669.00	767.62
	High Proficiency	712.29	24.31	662.99	761.60

This table presents the descriptive statistics of response times, including mean response times, standard errors, and 95% confidence intervals, for three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, for the two items, PTE6 and PTU6, English and Urdu, respectively.

As far as the English item, PTE6, is concerned, there seems to be a visible difference between how the three groups responded to it. The mean response time for the

Low Proficiency group was 1018.97 (SE = 75.27), with a 95% confidence interval ranging from 866.31 to 1171.63. The Medium Proficiency group had a mean response time of 1038.62 (SE = 75.27), with a 95% confidence interval ranging from 885.96 to 1191.29. The High Proficiency group exhibited a mean response time of 775.63 (SE = 75.27), with a 95% confidence interval ranging from 622.97 to 928.29.

In PTE6, the Medium Proficiency group had the highest mean response time (1038.62), followed by the Low Proficiency group (1018.97) and the High Proficiency group (775.63). This shows a clear-cut difference between the response time of the high proficiency group and the other two groups. However, this difference needs to be further analyzed.

These statistics clearly suggest that the high proficiency group was facilitated by the prime word while the other two groups were not. This means that partial priming did take place in the case of the high proficiency group and there was no priming effect observed in the case of the low and medium proficiency groups.

As far as the corresponding Urdu item, PTU6, is concerned, it seems as though partial priming took place across the three groups, as per the expectations. The mean response time for the Low Proficiency group was 692.92 (SE = 24.31), with a 95% confidence interval ranging from 643.61 to 742.23. The Medium Proficiency group had a mean response time of 718.31 (SE = 24.31), with a 95% confidence interval ranging from 669.00 to 767.62. The High Proficiency group displayed a mean response time of 712.29 (SE = 24.31), with a 95% confidence interval ranging from 662.99 to 761.60.

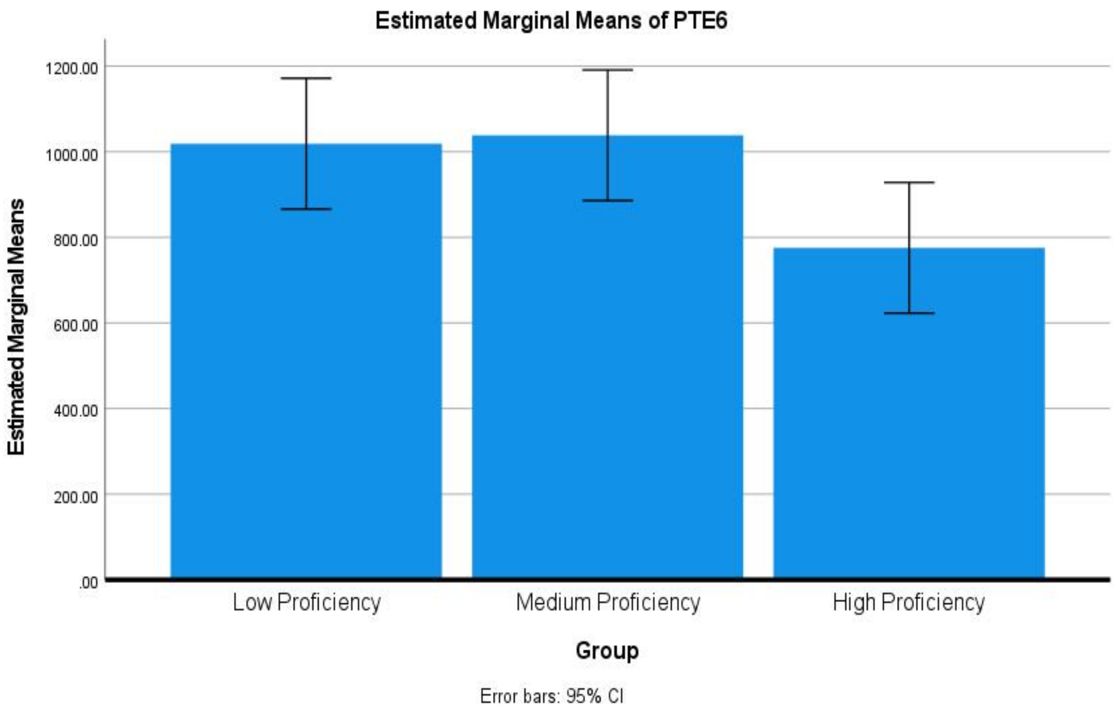
In response to the Urdu item, PTU6, the Medium Proficiency group had the highest mean response time (718.31), followed by the High Proficiency group (712.29) and the Low Proficiency group (692.92). However, all these response times are very similar to each other.

Considering the partial priming effect of the plural inflection being discussed here, the corresponding Urdu item should also display similar priming effects across the three groups. All the participants were Urdu native speakers and as per the theoretical framework of the study, they should be breaking down the morphologically complex words before storing them in the lexicon.

Let us further visualize the differences with the help of the following bar charts.

Figure 14

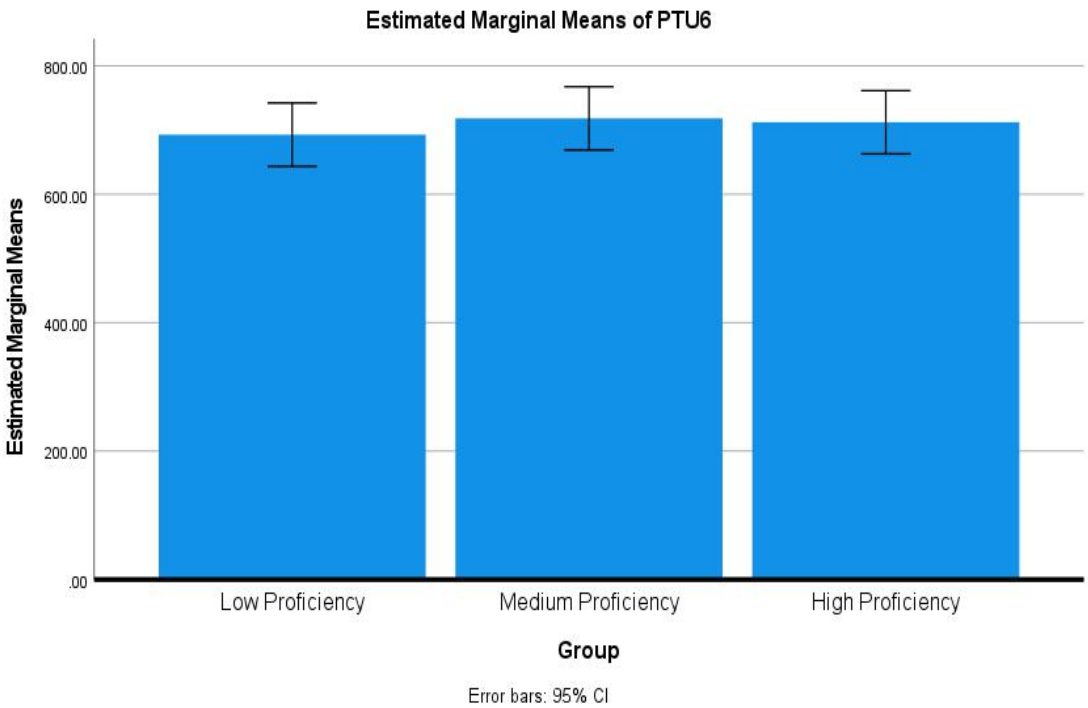
Estimated Marginal Means for PTE6



The above figure shows a clear difference between the mean response time of the high proficiency group and the other two groups. The difference shows that while responding to the English item (PTE6) partial priming took place in the case of high proficiency group only whereas there was no priming effect observed on the other two groups. Both the low and the medium proficiency groups responded in a similar fashion taking more time than the high proficiency group. The high proficiency group, on the other hand, took much less time in comparison.

Figure 15

Estimated Marginal Means for PTU6



This bar chart, pertaining to the Urdu item (PTU6), illustrates that all the groups responded in a similar way. The low proficiency group took a little lesser time compared to the other two groups. However, the overall response times of all the groups are quite similar.

The overall response of the participants in the Urdu item is very similar to the way the high proficiency group responded to the English item. This proves that partial priming took place in all the groups in the Urdu item, but it took place only in the high proficiency group in the case of the English item.

Let us examine the following contrast results in order to further analyze the data.

Table 30

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE6 and PTU6

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound

PTE6	Low Proficiency	Medium Proficiency	-19.65	106.45	1.000	-286.96	247.66
		High Proficiency	243.34	106.45	.085	-23.97	510.65
	Medium Proficiency	Low Proficiency	19.65	106.45	1.000	-247.66	286.96
		High Proficiency	262.99	106.45	.055	-4.31	530.30
	High Proficiency	Low Proficiency	-243.34	106.45	.085	-510.65	23.97
		Medium Proficiency	-262.99	106.45	.055	-530.30	4.31
PTU6	Low Proficiency	Medium Proficiency	-25.38	34.38	1.000	-111.72	60.96
		High Proficiency	-19.37	34.38	1.000	-105.71	66.97
	Medium Proficiency	Low Proficiency	25.38	34.38	1.000	-60.96	111.72
		High Proficiency	6.01	34.38	1.000	-80.33	92.35
	High Proficiency	Low Proficiency	19.37	34.38	1.000	-66.97	105.71
		Medium Proficiency	-6.01	34.38	1.000	-92.35	80.33

This table presents the results of the Bonferroni post hoc analysis for response times, including the mean differences, standard errors, p-values, and 95% confidence intervals for pairwise comparisons between three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, for the two corresponding items, PTE6 and PTU6.

As far as the English item, PTE6, is concerned, there seems to be some difference between the response of the high proficiency group and the other two groups. Comparing the Low Proficiency and Medium Proficiency groups showed a non-significant mean difference of -19.65 (SE = 106.45, p = 1.000), with a 95% confidence interval from -286.96 to 247.66. In contrast, the Low Proficiency and High Proficiency groups exhibited a mean difference of 243.34 (SE = 106.45, p = .085), with a 95% confidence interval from -23.97 to 510.65. While this difference is not statistically significant at the conventional level (p = .085), it's worth noting. There were no statistically significant mean differences between the Medium Proficiency and Low Proficiency groups (p = 1.000) or between the Medium Proficiency and High Proficiency groups (p = .055), as per the post hoc analysis being presented here.

The High Proficiency group did not demonstrate a significant difference in mean response times when compared to the Low Proficiency group (p = .085) or the Medium Proficiency group (p = .055). However, these significance values could not go without notice. Both values are below 0.10 which means that there are notable patterns of variations in the responses of these groups.

In the context of the corresponding Urdu item, PTU6, all the three groups responded very similarly. Comparing the Low Proficiency and Medium Proficiency groups yielded a non-significant mean difference of -25.38 (SE = 34.38, p = 1.000), with a 95% confidence interval from -111.72 to 60.96. Similarly, the Low Proficiency and High Proficiency groups displayed a non-significant mean difference of -19.37 (SE = 34.38, p = 1.000), with a 95% confidence interval from -105.71 to 66.97. No statistically significant mean differences were found between the Medium Proficiency and Low Proficiency groups (p = 1.000) or between the Medium Proficiency and High Proficiency groups (p = 1.000). The High Proficiency group did not exhibit significant mean differences when compared to the Low Proficiency group (p = 1.000) or the Medium Proficiency group (p = 1.000).

The statistics and the accompanying discussion strongly suggest that the Urdu native speakers break down the morphologically complex words in their native language. There is also a strong suggestion that only the highly proficient non-native users of English language break down the morphologically complex words before storing them in their mental lexicon.

4.4.7 PTE7 vs. PTU7

This item was also part of one of the items included to examine partial priming effects. The primes of both the English and Urdu items are plural inflections of the targets.

Table 31

Prime and Target for PTU7

Code	Item No.	Prime	Target
PTU7	42	دوستوں	دوست

The prime in this item was *doston* meaning *friends* in English. It is a noun in Urdu and is the plural inflection of the target word in this item which was *dost* which is the singular form of the prime.

This item was included to determine whether partial priming take place among the respondents or not. Ideally, there should be some partial priming for this Urdu item because as per the hypothesis of this study, native speakers of a language do show priming effects on the inflected forms of verbs and nouns.

The prime in the corresponding English item was *years* which is a noun. The target was *year* which is the singular form of the word used as prime in this item.

Table 32

Prime and Target for PTE7

Code	Item No.	Prime	Target
PTE7	42	years	YEAR

The prime is the plural inflection of the target word in this item. This item also was included in the list of items to observe whether the non-native users of the language show some priming effects taking place. As per the hypothesis of this study, the highly proficient non-native users of a language show priming effects in such situations.

The following table shows how the three groups responded to both the Urdu and the English item.

Table 33

Descriptive Statistics for PTE7 and PTU7

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE7	Low Proficiency	796.24	25.51	744.50	847.97
	Medium Proficiency	763.77	25.51	712.03	815.51
	High Proficiency	717.93	25.51	666.19	769.67

	Low Proficiency	689.01	24.59	639.14	738.88
PTU7	Medium Proficiency	673.42	24.59	623.55	723.30
	High Proficiency	679.42	24.59	629.55	729.30

This table presents the descriptive statistics of response times, including mean response times, standard errors, and 95% confidence intervals, for three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, in two different experiments.

In the case of the English item, PTE7, there was a difference in the way the three groups responded to the prime and target. The mean response time for the Low Proficiency group was 796.24 (SE = 25.51), with a 95% confidence interval ranging from 744.50 to 847.97. The Medium Proficiency group had a mean response time of 763.77 (SE = 25.51), with a 95% confidence interval ranging from 712.03 to 815.51. The High Proficiency group exhibited a mean response time of 717.93 (SE = 25.51), with a 95% confidence interval ranging from 666.19 to 769.67.

Responding to PTE7, the Low Proficiency group had the highest mean response time (796.24), followed by the Medium Proficiency group (763.77) and the High Proficiency group (717.93).

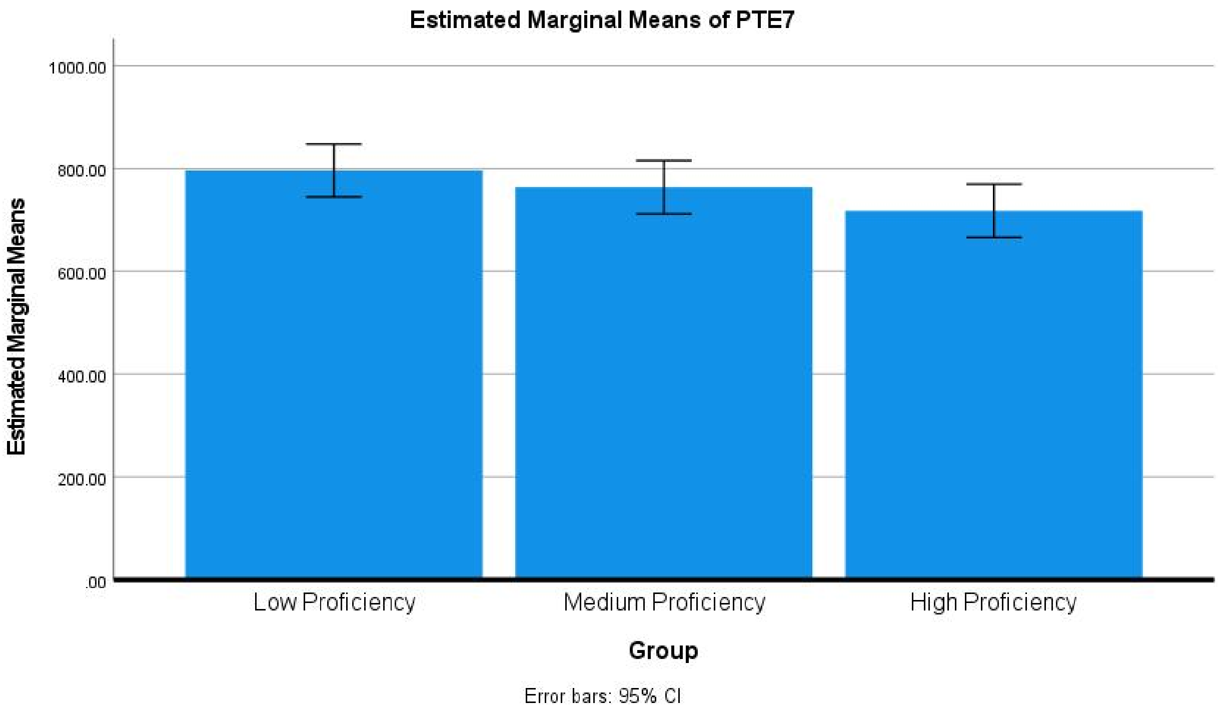
The corresponding Urdu item got the following response from the three groups. The mean response time for the Low Proficiency group was 689.01 (SE = 24.59), with a 95% confidence interval ranging from 639.14 to 738.88. The Medium Proficiency group had a mean response time of 673.42 (SE = 24.59), with a 95% confidence interval ranging from 623.55 to 723.30. The High Proficiency group displayed a mean response time of 679.42 (SE = 24.59), with a 95% confidence interval ranging from 629.55 to 729.30.

In the context of PTU7, the Low Proficiency group had the highest mean response time (689.01), followed by the High Proficiency group (679.42) and the Medium Proficiency group (673.42).

The following bar charts will throw further light on the differences and similarities between the groups in both the items one by one.

Figure 16

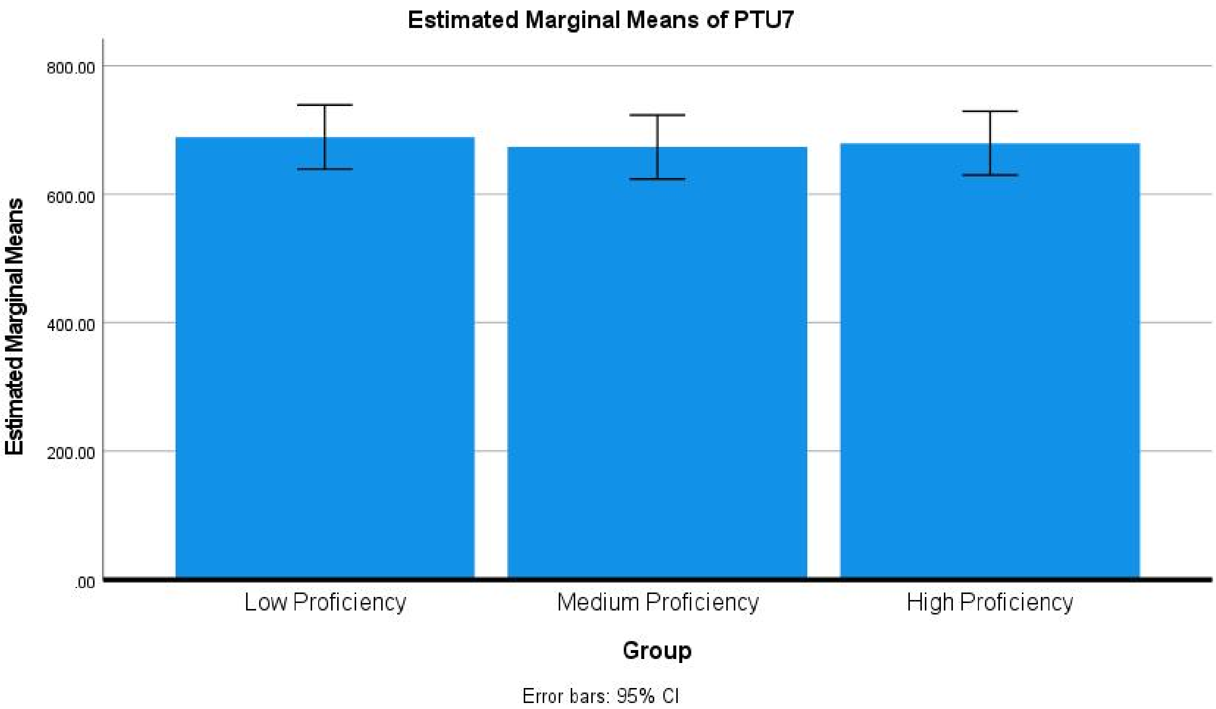
Estimated Marginal Means for PTE7



This figure shows that the high proficiency group did respond quicker than the other two groups. However, the difference in the response time was not enough to be termed as significant. Secondly, the other two groups also responded to this English item (PTE7) in a way that suggests the onset of partial priming, which makes the differences fade away a bit further. Conventionally, all the bars are approximately the same size, with their error bars overlapping those of the other groups as well as the line indicating the overall mean response times.

Figure 17

Estimated Marginal Means for PTU7



As far as the case of PTU7 is concerned, the onset of partial priming is evident from the mean scores of all the groups. They are not only less than 700 milliseconds but also are very similar to each other. The graph seems even across the board with the medium proficiency group's bar fractionally under the line representing the observed grand mean response times.

The above statistics suggest that both the items were responded to in a very similar manner by all the groups. This, in turn, suggests that priming took place in both the items across the board. Let us further analyze the data by using the statistics in the following table.

Table 34

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE7 and PTU7

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound

PTE7	Low Proficiency	Medium Proficiency	32.47	36.08	1.000	-58.12	123.06
		High Proficiency	78.30	36.08	.110	-12.29	168.90
	Medium Proficiency	Low Proficiency	-32.47	36.08	1.000	-123.06	58.12
		High Proficiency	45.84	36.08	.636	-44.75	136.43
	High Proficiency	Low Proficiency	-78.30	36.08	.110	-168.90	12.29
		Medium Proficiency	-45.84	36.08	.636	-136.43	44.75
PTU7	Low Proficiency	Medium Proficiency	15.59	34.78	1.000	-71.74	102.92
		High Proficiency	9.59	34.78	1.000	-77.74	96.92
	Medium Proficiency	Low Proficiency	-15.59	34.78	1.000	-102.92	71.74
		High Proficiency	-6.00	34.78	1.000	-93.33	81.33
	High Proficiency	Low Proficiency	-9.59	34.78	1.000	-96.92	77.74
		Medium Proficiency	6.00	34.78	1.000	-81.33	93.33

This table presents the results of the Bonferroni post hoc analysis for response times, including the mean differences, standard errors, p-values, and 95% confidence intervals for pairwise comparisons between three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, for the two items, PTE7 and PTU7.

Responding to the English item, PTE7, the three groups showed non-significant differences. Comparing the Low Proficiency and Medium Proficiency groups showed a non-significant mean difference of 32.47 (SE = 36.08, p = 1.000), with a 95% confidence interval from -58.12 to 123.06. In contrast, the Low Proficiency and High Proficiency groups exhibited a mean difference of 78.30 (SE = 36.08, p = .110), with a 95% confidence interval from -12.29 to 168.90. While this difference is not statistically significant at the conventional level (p = .110), it's worth noting. There were no statistically significant mean differences between the Medium Proficiency and Low Proficiency groups (p = 1.000) or between the Medium Proficiency and High Proficiency groups (p = .636).

The High Proficiency group did not demonstrate a significant difference in mean response times when compared to the Low Proficiency group (p = .110) which is worth noting and indicates that the group was close enough to indicate significant difference in response compared to the other two groups.

As far as the Urdu item, PTU7, is concerned, there was no difference noted that could be termed as statistically significant. Comparing the Low Proficiency and Medium Proficiency groups yielded a non-significant mean difference of 15.59 (SE = 34.78, p = 1.000), with a 95% confidence interval from -71.74 to 102.92. Similarly, the Low Proficiency and High Proficiency groups displayed a non-significant mean difference of 9.59 (SE = 34.78, p = 1.000), with a 95% confidence interval from -77.74 to 96.92. No statistically significant mean differences were found between the Medium Proficiency and Low Proficiency groups (p = 1.000) or between the Medium Proficiency and High Proficiency groups (p = 1.000).

In both the items, the analysis indicates that most comparisons did not result in statistically significant differences in response times between the proficiency groups. The p-values for most comparisons were greater than the typical significance level of 0.05, indicating no significant differences between groups. However, in the PTE7 experiment, the comparison between Low Proficiency and High Proficiency groups approached significance (p = .110).

The above discussion in the light of the presented statistics pertaining to PTE7 and PTU7 suggests that partial priming took place in all the groups in both the items. For Urdu, it seems fine because it was expected. In the English item too, it was expected from the high proficiency group. However, the low and the medium proficiency groups displaying the effect of partial priming, by taking lesser time to respond, is interesting and needs further investigation.

4.4.8 PTE8 vs. PTU8

This item was also part of one of the items included to examine partial priming effects. The prime in the English item is the past form inflected form of the target word. The prime used in the Urdu item is the plural inflection of the target.

Table 35

Prime and Target for PTU8

Code	Item No.	Prime	Target

PTU8	43	موضوعات	موضوع

The prime in the Urdu item was *mozuaat* meaning *topics* in English. It is a noun in Urdu and is the plural inflection of the target word in this item which was *mozuu* which is the singular form of the prime meaning *topic*.

This pair of prime and target words was put on the list of items which aimed at determining the occurring of partial priming. Ideally, there should be some partial priming for this Urdu item because as per the hypothesis of this study, native speakers of a language do show priming effects on the inflected forms of verbs and nouns. We already observed such priming in the Urdu items, PTU6 and PTU7.

The prime in the English item was *impressed* which a past tense inflection of *impress*. The inflection was used as the prime while the base form was used as the target in this item.

Table 36

Prime and Target for PTE8

Code	Item No.	Prime	Target
PTE8	43	impressed	IMPRESS

This pair of prime and target was placed in the experiment in order to find out whether any priming take place in the case of past tense inflections among the non-native speakers of English. In the previous two items, we saw that priming did take place in the case of PTE6, albeit in only the high proficiency group. In the case of PTE7, priming took place across all the groups which is interesting and intriguing at the same time.

Let us examine the table below to see how the three groups responded to both these items.

Table 37

Descriptive Statistics for PTE8 and PTU8

	Group	Mean	Std. Error	95% Confidence Interval

				Lower Bound	Upper Bound
	Low Proficiency	979.10	60.91	855.57	1102.64
PTE8	Medium Proficiency	910.62	60.91	787.08	1034.16
	High Proficiency	755.88	60.91	632.34	879.42
	Low Proficiency	721.25	20.30	680.07	762.42
PTU8	Medium Proficiency	742.35	20.30	701.17	783.52
	High Proficiency	734.31	20.30	693.13	775.48

This table presents the descriptive statistics of response times, including mean response times, standard errors, and 95% confidence intervals, for three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, in response to the two items, PTE8 and PTU8.

Responding to PTE8, the English past tense inflection, the high proficiency groups displayed a clear difference. The High Proficiency group exhibited a mean response time of 755.88 (SE = 60.91), with a 95% confidence interval ranging from 632.34 to 879.42. The Medium Proficiency group had a mean response time of 910.62 (SE = 60.91), with a 95% confidence interval ranging from 787.08 to 1034.16. The mean response time for the Low Proficiency group was 979.10 (SE = 60.91), with a 95% confidence interval ranging from 855.57 to 1102.64.

Thus, in response to PTE8, the High Proficiency group exhibited a significant onset of partial priming which seems evident from their mean response time discussed above.

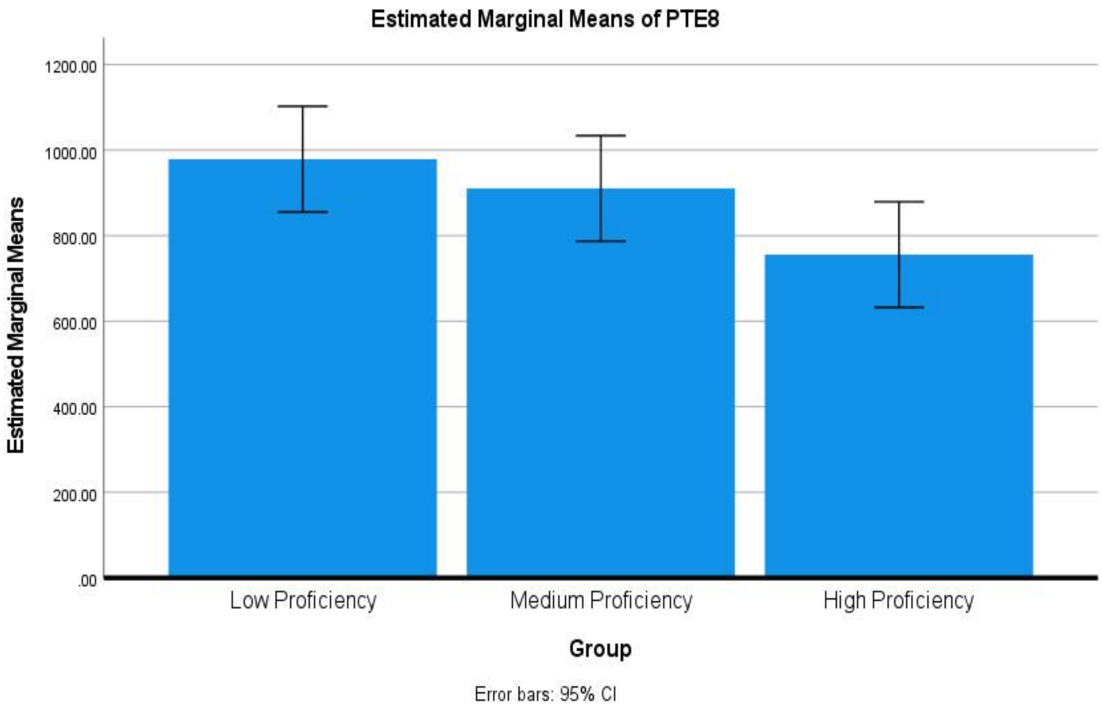
As far as the corresponding Urdu item is concerned, all the three groups responded in a very similar way that is quite similar to the high proficiency group's response to the English item. This shows that all the three groups were influenced by the prime in the Urdu item. The mean response time for the Low Proficiency group was 721.25 (SE = 20.30), with a 95% confidence interval ranging from 680.07 to 762.42. The Medium Proficiency group had a mean response time of 742.35 (SE = 20.30), with a 95% confidence interval ranging from 701.17 to 783.52. The High Proficiency group displayed a mean response time of 734.31 (SE = 20.30), with a 95% confidence interval ranging from 693.13 to 775.48.

Prima facie, the high proficiency group responded to the English item in a very similar response time to that of all the groups responding to the Urdu item. This suggests priming effects in the Urdu item in case of all the groups while in the English item, only the high proficiency group showed the priming effects.

The following bar graphs further clarify the situation.

Figure 18

Estimated Marginal Means for PTE8

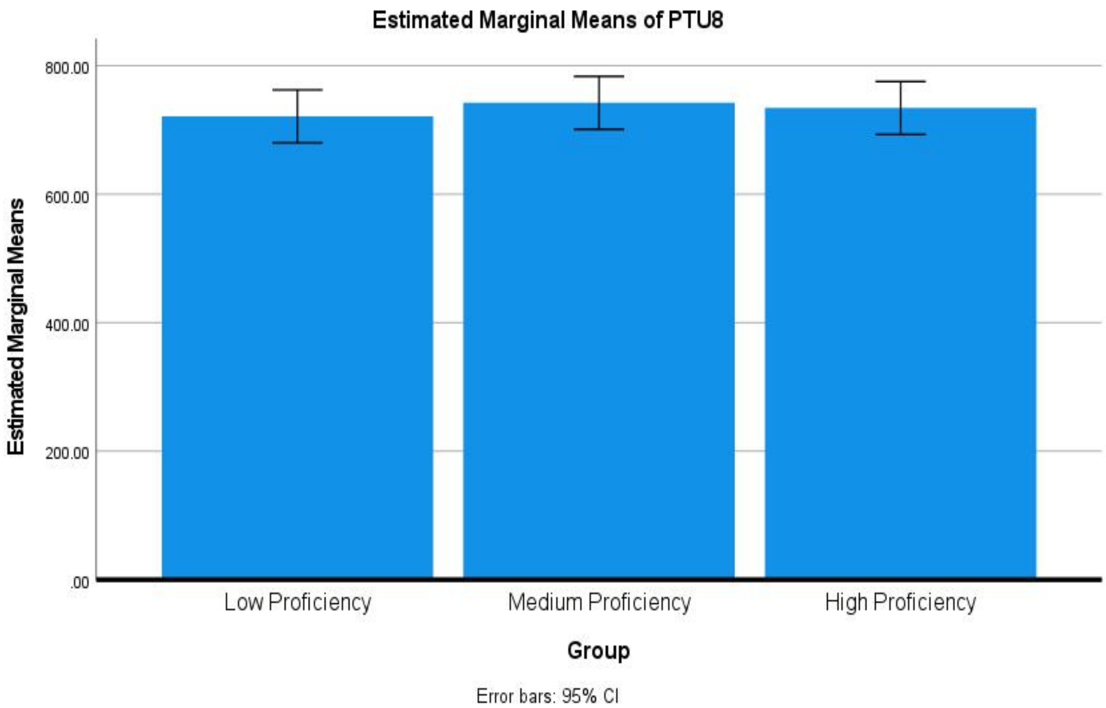


The above bar graph shows that the high proficiency group took considerably less time as compared to the other two groups in their response to the English item (PTE8). The higher error bar on the top of the bar belonging to the high proficiency group barely touches the line denoting the observed grand mean while the mean response times of the other two groups are above it. This means that the high proficiency group did experience some priming effects of the inflection used as a prime in this item whereas no priming took place in the case of the other two groups.

Let us now consider the case of the Urdu item (PTU8):

Figure 19

Estimated Marginal Means for PTU8



The above bar graph shows the slight variations among the response times of the respondents belonging to the three groups. The variations are slight as there is no significant difference between the mean response times. The bars and their respective error bars overlap with one another as well as with the line showing the overall mean response times.

In order to further investigate the prima facie impressions, let us examine the table below showing the difference between groups and its significance level.

Table 38.

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
PTE8	Low Proficiency	Medium Proficiency	68.49	86.14	1.000	-147.83	284.80
		High Proficiency	223.2240*	86.14	.041	6.91	439.54

	Medium Proficiency	Low Proficiency	-68.49	86.14	1.000	-284.80	147.83
		High Proficiency	154.74	86.14	.243	-61.57	371.05
	High Proficiency	Low Proficiency	-223.2240*	86.14	.041	-439.54	-6.91
		Medium Proficiency	-154.74	86.14	.243	-371.05	61.57
PTU8	Low Proficiency	Medium Proficiency	-21.10	28.71	1.000	-93.19	51.00
		High Proficiency	-13.06	28.71	1.000	-85.16	59.04
	Medium Proficiency	Low Proficiency	21.10	28.71	1.000	-51.00	93.19
		High Proficiency	8.04	28.71	1.000	-64.06	80.14
	High Proficiency	Low Proficiency	13.06	28.71	1.000	-59.04	85.16
		Medium Proficiency	-8.04	28.71	1.000	-80.14	64.06

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE8 and PTU8

The above table presents the results of the Bonferroni post hoc analysis for response times, including the mean differences, standard errors, p-values, and 95% confidence intervals for pairwise comparisons between three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, for the two items, PTE8 and PTU8.

The high proficiency groups demonstrated a significant onset of partial priming effect as far as PTE8 is concerned. Comparing the Low Proficiency and Medium Proficiency groups showed a non-significant mean difference of 68.49 (SE = 86.14, p = 1.000), with a 95% confidence interval from -147.83 to 284.80. In contrast, the Low Proficiency and High Proficiency groups exhibited a significant mean difference of 223.2240 (SE = 86.14, p = .041), with a 95% confidence interval from 6.91 to 439.54. There were no statistically significant mean differences between the Medium Proficiency and Low Proficiency groups (p = 1.000) or between the Medium Proficiency and High Proficiency groups (p = .243). The High Proficiency group did not show a significant difference in mean response times when compared to the Low Proficiency group (p = .041) or the Medium Proficiency group (p = .243).

The corresponding Urdu item, PTU8, seems to have witnessed partial priming at all levels as the response times are very similar to one another and to the response time taken by the high proficiency group in PTE8. Comparing the Low Proficiency and Medium Proficiency groups yielded a non-significant mean difference of -21.10 (SE = 28.71, p = 1.000), with a 95% confidence interval from -93.19 to 51.00. Similarly, the Low Proficiency and High Proficiency groups displayed a non-significant mean difference of -13.06 (SE = 28.71, p = 1.000), with a 95% confidence interval from -85.16 to 59.04. No statistically significant mean differences were found between the Medium Proficiency and Low Proficiency groups (p = 1.000) or between the Medium Proficiency and High Proficiency groups (p = 1.000).

The contents of the above table further solidify the impression that partial priming took place across the groups in the case of the Urdu item while it happened only in case of the high proficiency group while responding to the English item.

In the light of the above discussion, it can be concluded that all the three groups displayed some effects of partial priming in case of the Urdu item (Urdu being their native language). No priming effects could be seen in case of the low and medium proficiency groups in response to the English item (PTE8). However, the high proficiency group did show some priming effects while responding to this item. This further substantiate the hypothesis that the highly proficient users of a language do break down the morphologically complex words even if it is not their native language.

4.4.9 PTE9 vs. PTU9

This item was also part of one of the items included to examine partial priming effects. The prime in the English item is the past form inflected form of the target word. The prime used in the Urdu item is the plural inflection of the target.

Table 39

Prime and Target for PTU9

Code	Item No.	Prime	Target
PTU9	44	احسانات	احسان

The prime in this item was *ehsanaat* meaning *favours* in English. It is a noun in Urdu and is the plural inflection of the target word in this item which was *ehsaan* which is the singular form of the prime meaning *favour*.

This pair of prime and target words was included in the list of items specifically for observing partial priming effects. Ideally, there should be some partial priming for this Urdu item because as per the hypothesis of this study, native speakers of a language do show priming effects on the inflected forms of verbs and nouns. We already observed such priming in the Urdu items, PTU6 and PTU7 and PTU8.

The prime in the English item was *worked* which a past tense inflection of *work*. The inflection was used as the prime while the base form was used as the target in this item.

Table 40

Prime and Target for PTE9

Code	Item No.	Prime	Target
PTE9	44	worked	WORK

This pair of prime and target was placed in to see whether any priming take place in the case of past tense inflections among the non-native speakers of English. In the previous three English items, we saw that priming did take place in the case of PTE6 and PTE8 among the high proficiency group only. In the case of PTE7, priming took place across all the groups. Therefore, PTE9 being a similar item, partial priming was expected to take place.

Let us examine the table below to see how the three groups responded to both these items.

Table 41

Descriptive Statistics for PTE9 and PTU9

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE9	Low Proficiency	812.91	23.71	764.83	860.98
	Medium Proficiency	853.56	23.71	805.49	901.64
	High Proficiency	728.48	23.71	680.41	776.56

	Low Proficiency	704.61	24.16	655.61	753.61
PTU9	Medium Proficiency	716.65	24.16	667.65	765.65
	High Proficiency	710.12	24.16	661.12	759.12

This table presents the descriptive statistics of response times, including mean response times, standard errors, and 95% confidence intervals, for three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, in response to the two items (PTE9 and PTU9) in two different experiments, English and Urdu.

As far as PTE9 is concerned, the mean response time for the Low Proficiency group was 812.91 (SE = 23.71), with a 95% confidence interval ranging from 764.83 to 860.98. The Medium Proficiency group had a mean response time of 853.56 (SE = 23.71), with a 95% confidence interval ranging from 805.49 to 901.64. The High Proficiency group exhibited a mean response time of 728.48 (SE = 23.71), with a 95% confidence interval ranging from 680.41 to 776.56.

The high proficiency group seems to have experienced the onset of partial priming in this case as well by responding to the item a lot quicklier than the other two groups.

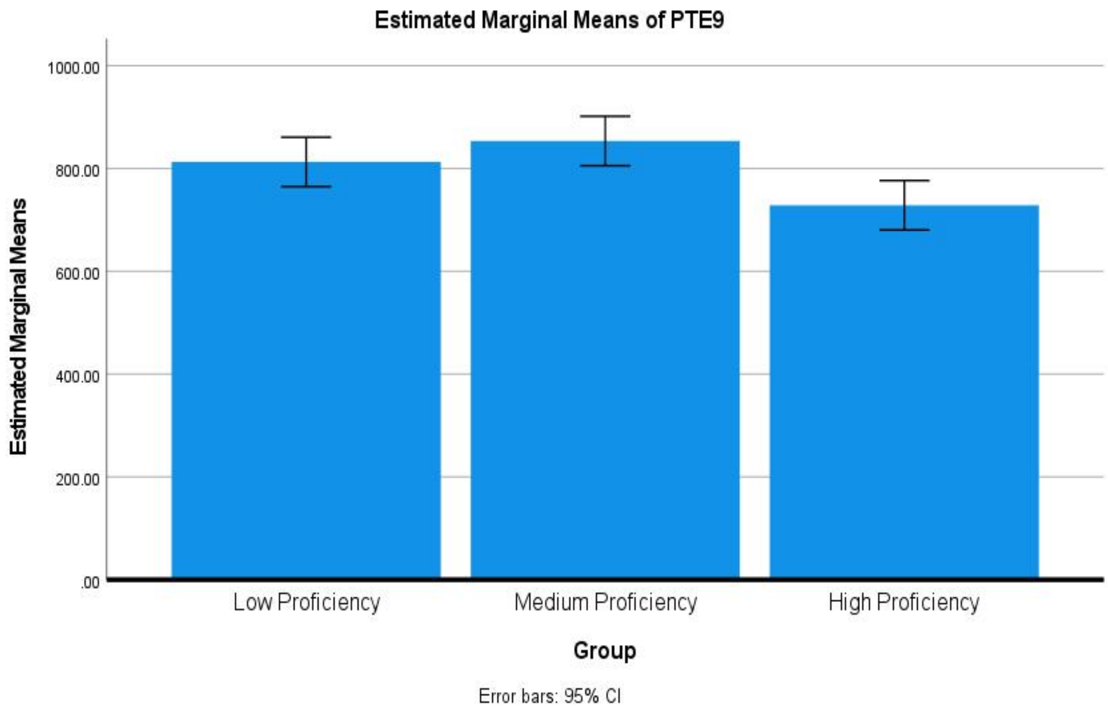
The corresponding Urdu item (PTU9) witnessed very similar response times from all the groups ranging between 700 and 717 milliseconds. This is very similar to the high proficiency group's response time in the English item (728.48). The mean response time for the Low Proficiency group was 704.61 (SE = 24.16), with a 95% confidence interval ranging from 655.61 to 753.61. The Medium Proficiency group had a mean response time of 716.65 (SE = 24.16), with a 95% confidence interval ranging from 667.65 to 765.65. The High Proficiency group displayed a mean response time of 710.12 (SE = 24.16), with a 95% confidence interval ranging from 661.12 to 759.12.

The responses to this English item (PTE9) are very similar to those of the previous item (PTE8). The low and the medium proficiency groups took significantly more time as compared to the high proficiency group while responding to this English item. The high proficiency group took less time which is suggestive of the onset of partial priming that was hypothesized for this item. The mean response time of the high proficiency group in the English item (PTE9) is very similar to the overall mean response time of all the groups in the Urdu item (PTU9). In the case of the Urdu item, the mean response times of all the three groups suggest that the partial priming did facilitate the responses. This was also hypothesized as Urdu is the native language of the respondents and they were expected to show these partial priming effects.

Let us consider the following bar graphs for the response time similarities and contrasts.

Figure 20

Estimated Marginal Means for PTE9

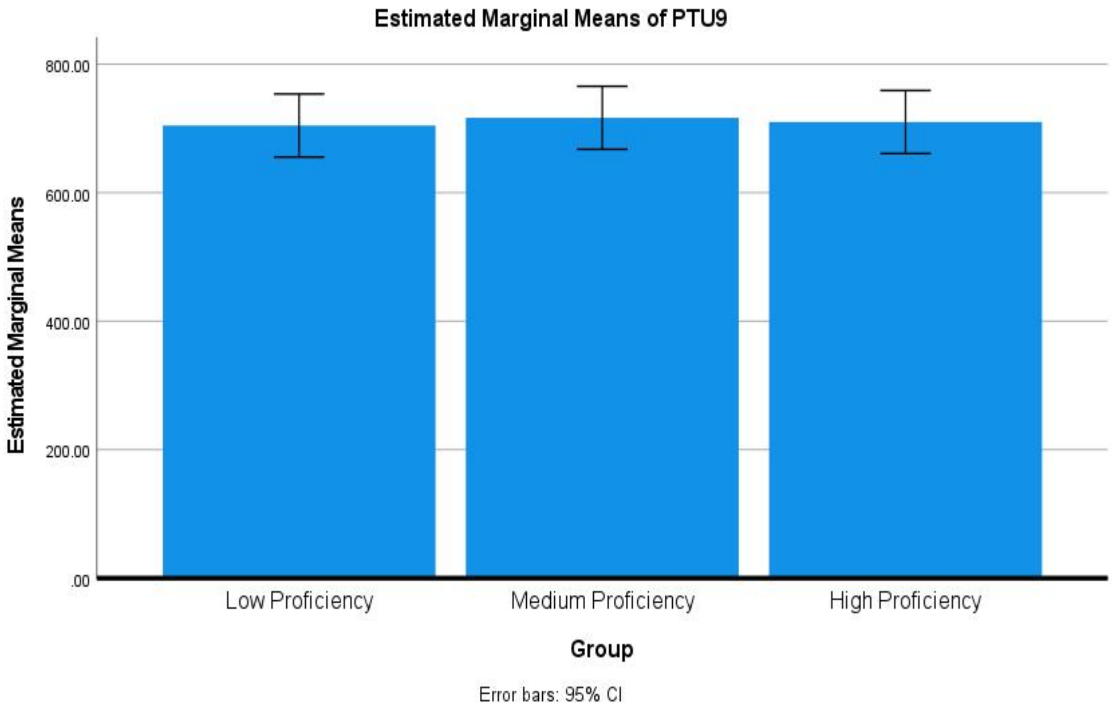


The above bar graph shows that the high proficiency group took considerably less time as compared to the medium proficiency group in their response to the English item (PTE9). However, their response was quite similar to that of the low proficiency group. This suggests that the high proficiency group did experience some priming effects of the inflection used as a prime in this item. Some of the respondents in the low proficiency group may also have experienced the priming effect because the overall mean score of the low proficiency group is quite less than the medium proficiency group and is very near to the mean response time of the high proficiency group. The medium proficiency group did not experience any priming in the case of this English item.

Let us now consider the case of the Urdu item (PTU9):

Figure 21

Estimated Marginal Means for PTU9



The above bar graph shows the slight variations among the response times of the respondents belonging to the three groups. The slight variations show that there is no significant difference between the mean response times. The bars and their respective error bars overlap with one another as well as with the line showing the overall mean response times.

These findings are further illustrated in the following contrast results:

Table 42

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE9 and PTU9

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PTE9	Low Proficiency	Medium Proficiency	-40.66	33.52	.699	-124.83	43.52

		High Proficiency	84.4219*	33.52	.049	0.24	168.60
	Medium Proficiency	Low Proficiency	40.66	33.52	.699	-43.52	124.83
		High Proficiency	125.0769*	33.52	.002	40.90	209.26
	High Proficiency	Low Proficiency	-84.4219*	33.52	.049	-168.60	-0.24
		Medium Proficiency	-125.0769*	33.52	.002	-209.26	-40.90
PTU9	Low Proficiency	Medium Proficiency	-12.04	34.17	1.000	-97.84	73.76
		High Proficiency	-5.51	34.17	1.000	-91.31	80.29
	Medium Proficiency	Low Proficiency	12.04	34.17	1.000	-73.76	97.84
		High Proficiency	6.53	34.17	1.000	-79.27	92.33
	High Proficiency	Low Proficiency	5.51	34.17	1.000	-80.29	91.31
		Medium Proficiency	-6.53	34.17	1.000	-92.33	79.27

The above table presents the results of the Bonferroni post hoc analysis for response times, including the mean differences, standard errors, p-values, and 95% confidence intervals for pairwise comparisons between three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, in response to two items, PTE9 and PTU9, in the two experiments.

As far as the English item, PTE9, is concerned, the high proficiency group performed significantly differently from the other two groups. Comparing the Low Proficiency and Medium Proficiency groups showed a non-significant mean difference of -40.66 (SE = 33.52, p = .699), with a 95% confidence interval from -124.83 to 43.52. In contrast, the Low Proficiency and High Proficiency groups exhibited a significant mean difference of 84.4219 (SE = 33.52, p = .049), with a 95% confidence interval from 0.24 to 168.60. There were no statistically significant mean differences between the Medium Proficiency and Low Proficiency groups (p = .699), but the Medium Proficiency and High Proficiency groups showed a significant mean difference of 125.0769 (SE = 33.52, p = .002), with a 95% confidence interval from 40.90 to 209.26.

The High Proficiency group did show a significant difference in mean response times when compared to the Low Proficiency group (p = .049), and the Medium Proficiency group (p = .002).

The three groups responded very similarly to the corresponding Urdu item, PTU9. Comparing the Low Proficiency and Medium Proficiency groups yielded a non-significant mean difference of -12.04 (SE = 34.17, p = 1.000), with a 95% confidence interval from -97.84 to 73.76. Similarly, the Low Proficiency and High Proficiency groups displayed a non-significant mean difference of -5.51 (SE = 34.17, p = 1.000), with a 95% confidence interval from -91.31 to 80.29. No statistically significant mean differences were found between the Medium Proficiency and Low Proficiency groups (p = 1.000) or between the Medium Proficiency and High Proficiency groups (p = 1.000).

The above description clearly suggests across the board priming effects in the case of the Urdu item (PTU9) among all the groups. However, in the case of the English item (PTE9), the priming effects are limited only to the high proficiency group. The low proficiency group took slightly more time than the high proficiency group while responding to the English item, but their mean score was about a hundred millisecond more than the overall mean score of all the respondents in the case of the Urdu item.

In the light of the above discussion, it can be concluded that all the three groups displayed some effects of partial priming in the case of the Urdu item as Urdu is the native language of all the respondents. No priming effects could be seen in case of the medium proficiency groups in response to the English item (PTE9). The low proficiency group did show some priming effects which were not similar to the priming effects shown by the high proficiency group responding to the English item and all the three groups responding to the Urdu item. However, the high proficiency group did show some strong priming effects while responding to this English item (PTE9). This further substantiates the hypothesis that the highly proficient users of a language do process the morphologically complex words by breaking them down even if it is not their native language (Clahsen, 2008).

4.4.10 PTE10 vs. PTU10

The tenth item in the Urdu experiment (PTU10), like the fourth and fifth one, had completely unrelated prime and target. These items were included in the experiment to provide contrastive results as no priming effects were expected in these cases.

Table 43

Prime and Target for PTU10

Code	Item No.	Prime	Target
PTU10	45	سنتا	کھانا

The prime in this item was *sunta* meaning *hearing/listening* in English. It is the past form of a verb *sun'na* in Urdu. The target word in this item was *khana* which is a noun and a verb at the same time meaning *meal/eating* in English.

The prime in the corresponding English item was *corner* which is a noun. The target was *corn* which is a noun in English.

Table 44

Prime and Target for PTE10

Code	Item No.	Prime	Target
PTE10	45	corner	CORN

The prime and target in this English item was not completely unrelated as it might seem in the first look. Although there is no semantic relationship between the two, there is a lot of orthographic similarity between them. *Corner* is orthographically *corn+er* which might facilitate some of the respondents in recognizing the target word in this item. This was intentionally done in order to find out whether any orthography related priming takes place or not. Let us examine the table below.

Table 45

Descriptive Statistics for PTE10 and PTU10

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE10	Low Proficiency	985.69	45.19	894.05	1077.33
	Medium Proficiency	855.56	45.19	763.92	947.20

	High Proficiency	872.94	45.19	781.30	964.57
PTU10	Low Proficiency	788.01	22.83	741.70	834.31
	Medium Proficiency	853.52	22.83	807.21	899.82
	High Proficiency	862.44	22.83	816.14	908.74

This table presents the descriptive statistics of response times, including mean response times, standard errors, and 95% confidence intervals, for three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, in response to the two items, PTE10 and PTU 10.

As far as PTE10 is concerned, the mean response time for the Low Proficiency group was 985.69 (SE = 45.19), with a 95% confidence interval ranging from 894.05 to 1077.33. The Medium Proficiency group had a mean response time of 855.56 (SE = 45.19), with a 95% confidence interval ranging from 763.92 to 947.20. The High Proficiency group exhibited a mean response time of 872.94 (SE = 45.19), with a 95% confidence interval ranging from 781.30 to 964.57.

In response to PTE10, the Low Proficiency group had the highest mean response time (985.69), followed by the High Proficiency group (872.94) and the Medium Proficiency group (855.56).

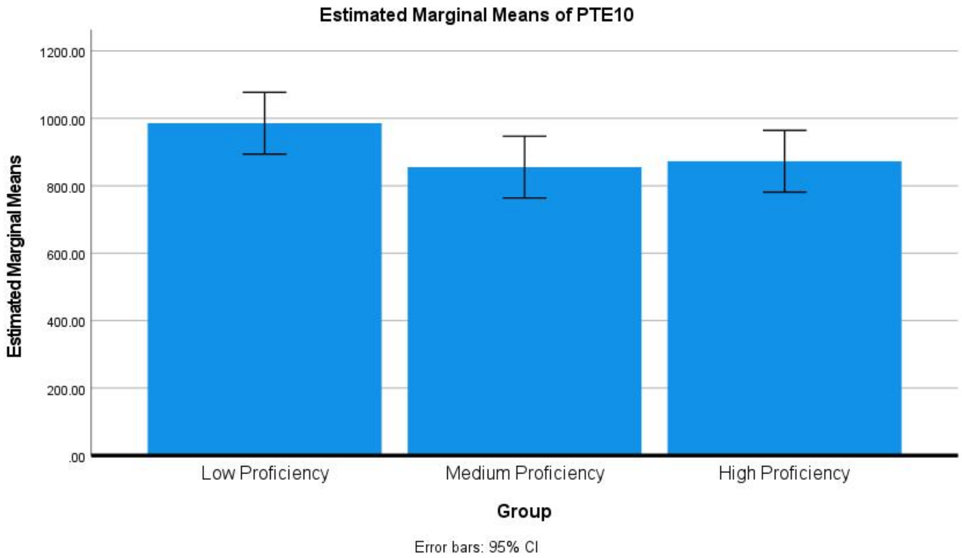
In the case of PTU10, the mean response time for the Low Proficiency group was 788.01 (SE = 22.83), with a 95% confidence interval ranging from 741.70 to 834.31. The Medium Proficiency group had a mean response time of 853.52 (SE = 22.83), with a 95% confidence interval ranging from 807.21 to 899.82. The High Proficiency group displayed a mean response time of 862.44 (SE = 22.83), with a 95% confidence interval ranging from 816.14 to 908.74.

Responding to PTU10, the High Proficiency group had the highest mean response time (862.44), followed by the Medium Proficiency group (853.52) and the Low Proficiency group (788.01).

The following bar graphs will further illustrate the situation. Let us take a look at the bar chart pertaining to the English item (PTE10) first.

Figure 22

Estimated Marginal Means for PTE10



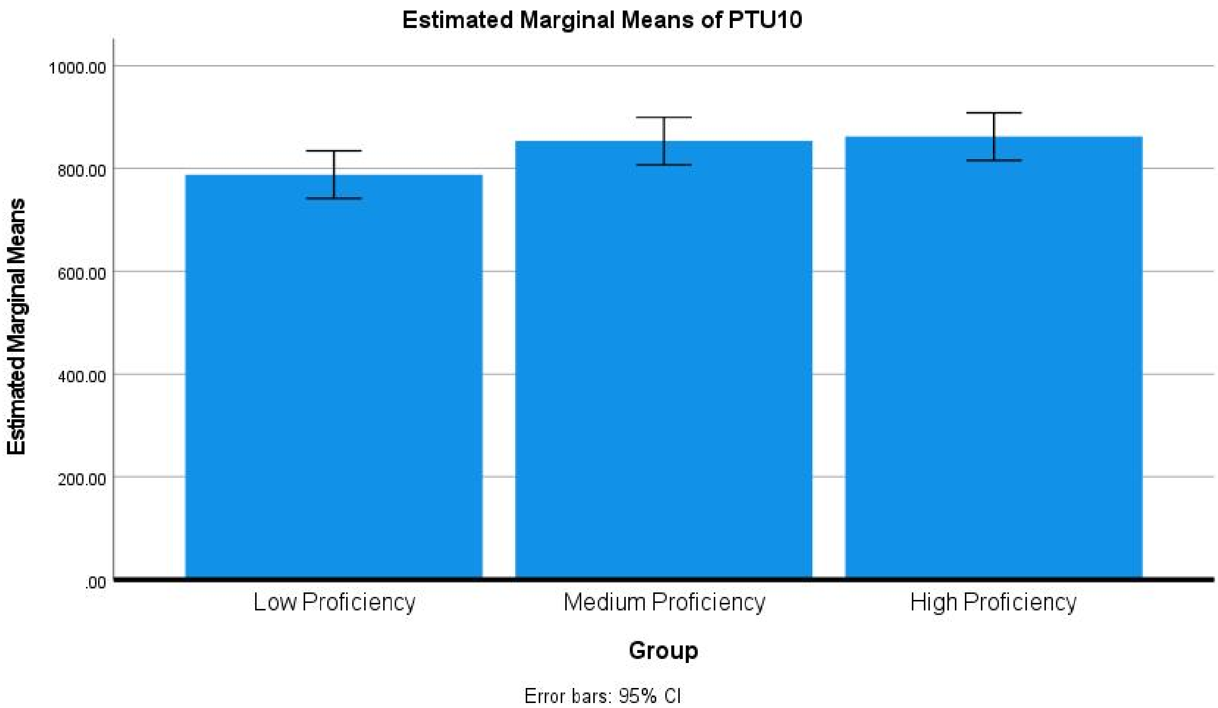
This figure shows that there is a gradual decrease in the mean response times from low proficiency group towards the high proficiency group. However, the magnitude of the difference in these response times is not significant. The error bars at the top of all the group bars overlap not only with one another but also with the line representing the overall mean response time of all the participants which renders these differences to be insignificant.

The response times are generally high in this item and there is no significant difference between the high proficiency group and the other two groups. This indicates that no orthography related priming took place although the prime and the target in this item (PTE10) had great orthographic similarity. The fact that there was no orthographic priming in this item (similar to the results of PTE5) establishes that the settings of the experiment were correct which did not allow the orthographic priming.

Let us take a look at the bar chart pertaining to the corresponding Urdu item (PTU10):

Figure 23

Estimated Marginal Means for PTU10



As discussed earlier, the responses to this item were quite random in nature. The haphazard nature of the responses is evident from the structure of this bar chart too. The size of the error bars in each group is quite big which shows the randomness of the data in the backdrop. Although the average response time of the high proficiency group can be seen to be a bit higher as compared to the other two groups, and that of the low proficiency group to be a bit lower in comparison with the other two groups, there seems to be no significance in it as the error bars are overlapping across the board.

Here is the table containing contrast results between the high proficiency group and the other two groups.

Table 46

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE10 and PTU10

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PTE10	Low	Medium	130.13	63.90	.147	-30.33	290.58

	Proficiency	Proficiency					
		High Proficiency	112.75	63.90	.258	-47.70	273.21
	Medium Proficiency	Low Proficiency	-130.13	63.90	.147	-290.58	30.33
		High Proficiency	-17.37	63.90	1.000	-177.83	143.08
	High Proficiency	Low Proficiency	-112.75	63.90	.258	-273.21	47.70
		Medium Proficiency	17.37	63.90	1.000	-143.08	177.83
PTU10	Low Proficiency	Medium Proficiency	-65.51	32.29	.150	-146.58	15.56
		High Proficiency	-74.43	32.29	.081	-155.50	6.64
	Medium Proficiency	Low Proficiency	65.51	32.29	.150	-15.56	146.58
		High Proficiency	-8.92	32.29	1.000	-89.99	72.15
	High Proficiency	Low Proficiency	74.43	32.29	.081	-6.64	155.50
		Medium Proficiency	8.92	32.29	1.000	-72.15	89.99

This table presents the results of the Bonferroni post hoc analysis for response times, including the mean differences, standard errors, p-values, and 95% confidence intervals for pairwise comparisons between three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, in case of the two items of the two experiments, PTE10 and PTU10.

In case of the English item, PTE10, there seems to be no statistically significant difference between the way the three groups responded. Comparing the Low Proficiency and Medium Proficiency groups showed a non-significant mean difference of 130.13 (SE = 63.90, p = .147), with a 95% confidence interval from -30.33 to 290.58. Similarly, the Low Proficiency and High Proficiency groups exhibited a non-significant mean difference of 112.75 (SE = 63.90, p = .258), with a 95% confidence interval from -47.70 to 273.21. There were no statistically significant mean differences between the Medium Proficiency and Low Proficiency groups (p = .147) or between the Medium Proficiency and High Proficiency groups (p = 1.000).

The High Proficiency group did not show a significant difference in mean response times when compared to the Low Proficiency group (p = .258) or the Medium Proficiency group (p = 1.000).

The case of the corresponding Urdu item, PTU10, is not any different. comparing the Low Proficiency and Medium Proficiency groups yielded a non-significant mean difference of -65.51 (SE = 32.29, p = .150), with a 95% confidence interval from -146.58 to 15.56. Similarly, the Low Proficiency and High Proficiency groups displayed a non-significant mean difference of -74.43 (SE = 32.29, p = .081), with a 95% confidence interval from -155.50 to 6.64. There were no statistically significant mean differences between the Medium Proficiency and Low Proficiency groups (p = .150) or between the Medium Proficiency and High Proficiency groups (p = 1.000). The High Proficiency group did not show a significant difference in mean response times when compared to the Low Proficiency group (p = .081) or the Medium Proficiency group (p = 1.000).

In both the items, most comparisons did not result in statistically significant differences in response times between the proficiency groups. However, some pairwise comparisons showed non-significant mean differences, suggesting no substantial differences in response times between the groups.

The above discussion suggests that no priming effect was seen among all the participants in both the Urdu and English experiments when the primes and the targets were unrelated. We have so far seen two sets of items with unrelated primes and targets, namely, PTE5 and PTE10, and PTU5 and PTU10, wherein there was no evidence of priming observed.

The case of PTE5 and PTE10 is interesting as the primes and targets in both these items were orthographically transparent. Still, there was no sign of orthographic priming having taken place in the observed results.

4.4.11 PTE11 vs. PTU11

The eleventh items in both the experiments had completely unrelated primes and targets. Hypothetically, no priming effects were expected in these items because of no similarity between the primes and the targets. However, it was necessary to put such items on the list of the experiments because they would provide the non-priming effect results which could be compared and contrasted with those showing full or partial priming effects.

Table 47

Prime and Target for PTU11

Code	Item No.	Prime	Target
PTU11	46	سوچتا	چلنا

The prime in this Urdu item was *sochta* meaning *thought* in English. It is the past form of a verb *sochna* in Urdu. The target word in this item was *chalna* which is a noun and a verb at the same time meaning *walking/working* in English.

The prime in the English item was *provided* which is the past form of the verb *provide*. The target was *summary* which is a noun in English.

Table 48

Prime and Target for PTE11

Code	Item No.	Prime	Target
PTE11	46	provided	SUMMARY

It can be seen that the primes and targets in both the Urdu and English item are completely unrelated. Because of the dissimilarity between the primes and the targets in both cases, no priming effect was expected in these items. Let us examine the table below.

Table 49

Descriptive Statistics for PTE11 and PTU11

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE11	Low Proficiency	917.37	43.57	829.00	1005.73
	Medium Proficiency	954.68	43.57	866.32	1043.05
	High Proficiency	906.00	43.57	817.64	994.37
PTU11	Low Proficiency	878.00	53.29	769.93	986.07

Medium Proficiency	941.43	53.29	833.36	1049.50
High Proficiency	855.64	53.29	747.57	963.70

This table provides descriptive statistics of response times, including mean response times, standard errors, and 95% confidence intervals, for three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, in response to the two corresponding items, PTE11 and PTU11.

The response to the English item, PTE11, was more or less similar by all the three groups. The mean response time for the Low Proficiency group was 917.37 (SE = 43.57), with a 95% confidence interval ranging from 829.00 to 1005.73. The Medium Proficiency group had a mean response time of 954.68 (SE = 43.57), with a 95% confidence interval ranging from 866.32 to 1043.05. The High Proficiency group exhibited a mean response time of 906.00 (SE = 43.57), with a 95% confidence interval ranging from 817.64 to 994.37.

In response to PTE11, the Medium Proficiency group had the highest mean response time (954.68), followed by the Low Proficiency group (917.37), and the High Proficiency group (906.00).

The response to the corresponding Urdu item, PTU11, was quite similar. The mean response time for the Low Proficiency group was 878.00 (SE = 53.29), with a 95% confidence interval ranging from 769.93 to 986.07. The Medium Proficiency group had a mean response time of 941.43 (SE = 53.29), with a 95% confidence interval ranging from 833.36 to 1049.50. The High Proficiency group displayed a mean response time of 855.64 (SE = 53.29), with a 95% confidence interval ranging from 747.57 to 963.70.

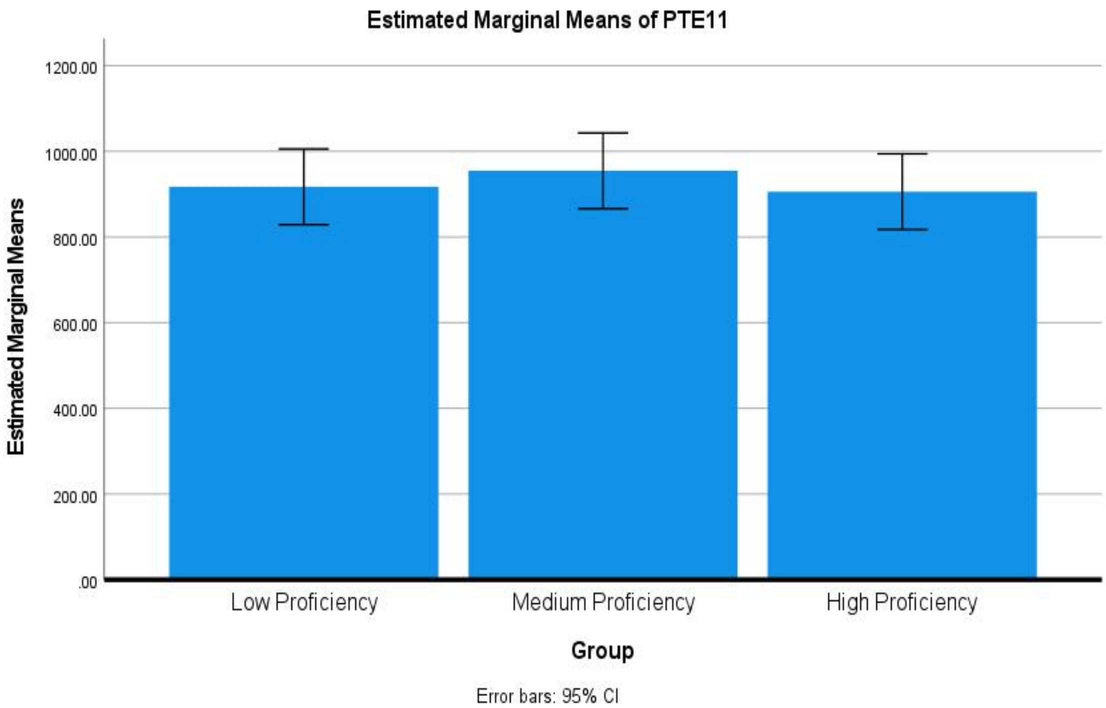
In the case of PTU11, the Medium Proficiency group had the highest mean response time (941.43), followed by the Low Proficiency group (878.00), and the High Proficiency group (855.64).

These response times indicate that no priming took place in any of the two items be it the English or the Urdu item. As discussed earlier in this subsection, the priming was not expected because the primes and targets in both the items were totally unrelated.

The following bar graphs will further illustrate the situation. Let us take a look at the bar chart of the English item (PTE11) first.

Figure 24

Estimated Marginal Means for PTE11



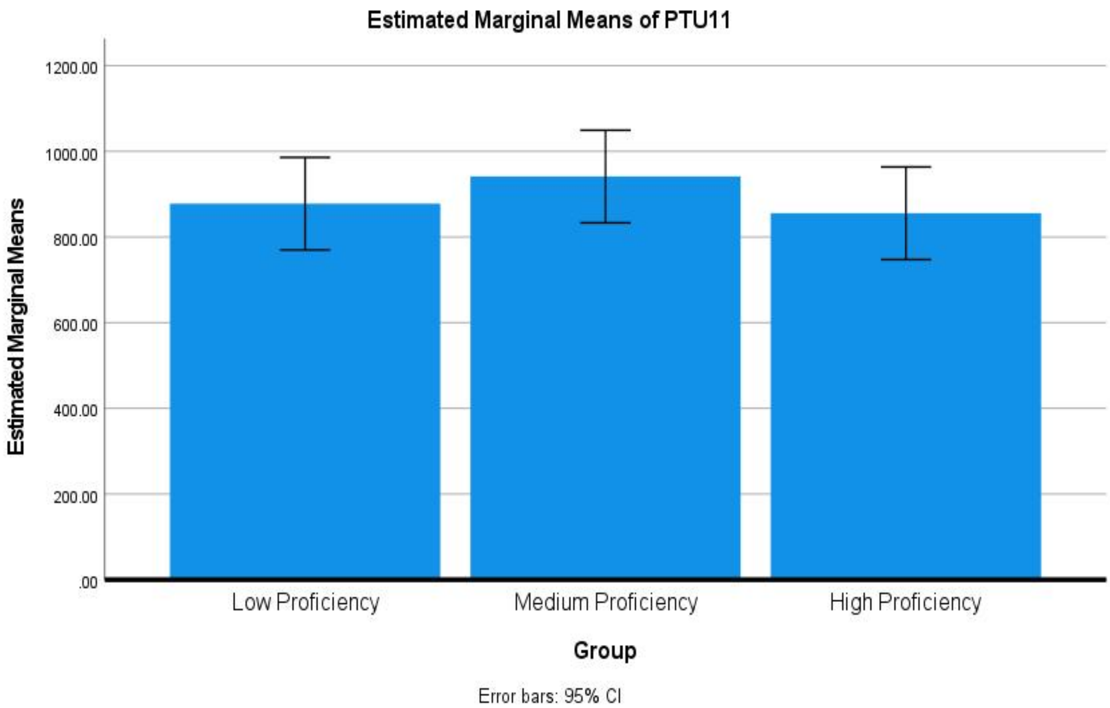
This bar chart shows that the medium proficiency group took more time in responding to the item as compared to the other two groups which were very similar in their respective responses. However, the magnitude of the difference in these response times is not significant. The error bars at the top of all the group bars overlap not only with one another but also with the line representing the overall mean response time of all the participants which renders these differences to be insignificant.

The insignificant difference between the mean response times of the three groups suggests that no priming effect took place in the case of this item. As discussed earlier, it was not expected as the prime and the target were not related.

Let us look at the bar chart pertaining to the corresponding Urdu item (PTU11):

Figure 25

Estimated Marginal Means for PTU11



As discussed earlier, the responses to this item were quite random in nature. The haphazard nature of the responses is evident from the structure of this bar chart too. The size of the error bars in each group is quite big which shows the randomness of the data in the backdrop. Although the average response time of the medium proficiency group can be seen to be a bit higher as compared to the other two groups, and that of the low proficiency group to be a bit lower in comparison with the other two groups, there seems to be no significance in it as the error bars are overlapping across the board.

Let us examine the table below containing contrast results between the high proficiency group and the other two groups.

Table 50

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE11 and PTU11

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
PTE11	Low	Medium	-37.32	61.62	1.000	-192.04	117.41

	Proficiency	Proficiency					
		High Proficiency	11.36	61.62	1.000	-143.36	166.09
	Medium Proficiency	Low Proficiency	37.32	61.62	1.000	-117.41	192.04
		High Proficiency	48.68	61.62	1.000	-106.04	203.40
	High Proficiency	Low Proficiency	-11.36	61.62	1.000	-166.09	143.36
		Medium Proficiency	-48.68	61.62	1.000	-203.40	106.04
PTU11	Low Proficiency	Medium Proficiency	-63.43	75.36	1.000	-252.66	125.79
		High Proficiency	22.37	75.36	1.000	-166.86	211.59
	Medium Proficiency	Low Proficiency	63.43	75.36	1.000	-125.79	252.66
		High Proficiency	85.80	75.36	.787	-103.43	275.02
	High Proficiency	Low Proficiency	-22.37	75.36	1.000	-211.59	166.86
		Medium Proficiency	-85.80	75.36	.787	-275.02	103.43

This table presents the results of the Bonferroni post hoc analysis for response times, including the mean differences, standard errors, p-values, and 95% confidence intervals for pairwise comparisons between three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, in response to the two items under consideration, PTE11 and PTU11.

The data suggest that there is no significant difference between the groups in the case of PTE11. Comparing the Low Proficiency and Medium Proficiency groups showed a non-significant mean difference of -37.32 (SE = 61.62, p = 1.000), with a 95% confidence interval from -192.04 to 117.41. Similarly, the Low Proficiency and High Proficiency groups exhibited a non-significant mean difference of 11.36 (SE = 61.62, p = 1.000), with a 95% confidence interval from -143.36 to 166.09. There were no statistically significant mean differences between the Medium Proficiency and Low Proficiency groups (p = 1.000) or between the Medium Proficiency and High Proficiency groups (p = 1.000).

The High Proficiency group did not show a significant difference in mean response times when compared to the Low Proficiency group (p = 1.000) or the Medium Proficiency group (p = 1.000).

The case of the Urdu item, PTU11, is not different. Comparing the Low Proficiency and Medium Proficiency groups yielded a non-significant mean difference of -63.43 (SE = 75.36, p = 1.000), with a 95% confidence interval from -252.66 to 125.79. Similarly, the Low Proficiency and High Proficiency groups displayed a non-significant mean difference of 22.37 (SE = 75.36, p = 1.000), with a 95% confidence interval from -166.86 to 211.59. There were no statistically significant mean differences between the Medium Proficiency and Low Proficiency groups (p = 1.000) or between the Medium Proficiency and High Proficiency groups (p = .787).

In both the cases, the pairwise comparisons did not result in statistically significant differences in response times between the proficiency groups, suggesting no substantial differences in response times across the proficiency levels.

The above discussion suggests that no priming effect was seen among all the participants in both the Urdu and English experiments when the primes and the targets were unrelated. We have so far seen three sets of items with unrelated primes and targets, namely, PTE5, PTE10, and PTE11 and PTU5, PTU10 and PTU11, wherein there was no evidence of priming observed.

4.4.12 PTE12 vs. PTU12

These two items, and the next three item in the discussion, were included in the experiments in order to find out the presence or absence of priming effects in the case of derivatives derived from nouns and verbs. The first two sets of primes and targets in this section of the two experiments are derivational adjectives in the case of Urdu and the last two pairs of items are derived nouns. Let us examine the primes and targets of this pair of items.

Table 51

Prime and Target for PTU12

Code	Item No.	Prime	Target
PTU12	51	اسلامی	اسلام

The prime in this Urdu item was *Islami* meaning *Islamic* in English. It is an adjective in Urdu and is the adjectival derivation of the target word in this item which was *Islam* which is a noun in Urdu.

This pair of prime and target words was put on the list of items which aimed at determining the occurring of partial priming. Whether the native speakers of Urdu show some priming effects in case of derivatives (morphologically complex words) remains to be seen.

The prime in the corresponding English item was *slowly* which an adverbial derivation of *slow* which is an adjective. The derivation was used as the prime while the adjective was used as the target in this item.

Table 52

Prime and Target for PTE12

Code	Item No.	Prime	Target
PTE12	51	slowly	SLOW

This pair of prime and target was placed in the experiment in order to find out whether any priming takes place in the case of derivations among the non-native speakers of English. Previously, there was some evidence of the onset of priming in cases of past tense and plural inflections. This item is different because it deals with derivations.

Let us examine the table below to see how the three groups responded to both these items.

Table 53

Descriptive Statistics for PTE12 and PTU12

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE12	Low Proficiency	835.10	36.46	761.17	909.04
	Medium Proficiency	837.57	36.46	763.63	911.50
	High Proficiency	692.18	36.46	618.24	766.11

	Low Proficiency	737.61	20.44	696.15	779.06
PTU12	Medium Proficiency	688.92	20.44	647.46	730.37
	High Proficiency	679.87	20.44	638.42	721.32

This table provides descriptive statistics of response times, including mean response times, standard errors, and 95% confidence intervals, for three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, responding to the two items under focus, PTE12 and PTU12.

In the case of PTE11, the mean response time for the Low Proficiency group was 835.10 (SE = 36.46), with a 95% confidence interval ranging from 761.17 to 909.04. The Medium Proficiency group had a mean response time of 837.57 (SE = 36.46), with a 95% confidence interval ranging from 763.63 to 911.50. The High Proficiency group exhibited a mean response time of 692.18 (SE = 36.46), with a 95% confidence interval ranging from 618.24 to 766.11.

In response to PTE12, the Medium Proficiency group had the highest mean response time (837.57), followed by the Low Proficiency group (835.10), and the High Proficiency group (692.18).

Dealing with PTU12, the mean response time for the Low Proficiency group was 737.61 (SE = 20.44), with a 95% confidence interval ranging from 696.15 to 779.06. The Medium Proficiency group had a mean response time of 688.92 (SE = 20.44), with a 95% confidence interval ranging from 647.46 to 730.37. The High Proficiency group displayed a mean response time of 679.87 (SE = 20.44), with a 95% confidence interval ranging from 638.42 to 721.32.

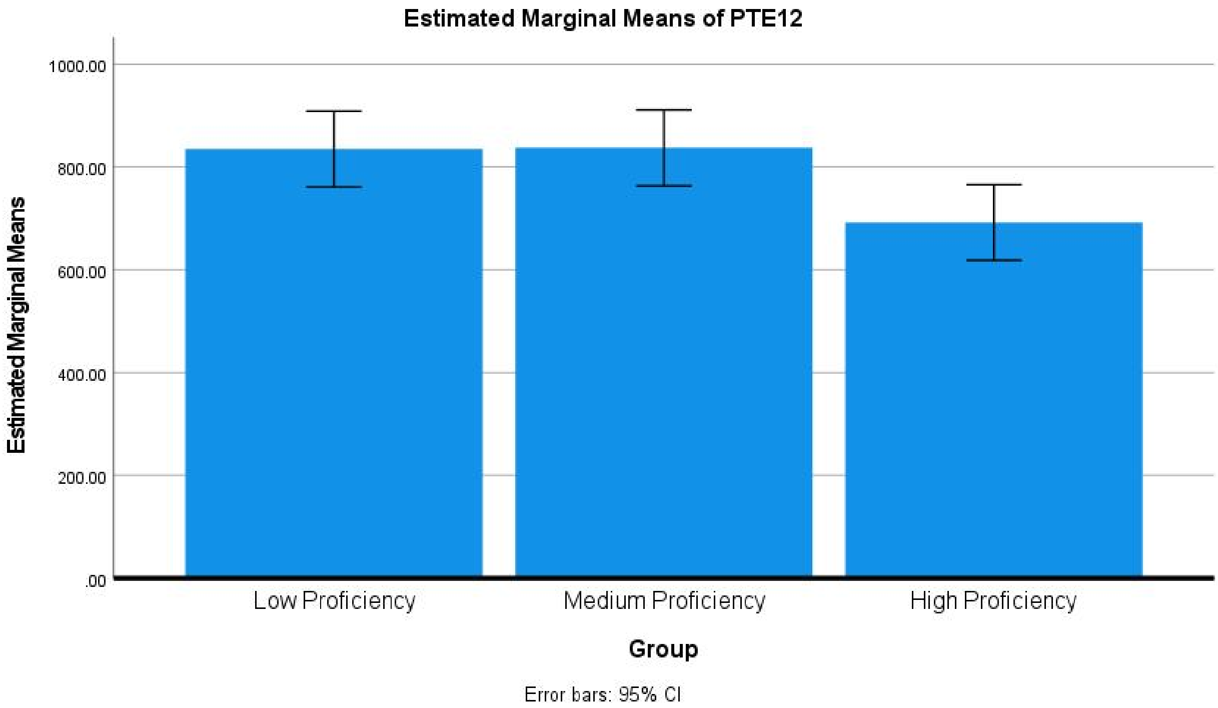
In the case of PTU12, the Low Proficiency group had the highest mean response time (737.61), followed by the Medium Proficiency group (688.92), and the High Proficiency group (679.87).

The statistics above create an impression that the high proficiency group responded to the English item in a very similar response time to that of all the groups responding to the Urdu item. This suggests priming effects in the Urdu item in case of all the groups while in the English item, only the high proficiency group showed the priming effects.

The following bar graphs further clarify the situation.

Figure 26

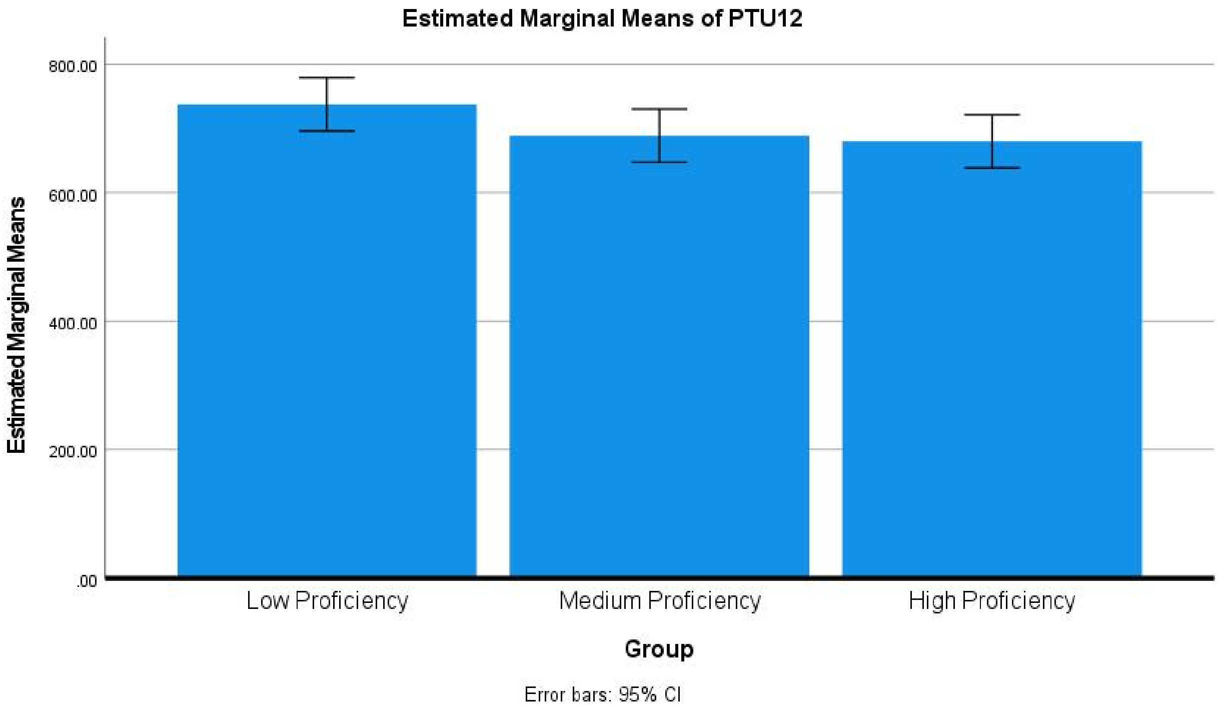
Estimated Marginal Means for PTE12



The above bar graph shows that the high proficiency group took considerably less time as compared to the other two groups in their response to the English item (PTE12). The higher error bar on the top of the bar belonging to the high proficiency group is clearly below the line denoting the observed grand mean while the mean response times of the other two groups are above it. This means that the high proficiency group did experience some priming effects of the inflection used as a prime in this item whereas no priming took place in the case of the other two groups.

Figure 27

Estimated Marginal Means for PTU12



The above bar graph shows the slight variations among the response times of the respondents belonging to the three groups. The variations are slight as there is no significant difference between the mean response times. The bars and their respective error bars overlap with one another as well as with the line showing the overall mean response times.

In order to further investigate the prima facie impressions, let us examine the table below showing the difference between groups and its significance level.

Table 54

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE12 and PTU12

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PTE12	Low	Medium	-2.46	51.56	1.000	-131.92	127.00

	Proficiency	Proficiency					
		High Proficiency	142.9285*	51.56	.026	13.47	272.39
	Medium Proficiency	Low Proficiency	2.46	51.56	1.000	-127.00	131.92
		High Proficiency	145.3896*	51.56	.023	15.93	274.85
	High Proficiency	Low Proficiency	-142.9285*	51.56	.026	-272.39	-13.47
		Medium Proficiency	-145.3896*	51.56	.023	-274.85	-15.93
PTU12	Low Proficiency	Medium Proficiency	48.69	28.91	.302	-23.89	121.27
		High Proficiency	57.74	28.91	.160	-14.85	130.32
	Medium Proficiency	Low Proficiency	-48.69	28.91	.302	-121.27	23.89
		High Proficiency	9.05	28.91	1.000	-63.54	81.63
	High Proficiency	Low Proficiency	-57.74	28.91	.160	-130.32	14.85
		Medium Proficiency	-9.05	28.91	1.000	-81.63	63.54

The above table presents the results of post hoc analysis for response times, including the mean differences, standard errors, significance (Sig.), and 95% confidence intervals for three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, in the two items (PTE12 and PTU12).

In the case of the English item, PTE12, the high proficiency group responded significantly differently compared to the other two groups. For the comparison between the Low Proficiency and Medium Proficiency groups, there was a non-significant mean difference of -2.46 (SE = 51.56) with a p-value of 1.000, indicating no significant difference in response times between these groups. In the comparison between the Low Proficiency and the High Proficiency groups, there was a significant mean difference of 142.93 (SE = 51.56) with a p-value of 0.026. The 95% confidence interval (CI) ranged from 13.47 to 272.39, suggesting that the High Proficiency group had significantly higher response times compared to the Low Proficiency group. The Medium Proficiency and High Proficiency groups also showed a significant mean difference of 145.39 (SE = 51.56) with a p-value of 0.023. The 95% CI ranged from 15.93 to 274.85, indicating that the High Proficiency group had significantly higher response times compared to the Medium Proficiency group.

In summary, in PTE12, the High Proficiency group had significantly lower response times compared to both the Low Proficiency and Medium Proficiency groups.

On the other hand, no significant differences were observed between the way the participants responded to the corresponding Urdu item, PTU12. The comparison between the Low Proficiency and the Medium Proficiency groups showed a non-significant mean difference of 48.69 (SE = 28.91) with a p-value of 0.302, indicating no significant difference in response times between these groups. Similarly, the comparison between Low Proficiency and High Proficiency groups revealed a non-significant mean difference of 57.74 (SE = 28.91) with a p-value of 0.160, suggesting no significant difference in response times between these groups. The Medium Proficiency and High Proficiency groups also showed a non-significant mean difference of 9.05 (SE = 28.91) with a p-value of 1.000, indicating no significant difference in response times between these groups.

In summary, in the case of PTU12, there were no significant differences in response times among the Low Proficiency, Medium Proficiency, and High Proficiency groups.

The contents of the above table further solidify the impression that partial priming took place across the groups in the case of the Urdu item while it happened only in case of the high proficiency group while responding to the English item.

In the light of the above discussion, it can be concluded that all the three groups displayed some effects of partial priming in case of the Urdu item (Urdu being their native language). No priming effects could be seen in case of the low and medium proficiency groups in response to the English item (PTE12). However, the high proficiency group did show some priming effects while responding to this item. This further substantiates the hypothesis that the highly proficient users of a language do break down the morphologically complex words even if it is not their native language (Zeng et al., 2019; Clahsen, 2008).

4.4.13 PTE13 vs. PTU13

As discussed in the previous subsection, there were four sets of items in both the Urdu and the English experiments aiming at determining the presence (or absence) of priming effects in the case of derivations. This pair of items is the second on the list. In the previous Urdu and English items, we observed partial priming taking place. In the case of Urdu item (PTU12), the priming effect was observed across all the three groups while in the case of the English item (PTE12) the priming occurred only in the case of the high proficiency group. The pair of items under discussion (PTU13 and PTE13) aims at finding the same phenomenon.

Table 55

Prime and Target for PTU13

Code	Item No.	Prime	Target
PTU13	52	عقلی	عقل

The prime in this Urdu item was *Aqli* meaning *rational* in English. It is an adjective in Urdu and is the adjectival derivation of the target word in this item which was *Aqal* which is a noun in Urdu and means *intellect*.

This pair of prime and target are semantically very closely related. In fact, the prime is derived from the target. Since the respondents were all native speakers of Urdu, they were expected to show some priming effects in this case. Whether the priming took place or not, will be seen in the following discussion of the analysis.

The prime in the English item was *politely* which an adverbial derivation of *polite* which is an adjective. The derivation was used as the prime while the adjective was used as the target in this item.

Table 56

Prime and Target for PTE13

Code	Item No.	Prime	Target
PTE13	52	politely	POLITE

This pair of prime and target was placed in the experiment in order to find out whether any priming takes place in the case of derivations among the non-native speakers of English. In the case of the previous English item (PTE12), there was some solid evidence of the onset of priming in the case of derivations. This item is set to see the similar process.

Let us examine the table below to see how the three groups responded to both these items.

Table 57

Descriptive Statistics for PTE13 and PTU13

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE13	Low Proficiency	975.82	53.92	866.46	1085.18
	Medium Proficiency	769.46	53.92	660.10	878.82
	High Proficiency	729.25	53.92	619.89	838.60
PTU13	Low Proficiency	707.23	18.87	668.95	745.50
	Medium Proficiency	726.45	18.87	688.17	764.72
	High Proficiency	731.03	18.87	692.75	769.30

The above table shows the results of the analysis for response times, including the mean, standard error, and 95% confidence intervals (CI), for three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, in the two items under discussion (PTE13 and PTU13).

Responding to PTE13, the Low Proficiency group had a mean response time of 975.82 (SE = 53.92) with a 95% CI ranging from 866.46 to 1085.18. The Medium Proficiency group had a mean response time of 769.46 (SE = 53.92) with a 95% CI ranging from 660.10 to 878.82. The High Proficiency group had a mean response time of 729.25 (SE = 53.92) with a 95% CI ranging from 619.89 to 838.60.

These results indicate that, in PTE13, the Low Proficiency group had the highest mean response time, followed by the Medium Proficiency group, and the High Proficiency group had the lowest mean response time.

In the case of PTU13, the Low Proficiency group had a mean response time of 707.23 (SE = 18.87) with a 95% CI ranging from 668.95 to 745.50. The Medium Proficiency group had a mean response time of 726.45 (SE = 18.87) with a 95% CI ranging from 688.17 to 764.72. The High Proficiency group had a mean response time of 731.03 (SE = 18.87) with a 95% CI ranging from 692.75 to 769.30.

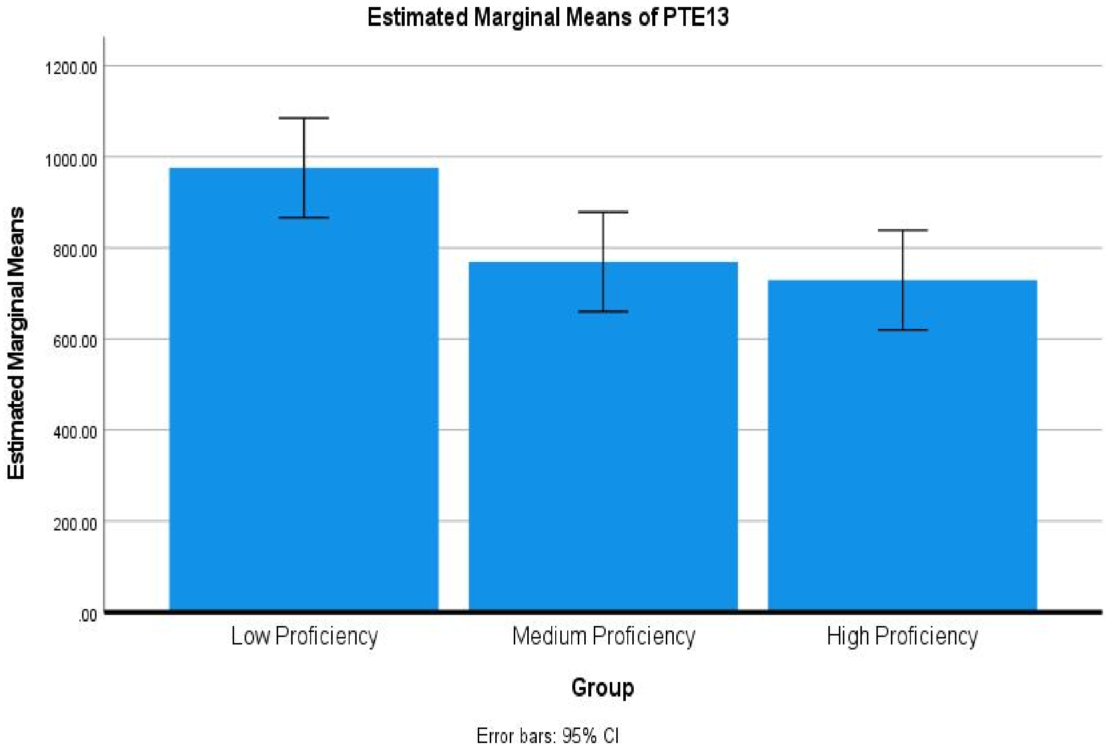
This shows that the Low Proficiency group had the lowest mean response time, followed by the Medium Proficiency group, and the High Proficiency group had the highest mean response time. The differences in mean response times among these proficiency groups in PTU13 were relatively small.

In case of the English item, the low and the medium proficiency groups responded in a haphazard manner. Not only are their mean response times high, but also their respective standard error scores are high, which indicate that the response was of a mixed kind. However, the high proficiency group stands apart in their response to the English item. Their mean response time is low. It suggests that all the respondents in the group responded in a precise manner and there was no fluctuation in the individual response times. The mean response time of the high proficiency group in the English item is also very similar to the overall response of all the respondents in the Urdu item. It suggests that priming did take place in case of the English item only among the respondents belonging to the high proficiency group while it took place across the board in the case of the English item.

The following figures will further clarify the situation.

Figure 28

Estimated Marginal Means for PTE13

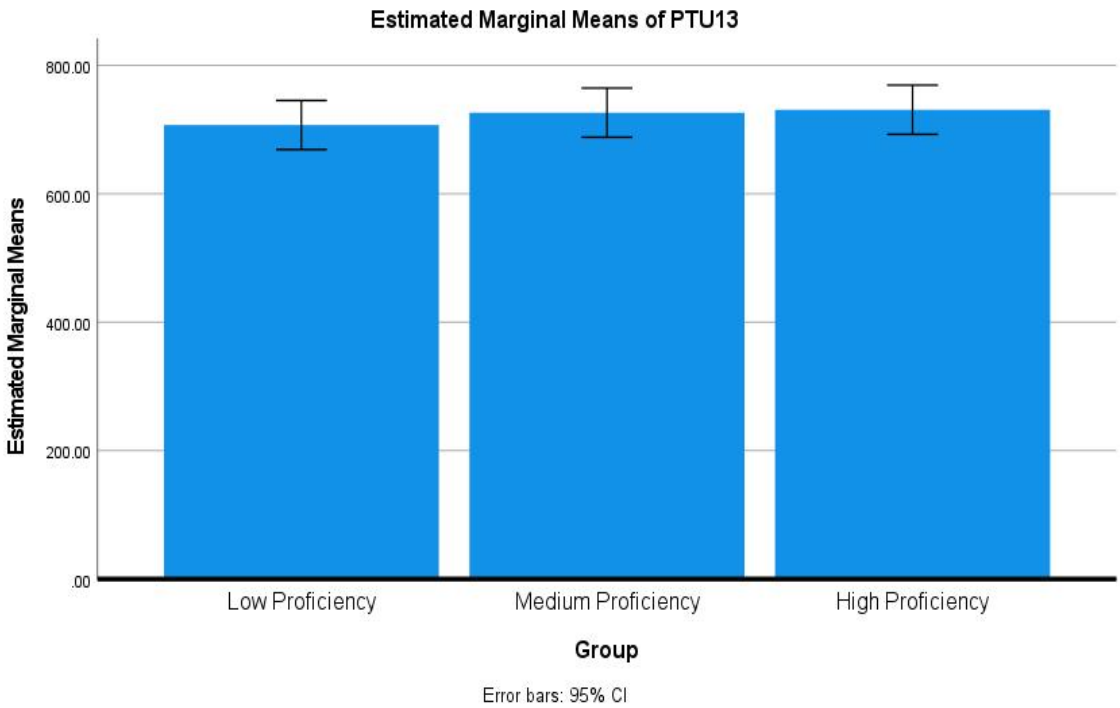


The above figure shows that the medium and the high proficiency groups took considerably less time as compared to the low proficiency group in their response to the English item (PTE13). The gradual decrease in the response time averages from the low proficiency group towards the high proficiency group indicates that the effect of priming in case of this item is directly linked to the proficiency in the language. However, the low mean response time of the high proficiency group and the similarity of the score with the mean response times in the corresponding Urdu item strongly suggest the onset of priming in this case.

Let us now consider the case of the Urdu item (PTU13):

Figure 29

Estimated Marginal Means for PTU13



The above figure shows the slight variations among the response times of the respondents belonging to the three groups. In fact, they seem very similar to one another. The variations are slight as there is no significant difference between the mean response times. The bars and their respective error bars overlap with one another as well as with the line showing the overall mean response times.

Let us try to examine the differences and similarities in the response times with the help of the following post hoc results.

Table 58

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE13 and PTU13

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
PTE13	Low Proficiency	Medium Proficiency	206.3600*	76.26	.031	14.88	397.84
		High Proficiency	246.5769*	76.26	.008	55.09	438.06

	Medium Proficiency	Low Proficiency	-206.3600*	76.26	.031	-397.84	-14.88
		High Proficiency	40.22	76.26	1.000	-151.27	231.70
	High Proficiency	Low Proficiency	-246.5769*	76.26	.008	-438.06	-55.09
		Medium Proficiency	-40.22	76.26	1.000	-231.70	151.27
PTU13	Low Proficiency	Medium Proficiency	-19.22	26.69	1.000	-86.24	47.80
		High Proficiency	-23.80	26.69	1.000	-90.82	43.22
	Medium Proficiency	Low Proficiency	19.22	26.69	1.000	-47.80	86.24
		High Proficiency	-4.58	26.69	1.000	-71.60	62.44
	High Proficiency	Low Proficiency	23.80	26.69	1.000	-43.22	90.82
		Medium Proficiency	4.58	26.69	1.000	-62.44	71.60

This table provides the results of the post hoc analysis for response times, which compares mean differences, standard errors, significance levels (Sig.), and 95% confidence intervals (CI) between three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, for the two items under focus (PTE13 and PTU13).

The mean difference (Low Proficiency - Medium Proficiency) was 206.36 with a standard error (SE) of 76.26. The result was statistically significant (Sig. = 0.031), indicating a significant difference between the Low Proficiency and Medium Proficiency groups in response to PTE13. The 95% confidence interval (CI) for this difference ranged from 14.88 to 397.84.

The mean difference (Low Proficiency - High Proficiency) was 246.58 with an SE of 76.26. The result was statistically significant (Sig. = 0.008), indicating a significant difference between the low proficiency and high proficiency groups. The 95% CI for this difference ranged from 55.09 to 438.06.

The mean difference (Medium Proficiency - High Proficiency) was 40.22 with an SE of 76.26. This result was not statistically significant (Sig. = 1.000). The 95% CI for this difference ranged from -151.27 to 231.70.

No statistically significant differences were observed in the case of PTU13. However, the response times across the three groups were quite similar to those of the medium and high proficiency groups responding to the corresponding English item, which indicates the onset of partial priming in this item (PTU13).

Between Low Proficiency and Medium Proficiency groups the mean difference (Low Proficiency - Medium Proficiency) was -19.22 with a SE of 26.69. This result was not statistically significant (Sig. = 1.000). The 95% CI for this difference ranged from -86.24 to 47.80. Between Low Proficiency and High Proficiency groups in PTU13, the mean difference (Low Proficiency - High Proficiency) was -23.80 with an SE of 26.69. This result was not statistically significant (Sig. = 1.000). The 95% CI for this difference ranged from -90.82 to 43.22. The mean difference (Medium Proficiency - High Proficiency) was -4.58 with an SE of 26.69. This result was not statistically significant (Sig. = 1.000). The 95% CI for this difference ranged from -71.60 to 62.44.

These results indicate that there were significant differences in mean response times between the Low Proficiency and Medium Proficiency groups, as well as between the Low Proficiency and High Proficiency groups in Experiment PTE13. However, there was no significant difference between the Medium Proficiency and High Proficiency groups. This indicates that both the Medium Proficiency and High Proficiency groups experienced the onset of partial priming in this case. This also indicates that the processing of morphologically complex words in the second language is not exclusive to the high proficiency achievers. It is a progressive phenomenon, and, in some cases, the medium proficiency level learners can also exhibit it.

The contents of the above table further solidify the impression that partial priming took place across the groups in the case of the Urdu item while it happened in case of the medium and the high proficiency groups while responding to the English item.

4.4.14 PTE14 vs. PTU14

The Urdu and English items to be discussed in this section, again, belong to the section of the experiments that aimed at determining the priming effects in case of derivatives. These items also have derivations as their primes and the sources of the derivations as their targets.

Table 59

Prime and Target for PTU14

Code	Item No.	Prime	Target
PTU14	53	پرلطف	لطف

The prime in this Urdu item was *pur-lutf* meaning *enjoyable/funny* in English. It is an adjective in Urdu and is the adjectival derivation of the target word in this item which was *lutf* which is a noun in Urdu and means *fun/enjoyment*.

In Urdu morphology, there are a number of prefixes that derive a word from another word belonging to a different word class. In this case there is a lot of orthographic similarity as well as the semantic similarity.

The prime in the English item was *treatment* which a noun derived from *treat* which is a verb. The derivation was used as the prime while the verb was used as the target in this item.

Table 60

Prime and Target for PTE14

Code	Item No.	Prime	Target
PTE14	53	treatment	TREAT

This pair of prime and target was placed in the experiment for the same purpose as the previous two items: to find out whether any priming takes place in the case of derivations among the non-native speakers of English. In the case of the previous two English items (PTE12 and PTE13), there was some solid evidence of the priming effects in the case of derivations. This item is set to see the similar process.

Let us examine the table below to see how the three groups responded to both these items.

Table 61

Descriptive Statistics for PTE14 and PTU14

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE14	Low Proficiency	915.38	31.14	852.24	978.53
	Medium Proficiency	858.74	31.14	795.60	921.89
	High Proficiency	750.97	31.14	687.83	814.12
PTU14	Low Proficiency	762.51	21.01	719.90	805.12
	Medium Proficiency	728.15	21.01	685.53	770.76
	High Proficiency	737.09	21.01	694.48	779.71

This table displays the results for response times among three different proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency, for the two items involving adjectival inflections (PTE14 and PTU14).

In case of the English item, PTE14, the Low Proficiency group responded with the mean response time of 915.38, with a standard error (Std. Error) of 31.14. The 95% confidence interval (CI) for this group ranged from 852.24 to 978.53. In the Medium Proficiency group, the mean response time was 858.74, with a Std. Error of 31.14. The 95% CI for this group ranged from 795.60 to 921.89. In the High Proficiency group, the mean response time was 750.97, with a Std. Error of 31.14. The 95% CI for this group ranged from 687.83 to 814.12.

These statistics indicate that the high proficiency group did experience the onset of partial priming in this case.

As far as the corresponding Urdu item is concerned, in the Low Proficiency group, the mean response time was 762.51, with a Std. Error of 21.01. The 95% CI for this group ranged from 719.90 to 805.12. In the Medium Proficiency group, the mean response time was 728.15, with a Std. Error of 21.01. The 95% CI for this group ranged from 685.53 to 770.76. In the High Proficiency group, the mean response time was

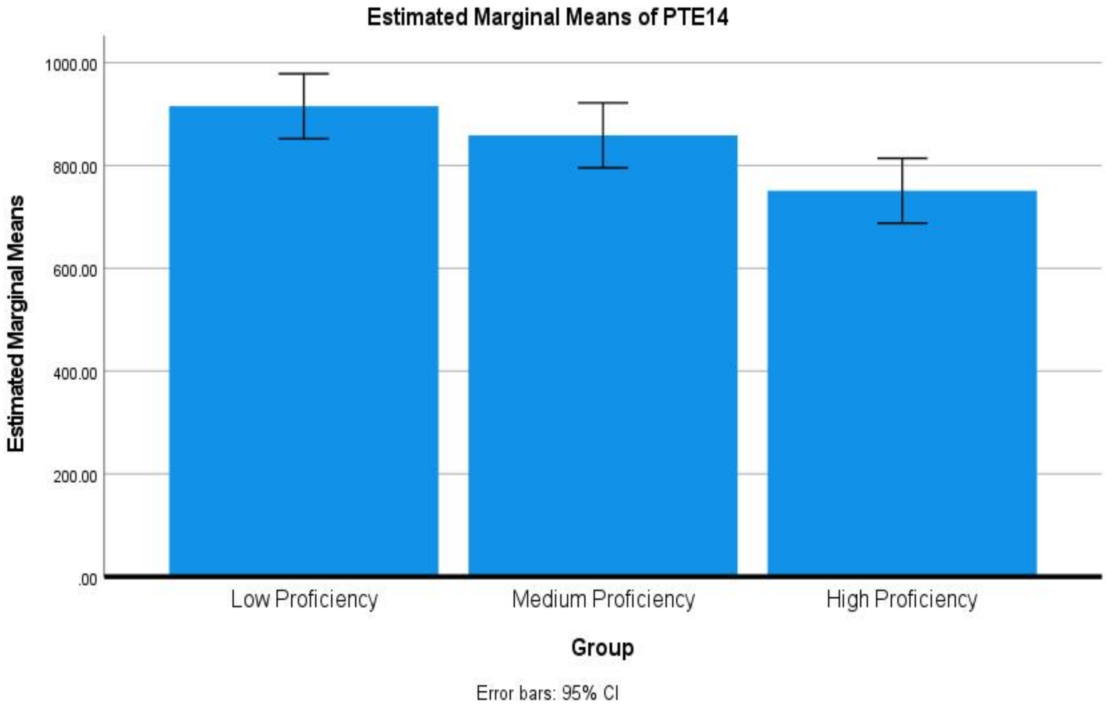
737.09, with a Std. Error of 21.01. The 95% CI for this group ranged from 694.48 to 779.71.

These statistics suggest that the priming took place across all the groups in response to the Urdu item (PTU14).

The following figures will further clarify the situation.

Figure 30

Estimated Marginal Means for PTE14

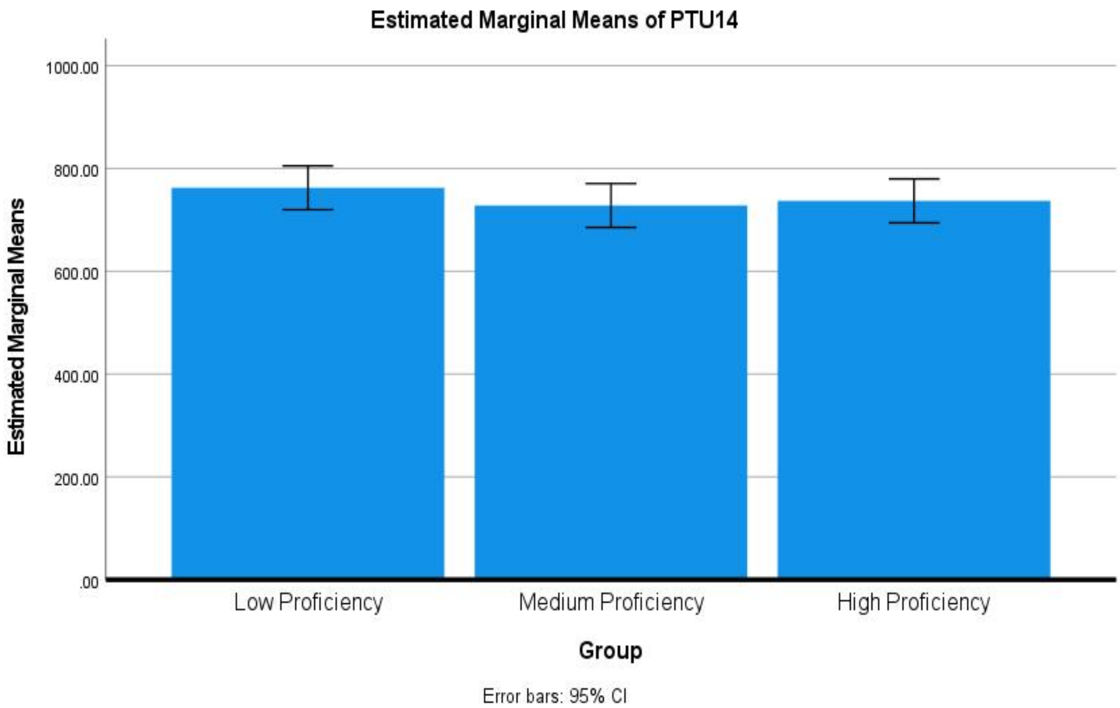


The above figure shows that the high proficiency group took considerably less time as compared to the other two groups in their response to the English item (PTE14). Therefore, we can conclude that the high proficiency group did show some priming effects. The other two groups responded in higher response times. This means that their responses were not affected by the prime in this item (PTE14).

Let us now consider the case of the Urdu item (PTU14):

Figure 31

Estimated Marginal Means for PTU14



The above figure shows that the low proficiency group took a little more time, on average, to respond to this Urdu item as compared to the medium and high proficiency groups. However, the difference is not statistically significant as we saw in the contrasts results above. As far as priming is concerned, it is easy to conclude that partial priming is evident in the responses given by all the three groups.

Let us examine the following post hoc results table in order to further evaluate the situation:

Table 62

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE14 and PTU14

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
PTE14	Low Proficiency	Medium Proficiency	56.64	44.03	.620	-53.92	167.21
		High Proficiency	164.4102*	44.03	.002	53.85	274.97

	Medium Proficiency	Low Proficiency	-56.64	44.03	.620	-167.21	53.92
		High Proficiency	107.77	44.03	.058	-2.80	218.33
	High Proficiency	Low Proficiency	-164.4102*	44.03	.002	-274.97	-53.85
		Medium Proficiency	-107.77	44.03	.058	-218.33	2.80
PTU14	Low Proficiency	Medium Proficiency	34.36	29.72	.765	-40.26	108.98
		High Proficiency	25.42	29.72	1.000	-49.20	100.03
	Medium Proficiency	Low Proficiency	-34.36	29.72	.765	-108.98	40.26
		High Proficiency	-8.94	29.72	1.000	-83.56	65.67
	High Proficiency	Low Proficiency	-25.42	29.72	1.000	-100.03	49.20
		Medium Proficiency	8.94	29.72	1.000	-65.67	83.56

The table outlines the outcomes of post hoc analyses conducted in the two cases under focus, PTE14 and PTU14, investigating response times across three proficiency groups: Low Proficiency, Medium Proficiency, and High Proficiency.

In PTE14, significant differences emerged in certain comparisons. The Low Proficiency group exhibited a non-significant mean difference (56.64, SE = 44.03) when compared to the Medium Proficiency group (p = 0.620), indicating no significant disparity. Conversely, when compared to the High Proficiency group, the Low Proficiency group displayed a substantial mean difference (164.41, SE = 44.03) with a significant result (p = 0.002), signifying a noteworthy contrast. Similarly, the Medium Proficiency group did not significantly differ from the Low Proficiency group. The mean difference was -56.64 (SE = 44.03), and the p-value was 0.620. When compared to the High Proficiency group, the Medium Proficiency group showed a marginally significant mean difference (107.77, SE = 44.03) with p = 0.058.

In PTU14, there were no significant differences in response times between the Low Proficiency and Medium Proficiency groups (mean difference = 34.36, SE = 29.72, p = 0.765). Likewise, the Low Proficiency group did not significantly differ from the High Proficiency group (mean difference = 25.42, SE = 29.72, p = 1.000). The Medium

Proficiency group did not significantly differ from the Low Proficiency group (mean difference = -34.36, SE = 29.72, p = 0.765) or the High Proficiency group (mean difference = 8.94, SE = 29.72, p = 1.000). The High Proficiency group did not exhibit significant differences in response times when compared to the Low Proficiency group (mean difference = -25.42, SE = 29.72, p = 1.000) or the Medium Proficiency group (mean difference = 8.94, SE = 29.72, p = 1.000).

In the case of the English item, the high proficiency group displayed robust priming effects as their response was more precise and they took lesser time. In case of the low and the medium proficiency groups, the response times were too high to be indicative of a precise and similar response. Therefore, it would be incorrect to conclude that any priming took place in these cases.

4.4.15 PTE15 vs. PTU15

This pair of items in both the Urdu and English experiments, again, belongs to the section of the experiments that aimed at determining the priming effects in case of derivatives. In fact, this is the last pair of items aimed at determining priming in case of derivatives in both Urdu and English languages. These items also have derivations as their primes and the sources of the derivations as their targets.

Table 63

Prime and Target for PTU15

Code	Item No.	Prime	Target
PTU15	54	پرنم	نم

The prime in the Urdu item was *pur-nam* meaning *moist* in English. It is an adjective in Urdu and is the adjectival derivation of the target word in this item which was *nam* which is a noun in Urdu and means *moisture*.

In Urdu morphology, there are a number of prefixes that derive a word from another word belonging to a different word class. In this case there is a lot of orthographic similarity as well as the semantic similarity.

This Urdu item, like the previous three Urdu items, was specifically included in the experiment to find out whether the native speakers of Urdu display any priming effects in case of derivations. In the previous Urdu item (PTE14), the high and the medium proficiency groups did show some priming effects in case of Urdu derivations. On the contrary, the low proficiency group did not show any strong priming effects even though they are the native speakers of the language.

The prime in the English item was *adjustment* which a noun derived from *adjust* which is a verb. The derivation was used as the prime while the verb was used as the target in this item.

Table 64

Prime and Target for PTE15

Code	Item No.	Prime	Target
PTE15	54	adjustment	ADJUST

As mentioned above, this item was also one amongst those set to observe the existence of priming in case of derivations in English. In the case of the previous three English items (PTE12, PTE13, and PTE14), there was some solid evidence of the priming effects in the case of derivations. This item is aimed at finding the similar phenomenon.

Let us examine the table below to see how the three groups responded to both these items.

Table 65

Descriptive Statistics for PTE15 and PTU15

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE15	Low Proficiency	938.49	48.32	840.49	1036.49
	Medium Proficiency	909.36	48.32	811.36	1007.36
	High Proficiency	772.75	48.32	674.74	870.75
PTU15	Low Proficiency	900.28	56.22	786.26	1014.31
	Medium	817.75	56.22	703.72	931.77

Proficiency				
High Proficiency	755.62	56.22	641.60	869.65

The table displays the means, standard errors, and 95% confidence intervals for the two items (PTE15 and PTU15) across three proficiency groups (Low Proficiency, Medium Proficiency, and High Proficiency) for the dependent variable.

In case of the English item, PTE15, the mean for the Low Proficiency group is 938.49, with a standard error of 48.32. The 95% confidence interval ranges from 840.49 to 1036.49, indicating that we can be 95% confident that the true population mean falls within this interval. The mean for the Medium Proficiency group is 909.36, with a standard error of 48.32. The 95% confidence interval ranges from 811.36 to 1007.36. The mean for the High Proficiency group is 772.75, with a standard error of 48.32. The 95% confidence interval ranges from 674.74 to 870.75.

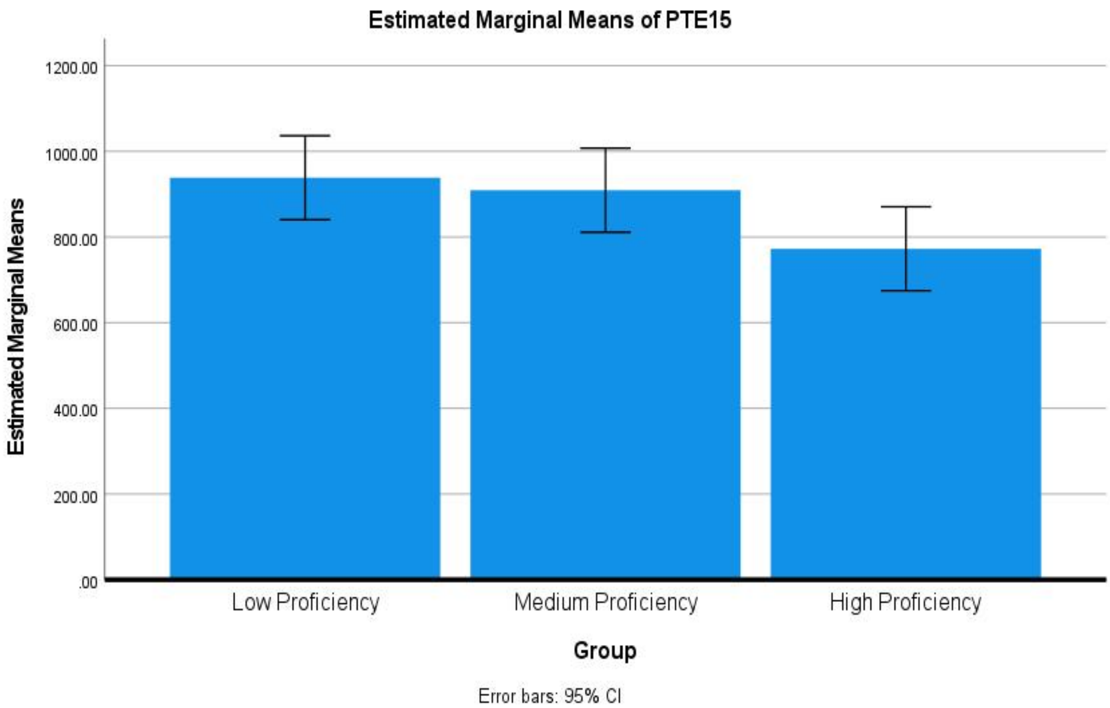
As far as the corresponding Urdu item (PTU15) is concerned, the mean for the Low Proficiency group in PTU15 is 900.28, with a standard error of 56.22. The 95% confidence interval ranges from 786.26 to 1014.31. The mean for the Medium Proficiency group is 817.75, with a standard error of 56.22. The 95% confidence interval ranges from 703.72 to 931.77. The mean for the High Proficiency group is 755.62, with a standard error of 56.22. The 95% confidence interval ranges from 641.60 to 869.65.

The statistics above create an impression that the high proficiency group responded to the English item in a very similar response time to that of the medium and high proficiency groups responding to the Urdu item. This suggests priming effects in the Urdu item in case of the medium and high proficiency groups while in the English item, only the high proficiency group showed the priming effects. The low proficiency group responded in a very similar manner to both the Urdu and English items which denotes the absence of priming in both cases.

The following bar graphs will further clarify the situation.

Figure 32

Estimated Marginal Means for PTE15

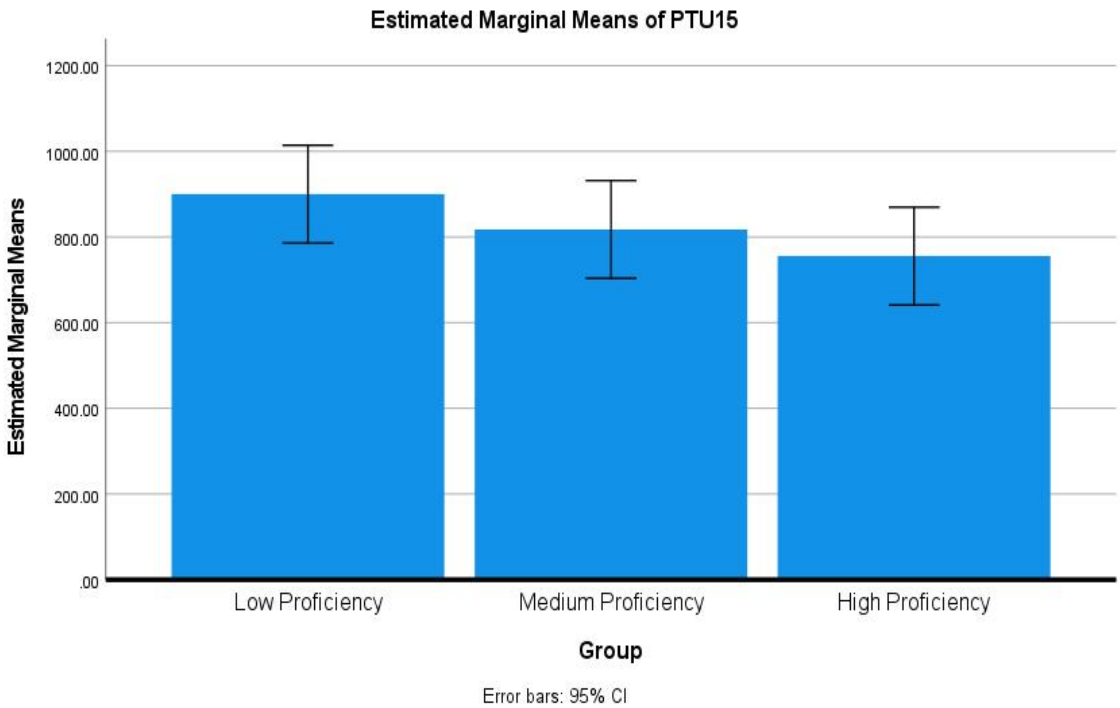


The above bar graph shows that the high proficiency group took considerably less time as compared to the other two groups in their response to the English item (PTE15). However, the haphazard nature of response in case of the high proficiency group makes the difference statistically insignificant.

Let us now consider the case of the Urdu item (PTU15):

Figure 33

Estimated Marginal Means for PTU15



The above bar graph shows the slight variations among the response times of the respondents belonging to the three groups. It can be seen that the native speakers of Urdu responded to this item in a mixed manner. The medium and high proficiency groups were noticeably quicker to respond which indicates the presence of priming whereas the low proficiency group did not display any priming effects as it took longer to respond.

Let us see the contrast results to further examine the situation:

Table 66

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE15 and PTU15

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PTE15	Low Proficiency	Medium Proficiency	29.13	68.34	1.000	-142.47	200.73
		High Proficiency	165.74	68.34	.061	-5.86	337.35
	Medium	Low Proficiency	-29.13	68.34	1.000	-200.73	142.47

	Proficiency	High Proficiency	136.61	68.34	.160	-34.99	308.22
	High Proficiency	Low Proficiency	-165.74	68.34	.061	-337.35	5.86
		Medium Proficiency	-136.61	68.34	.160	-308.22	34.99
PTU15	Low Proficiency	Medium Proficiency	82.54	79.51	.919	-117.12	282.19
		High Proficiency	144.66	79.51	.232	-55.00	344.31
	Medium Proficiency	Low Proficiency	-82.54	79.51	.919	-282.19	117.12
		High Proficiency	62.12	79.51	1.000	-137.53	261.78
	High Proficiency	Low Proficiency	-144.66	79.51	.232	-344.31	55.00
		Medium Proficiency	-62.12	79.51	1.000	-261.78	137.53

The provided table contains information about the mean differences, standard errors, significance levels (Sig.), and 95% confidence intervals for pairwise comparisons between proficiency groups in the two items: PTE15 and PTU15.

In case of the English item, PTE15, the mean difference between the Low Proficiency and Medium Proficiency groups is 29.13, with a standard error of 68.34. The result is not statistically significant (Sig. = 1.000), and the 95% confidence interval ranges from -142.47 to 200.73. When comparing the Low Proficiency and High Proficiency groups, a mean difference of 165.74 is observed, with a p-value of 0.061, indicating marginal significance. The 95% confidence interval ranges from -5.86 to 337.35. The mean difference between the Medium Proficiency and High Proficiency groups is 136.61, with marginal significance (Sig. = 0.160). The 95% confidence interval ranges from -34.99 to 308.22.

In the case of the Urdu item, PTU15, the mean difference between the Low Proficiency and Medium Proficiency groups in PTU15 is 82.54, with a standard error of 79.51. The result is not statistically significant (Sig. = 0.919), and the 95% confidence interval ranges from -117.12 to 282.19. When comparing the Low Proficiency and High Proficiency groups, a mean difference of 144.66 is observed, with a p-value of 0.232, indicating no statistical significance. The 95% confidence interval ranges from -55.00 to 344.31. The mean difference between the Medium Proficiency and High Proficiency groups is 62.12, with a p-value of 1.000, meaning it's not statistically significant. The 95% confidence interval ranges from -137.53 to 261.78.

These results suggest that in both experiments, many of the comparisons between proficiency groups do not yield statistically significant differences, as indicated by non-significant p-values (greater than 0.05). However, there are instances of marginal significance, where the p-values are close to the significance threshold of 0.05, suggesting potential differences that require further investigation.

The contents of the above table further suggest that the priming in case of the high proficiency group was limited to some of its members in case of the English item (PTE15). However, in the case of the Urdu item (PTU15), the priming took place in the medium and high proficiency groups. The low proficiency group showed a mixed response while responding to the Urdu item.

4.4.16 PTE16 vs. PTU16

The 16th item in the Urdu experiment (PTU16), like a few used before, had completely unrelated prime and target. These items were included in the experiment to provide contrastive results as no priming effects were expected in these cases.

Table 67

Prime and Target for PTU16

Code	Item No.	Prime	Target
PTU16	55	پرسوز	رشتہ

The prime in this item was *pur-soz* meaning *melancholic* in English. It is a derivation from *soz* which means *melancholy* in Urdu. The target word in this item was *rishta* which is a noun and means *relation/relationship* in English. It can be seen that the prime and the target are not even remotely related in case of this item. These unrelated primes and targets are placed in the experiment to provide the no-priming-effect results which can be compared and contrasted with the cases where full or partial priming effects were observed.

The case of this English item is quite different from that of the corresponding Urdu item. The prime and target in PTE16 are not completely unrelated.

Table 68

Prime and Target for PTE16

Code	Item No.	Prime	Target
PTE16	55	honeymoon	MOON

The prime in this item was *honeymoon* which is a compound noun in English. *Honeymoon* as a compound noun is not semantically transparent. Semantically transparent compound nouns incorporate meanings of the combining words. For example, *classroom* is a room used for a class. In the case of *honeymoon,* the meaning is neither related to honey nor to the moon. This type of compound nouns is called semantically opaque nouns. This item was placed in the experiment to see whether the orthographic transparency/similarity present between the prime and the target generates any type of priming effect or not.

Let us examine the table below to find out how the respondents reacted to both these Urdu and English items.

Table 69

Descriptive Statistics for PTE16 and PTU16

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE16	Low Proficiency	920.35	95.06	727.57	1113.14
	Medium Proficiency	904.94	95.06	712.15	1097.72
	High Proficiency	984.75	95.06	791.97	1177.53
PTU16	Low Proficiency	827.68	23.13	780.78	874.58
	Medium Proficiency	833.08	23.13	786.17	879.98
	High Proficiency	831.91	23.13	785.00	878.81

The table presents data for the two items, PTE16 and PTU16, with information about the dependent variable, including the group means, standard errors, and 95% confidence intervals.

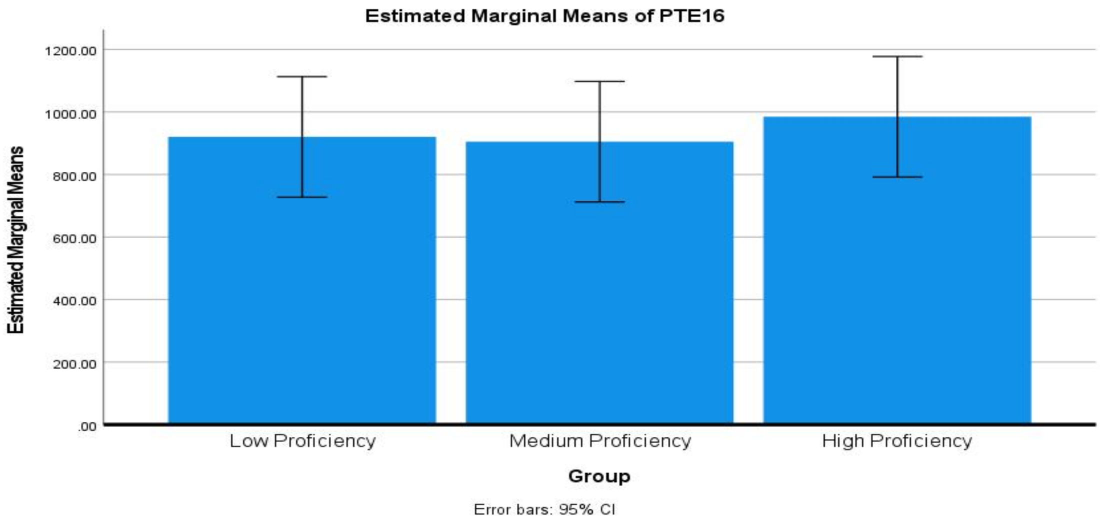
In the case of the English item, PTE16, the mean for the Low Proficiency group in PTE16 is 920.35, with a standard error of 95.06. The 95% confidence interval ranges from 727.57 to 1113.14, providing a range within which the true population mean is likely to fall. The mean for the Medium Proficiency group is 904.94, with a standard error of 95.06. The 95% confidence interval ranges from 712.15 to 1097.72. In the High Proficiency group, the mean is 984.75, with a standard error of 95.06. The 95% confidence interval ranges from 791.97 to 1177.53.

In the corresponding Urdu item, PTU16, the mean for the Low Proficiency group in PTU16 is 827.68, with a smaller standard error of 23.13. The 95% confidence interval ranges from 780.78 to 874.58. The mean for the Medium Proficiency group is 833.08, with a standard error of 23.13. The 95% confidence interval ranges from 786.17 to 879.98. In the High Proficiency group, the mean is 831.91, with a standard error of 23.13. The 95% confidence interval ranges from 785.00 to 878.81.

The following bar graphs will further illustrate the situation. Let us take a look at the bar chart pertaining to the English item (PTE16) first.

Figure 34

Estimated Marginal Means for PTE16



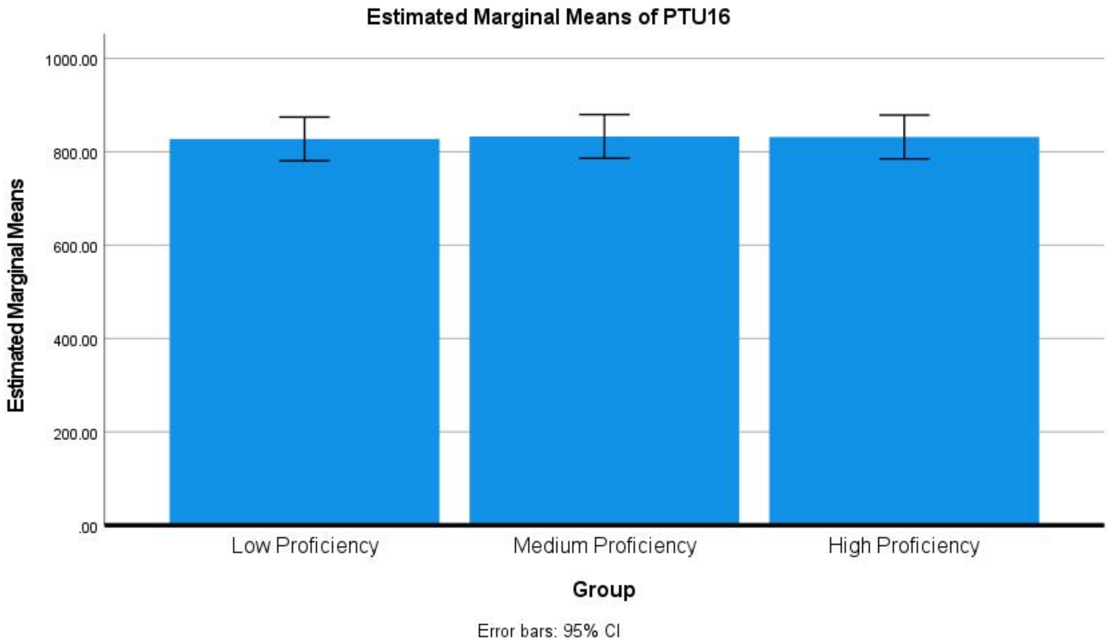
The above figure shows that the high proficiency group took a little more time, on average, while responding to this English item (PTE16). The other two groups took a very similar time which is less than the time took by the high proficiency group. However, the wide margins of the error bars, which indicate the haphazard nature of responses, cause the across-the-board overlap making the differences between response times statistically insignificant.

The response times are generally high in this item and there is no significant difference between the high proficiency group and the other two groups. This indicates that no orthography related priming took place although the prime and the target in this item (PTE16) had great orthographic similarity. This also indicates that semantically opaque prime did not facilitate the respondents in any way in their responses. It can be safely concluded that no priming took place in the case of this English item (PTE16).

Let us take a look at the bar chart pertaining to the corresponding Urdu item (PTU16):

Figure 35

Estimated Marginal Means for PTU16



As discussed earlier, the responses to this item were quite similar in nature. The evenness of the responses is evident from the structure of this bar chart too. The size of the error bars in each group is quite small which shows the precise nature of the data in the backdrop. Although the average response time of the low proficiency group can be seen to be a bit higher as compared to the other two groups, there seems to be no significance in it as the error bars are overlapping across the board.

Here is the table containing contrast results between the high proficiency group and the other two groups.

Table 70

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE16 and PTU16

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PTE16	Low Proficiency	Medium Proficiency	15.42	134.43	1.000	-322.14	352.98

		High Proficiency	-64.40	134.43	1.000	-401.96	273.17
	Medium Proficiency	Low Proficiency	-15.42	134.43	1.000	-352.98	322.14
		High Proficiency	-79.81	134.43	1.000	-417.37	257.75
	High Proficiency	Low Proficiency	64.40	134.43	1.000	-273.17	401.96
		Medium Proficiency	79.81	134.43	1.000	-257.75	417.37
PTU16	Low Proficiency	Medium Proficiency	-5.39	32.71	1.000	-87.52	76.73
		High Proficiency	-4.22	32.71	1.000	-86.35	77.90
	Medium Proficiency	Low Proficiency	5.39	32.71	1.000	-76.73	87.52
		High Proficiency	1.17	32.71	1.000	-80.96	83.30
	High Proficiency	Low Proficiency	4.22	32.71	1.000	-77.90	86.35
		Medium Proficiency	-1.17	32.71	1.000	-83.30	80.96

The provided table shows the results of pairwise comparisons between proficiency groups for the two items, PTE16 and PTU16, involving mean differences, standard errors, significance levels (Sig.), and 95% confidence intervals.

In case of the English item, PTE16, the mean difference between the Low Proficiency and Medium Proficiency groups is 15.42, with a standard error of 134.43. The result is not statistically significant (Sig. = 1.000), and the 95% confidence interval ranges from -322.14 to 352.98. When comparing the Low Proficiency and High Proficiency groups, a mean difference of -64.40 is observed, with a non-significant result (Sig. = 1.000). The 95% confidence interval ranges from -401.96 to 273.17. The mean difference between the Medium Proficiency and High Proficiency groups is -79.81, with no statistical significance (Sig. = 1.000). The 95% confidence interval ranges from -417.37 to 257.75.

The case of the corresponding Urdu item (PTU16) is not different. The mean difference between the Low Proficiency and Medium Proficiency groups in PTU16 is -5.39, with a standard error of 32.71. The result is not statistically significant (Sig. = 1.000), and the 95% confidence interval ranges from -87.52 to 76.73. When comparing the Low Proficiency and High Proficiency groups, a mean difference of -4.22 is observed, with a non-significant result (Sig. = 1.000). The 95% confidence interval ranges from -86.35 to 77.90. The mean difference between the Medium Proficiency and High

Proficiency groups is 1.17, with no statistical significance (Sig. = 1.000). The 95% confidence interval ranges from -80.96 to 83.30.

In both the cases discussed above, the pairwise comparisons between proficiency groups do not show statistically significant differences, as indicated by non-significant p-values (all equal to 1.000). The 95% confidence intervals are wide and include zero, further suggesting a lack of significant distinctions between the groups in terms of the dependent variable.

The above discussion suggests that no priming effect was seen among all the participants in both the Urdu and English experiments when the primes and the targets were unrelated. We have so far seen two sets of items with unrelated primes and targets, namely, PTE5 and PTE10, PTU5 and PTU10, and PTE16 and PTU16 wherein there was no evidence of priming observed.

The cases of PTE5, PTE10, and PTE16 are interesting as the primes and targets in all these items were orthographically transparent. Still, there was no sign of orthographic priming having taken place in the observed results.

4.4.17 PTE17 vs. PTU17

The 17th items in the both the experiments were used for contrast purposes. In both these items, the primes and targets were completely unrelated. This sort of items generates and provides data that can be compared and contrasted with the items having related primes and targets to see whether any priming takes place. If the data generated by the items with unrelated primes and targets is very similar to the data generated by the related primes and targets, the occurrence of priming becomes doubtful.

Table 71

Prime and Target for PTU17

Code	Item No.	Prime	Target
PTU17	56	فلاحی	سایہ

The prime in the Urdu item was *falahi* meaning *welfare-related* in English. It is an adjective in Urdu. The target word in this item was *saaya* which means *shadow* in English. It is a noun in Urdu.

The prime and target in the seventeenth item in the English experiment were also completely unrelated. The prime in the item was *new* which is an adjective. The target was *kind* which is both a noun and an adjective in English.

Table 72

Prime and Target for PTE17

Code	Item No.	Prime	Target
PTE17	56	new	KIND

It is obvious that the primes and targets in both the Urdu and English items were completely unrelated both orthographically and semantically. Let us find out the response to these items.

As in all other items, there were the same three groups consisting of 13 members each responding to these items as well. The following table illustrates how the three groups responded to these items.

Table 73

Descriptive Statistics for PTE17 and PTU17

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE17	Low Proficiency	867.16	46.80	772.25	962.07
	Medium Proficiency	882.78	46.80	787.87	977.70
	High Proficiency	888.34	46.80	793.43	983.26
PTU17	Low Proficiency	894.68	61.86	769.22	1020.14
	Medium Proficiency	963.04	61.86	837.58	1088.50
	High Proficiency	901.46	61.86	776.00	1026.92

The above table provides information about the dependent variable, including group means, standard errors, and 95% confidence intervals for the two corresponding items under discussion, PTE17 and PTU17, across different proficiency groups.

In the case of the English item, PTE17, the mean response time for the Low Proficiency group in PTE17 is 867.16, with a standard error of 46.80. The 95% confidence interval ranges from 772.25 to 962.07, indicating the range within which the true population mean is likely to fall. The mean response time for the Medium Proficiency group is 882.78, with a standard error of 46.80. The 95% confidence interval for the mean response time ranges from 787.87 to 977.70. In the High Proficiency group, the mean response time is 888.34, with a standard error of 46.80. The 95% confidence interval for the mean response time ranges from 793.43 to 983.26.

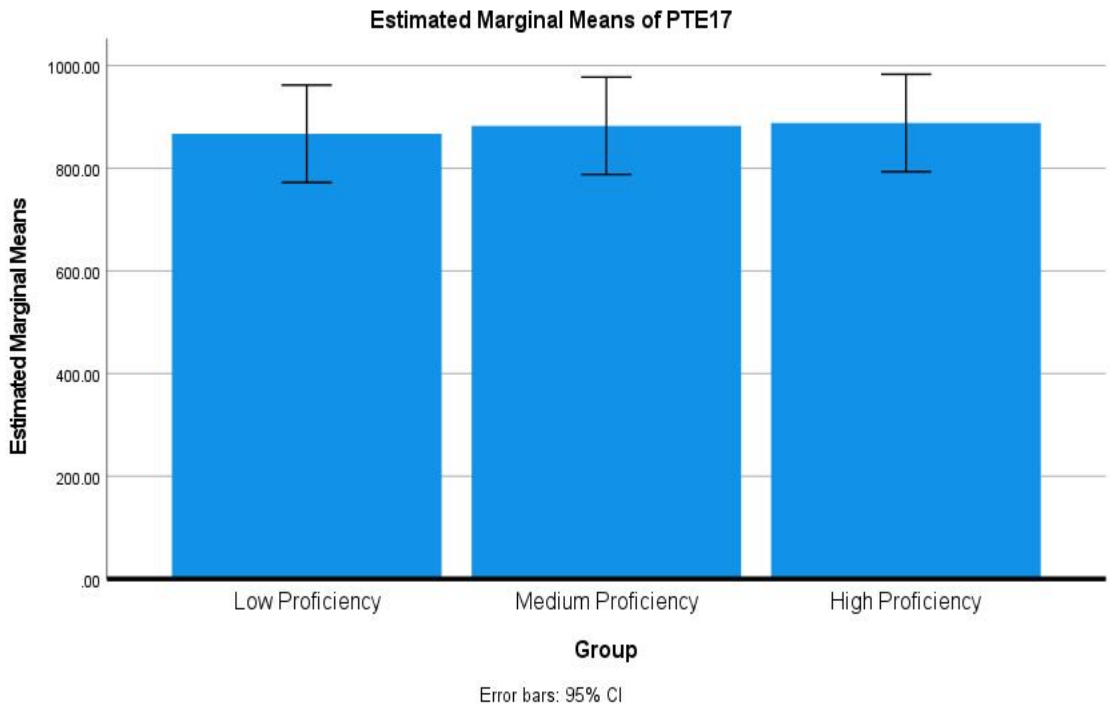
While responding to the corresponding Urdu item, PTU17, the mean response time for the Low Proficiency group in PTU17 is 894.68, with a standard error of 61.86. The 95% confidence interval for the mean response time ranges from 769.22 to 1020.14. The mean response time for the Medium Proficiency group is 963.04, with a standard error of 61.86. The 95% confidence interval for the mean response time ranges from 837.58 to 1088.50. In the High Proficiency group, the mean response time is 901.46, with a standard error of 61.86. The 95% confidence interval for the mean response time ranges from 776.00 to 1026.92.

Urdu being the first language of the respondents, there are two noteworthy points here. First, the respondents took comparatively more time to respond to the target word that had an unrelated prime, and the second, the overall standard deviation in the Urdu item was higher than that of the English item.

This situation is further illustrated by the following bar charts.

Figure 36

Estimated Marginal Means for PTE17

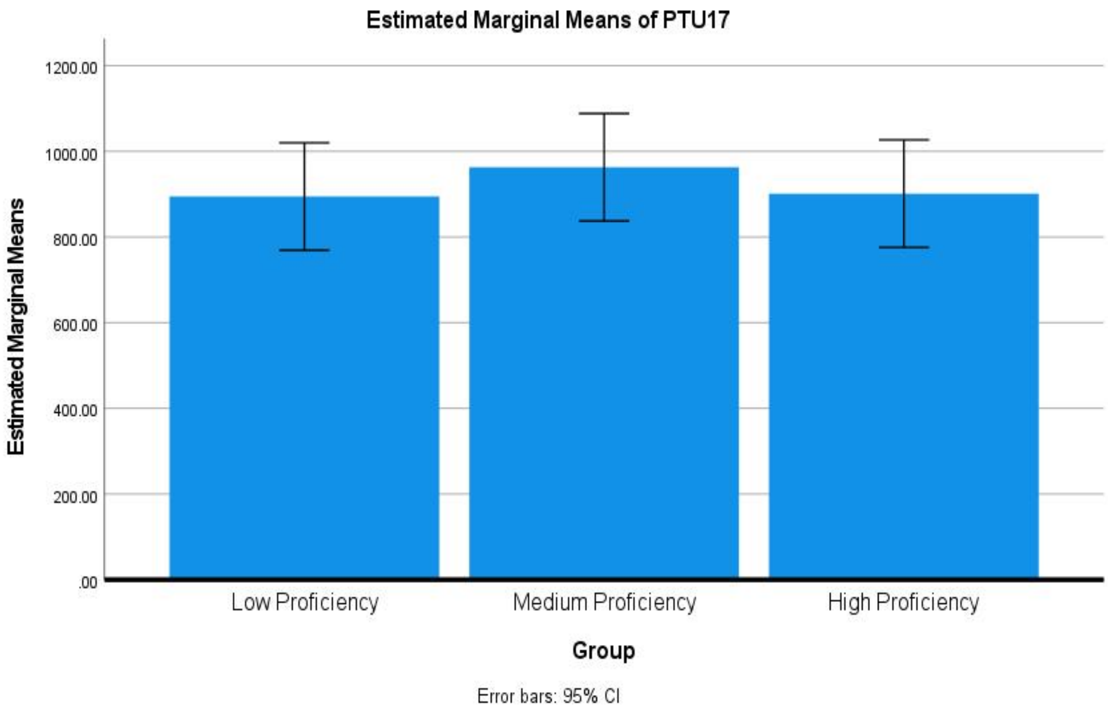


The above bar chart shows that all the three groups responded in a very similar way to this item (PTE17). It can be seen that the top sides of all the bars belonging to the three groups are very close to each other. The error bars of all the groups overlap across the chart not only with those of other groups but also with the observed grand mean. The error bars in the case of this item indicate the variation in the response times of the respondents of each group. If the bars and the error bars are seen together, there is a lot of overlapping and that is why the analysis shows that there is no significant difference in the mean response times of the three groups.

Let us now consider the bar chart pertaining to the Urdu item (PTU17).

Figure 37

Estimated Marginal Means for PTU17



This bar chart confirms the earlier discussion that there is no significant difference between the mean response times between the groups. The low proficiency group responded to this Urdu item relatively quicklier than the other two groups but if the variation (indicated by the error bars) is brought into account, the mean responses of this group still overlap one another's response times. That is why the analysis indicates that there is no difference in the response times between the groups as far as PTU17 is concerned. The error bars on this chart (PTU17) are wider than the corresponding bar chart pertaining to PTE17 discussed above.

There seems to be no significant difference in the mean response times as per the above table. In order to confirm this prima facie hypothesis, let us take a look at the table below.

Table 74

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE17 and PTU17

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower	Upper

						Bound	Bound
PTE17	Low Proficiency	Medium Proficiency	-15.62	66.18	1.000	-181.8107	150.5659
		High Proficiency	-21.18	66.18	1.000	-187.3706	145.0060
	Medium Proficiency	Low Proficiency	15.62	66.18	1.000	-150.5659	181.8107
		High Proficiency	-5.56	66.18	1.000	-171.7482	160.6284
	High Proficiency	Low Proficiency	21.18	66.18	1.000	-145.0060	187.3706
		Medium Proficiency	5.56	66.18	1.000	-160.6284	171.7482
PTU17	Low Proficiency	Medium Proficiency	-68.36	87.49	1.000	-288.0399	151.3199
		High Proficiency	-6.78	87.49	1.000	-226.4576	212.9022
	Medium Proficiency	Low Proficiency	68.36	87.49	1.000	-151.3199	288.0399
		High Proficiency	61.58	87.49	1.000	-158.0976	281.2622
	High Proficiency	Low Proficiency	6.78	87.49	1.000	-212.9022	226.4576
		Medium Proficiency	-61.58	87.49	1.000	-281.2622	158.0976

The table provides the results of pairwise comparisons between proficiency groups for the two items, PTE17 and PTU17. It includes mean differences, standard errors, significance levels (Sig.), and 95% confidence intervals.

As far as the English item, PTE17, is concerned, the mean difference between the Low Proficiency and Medium Proficiency groups is -15.62, with a standard error of 66.18. The result is not statistically significant (Sig. = 1.000), and the 95% confidence interval ranges from -181.8107 to 150.5659. When comparing the Low Proficiency and High Proficiency groups, a mean difference of -21.18 is observed, with no statistical significance (Sig. = 1.000). The 95% confidence interval ranges from -187.3706 to 145.0060. The mean difference between the Medium Proficiency and High Proficiency groups is -5.56, with a non-significant result (Sig. = 1.000). The 95% confidence interval ranges from -171.7482 to 160.6284.

In the case of the corresponding Urdu item, PTU17, the mean difference between the Low Proficiency and Medium Proficiency groups in PTU17 is -68.36, with a standard error of 87.49. The result is not statistically significant (Sig. = 1.000), and the 95%

confidence interval ranges from -288.0399 to 151.3199. When comparing the Low Proficiency and High Proficiency groups, a mean difference of -6.78 is observed, with no statistical significance (Sig. = 1.000). The 95% confidence interval ranges from -226.4576 to 212.9022. The mean difference between the Medium Proficiency and High Proficiency groups is 61.58, with no statistical significance (Sig. = 1.000). The 95% confidence interval ranges from -158.0976 to 281.2622.

In both the items, none of the pairwise comparisons between proficiency groups show statistically significant differences, as indicated by non-significant p-values (all equal to 1.000). The wide 95% confidence intervals, which often span zero, further suggest a lack of significant distinctions between the groups in terms of the dependent variable.

The table illustrates that there is no significant difference in the way the participants responded to both these Urdu and the English items. Both these items (PTE17 and PTU17) had unrelated primes and targets. Therefore, it was expected that the respondents would take similar time to respond to them as there was no facilitation possible because of the unrelated primes.

4.4.18 PTE18 vs. PTU18

This pair of items and the next two pairs relate to the compound words. This part of the experiment was designed to see whether any priming takes place in the case of compound words. There were three pairs of items (18,19, and 20), included in the experiment for the same purpose.

The prime in the Urdu item was a compound noun *shor o ghul* which means *hubbub* in English. It is made up of two nouns, *shor* and *ghul* which both have similar meanings, *noise*. The *o* between the two nouns is a common joinder used in Urdu constructions of Persian origin.

Table 75

Prime and Target for PTU18

Code	Item No.	Prime	Target
PTU18	61	شوروغل	شور

The target in this Urdu item, *shor*, meaning *noise*, is one of the two nouns making up the compound noun.

Table 76

Prime and Target for PTE18

Code	Item No.	Prime	Target
PTE18	61	grandmother	MOTHER

In the case of English item, the target word was a compound noun, *grandmother*, and the target word, *mother*, was, like the corresponding Urdu item, one of the nouns making up the compound noun used as the prime.

As mentioned earlier, this part of the experiment was designed to find out whether any priming effects take place in the case of Urdu (the native language of the respondents) and English (the second language of the respondents) compound words.

Let us examine the table below to see how the three groups responded to both these items.

Table 77

Descriptive Statistics for PTE18 and PTU18

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE18	Low Proficiency	1170.09	87.74	992.15	1348.03
	Medium Proficiency	806.05	87.74	628.11	983.99
	High Proficiency	716.54	87.74	538.59	894.48
PTU18	Low Proficiency	743.99	17.81	707.87	780.10
	Medium Proficiency	706.36	17.81	670.24	742.48
	High Proficiency	733.74	17.81	697.63	769.86

The table presents data for the two items, PTE18 and PTU18, with information about the dependent variable, including group means, standard errors, and 95% confidence intervals, for the three groups.

In the case of the English item, PTE18, the mean response time for the Low Proficiency group in PTE18 is 1170.09, with a standard error of 87.74. The 95% confidence interval for the mean ranges from 992.15 to 1348.03, providing a range within which the true population mean is likely to fall. The mean response time for the Medium Proficiency group is 806.05, with a standard error of 87.74. The 95% confidence interval for the mean response time ranges from 628.11 to 983.99. In the High Proficiency group, the mean response time is 716.54, with a standard error of 87.74. The 95% confidence interval for the mean response time ranges from 538.59 to 894.48.

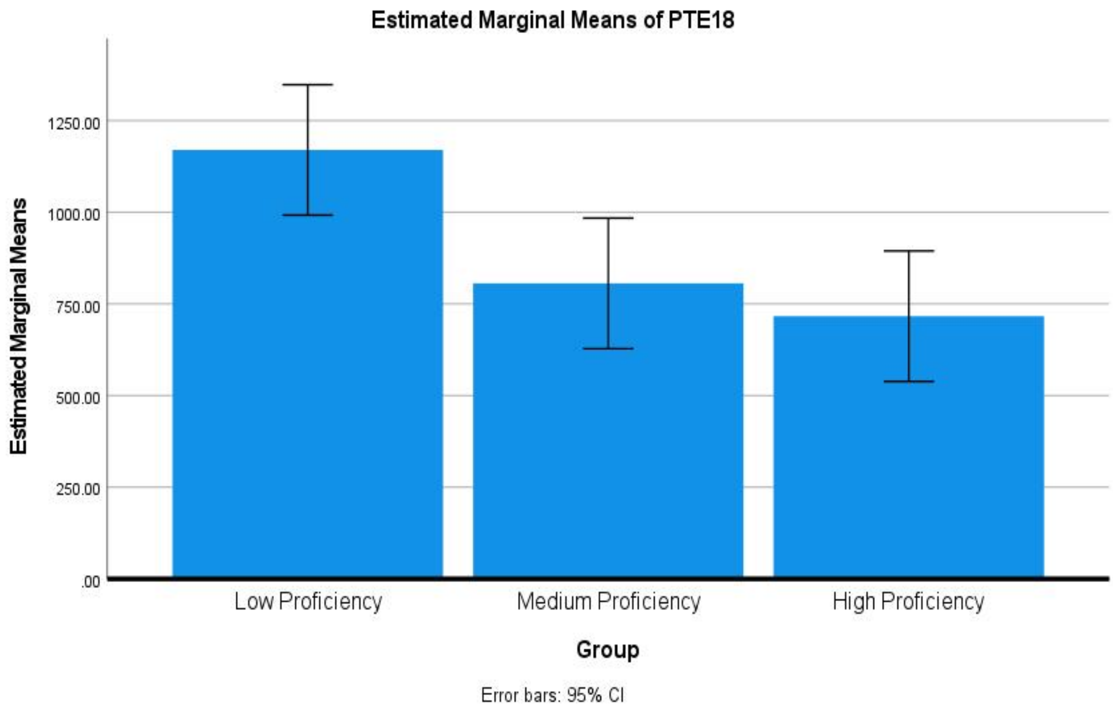
Responding to the corresponding Urdu item, PTU18, the mean response time for the Low Proficiency group in PTU18 is 743.99, with a smaller standard error of 17.81. The 95% confidence interval for the mean response time ranges from 707.87 to 780.10. The mean response time for the Medium Proficiency group is 706.36, with a standard error of 17.81. The 95% confidence interval for the mean response time ranges from 670.24 to 742.48. In the High Proficiency group, the mean response time is 733.74, with a standard error of 17.81. The 95% confidence interval for the mean response time ranges from 697.63 to 769.86.

The statistics above create an impression that the high proficiency group responded to the English item in a very similar response time to that of all the groups responding to the Urdu item. This suggests priming effects in the Urdu item in case of all the groups while in the English item, only the high proficiency group showed the priming effects.

The following bar graphs will further clarify the situation.

Figure 38

Estimated Marginal Means for PTE18

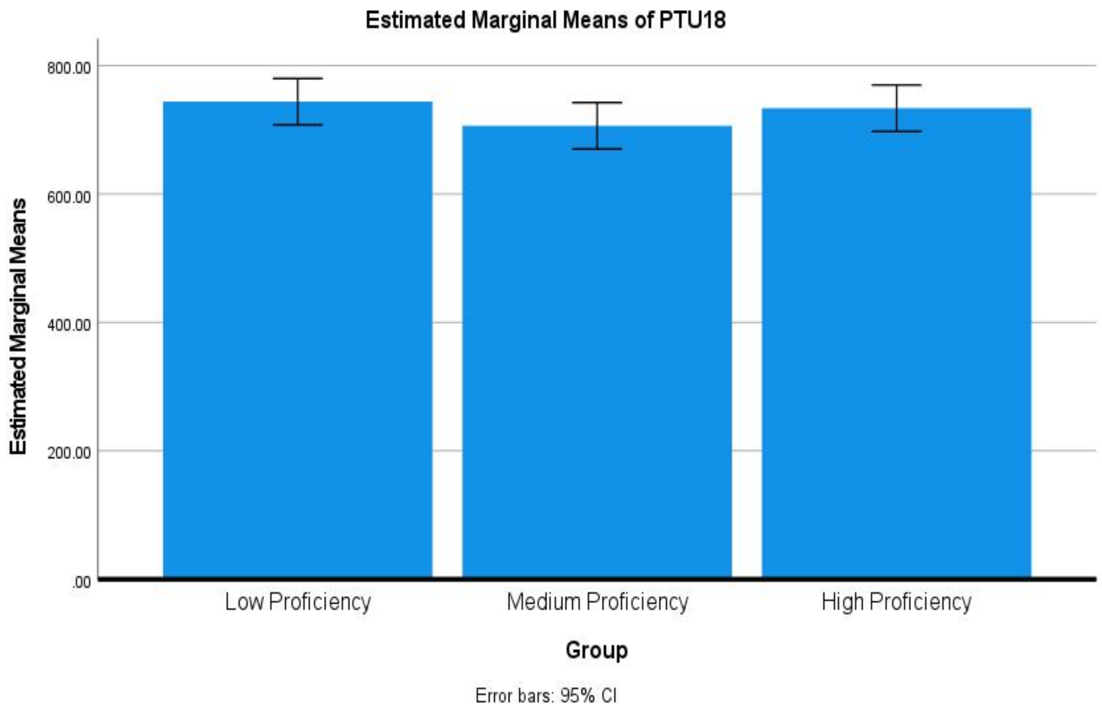


The above bar graph shows that the high proficiency group took considerably less time as compared to the low proficiency group in their response to the English item (PTE18). The higher error bar on the top of the bar belonging to the high proficiency group is clearly below the lower error bar belonging to the low proficiency group. The medium proficiency group's response seems to be quite similar to that of the high proficiency group. This means that many members of the medium proficiency group also experienced some priming effects. However, in the case of the high proficiency group, it seems to be quite evident that there was some priming experienced by its members.

Let us now consider the case of the Urdu item (PTU18):

Figure 39

Estimated Marginal Means for PTU18



The above bar graph shows the slight variations among the response times of the respondents belonging to the three groups. The variations are slight as there is no significant difference between the mean response times. The bars and their respective error bars overlap with one another as well as with the line showing the overall mean response times. The small sizes of the error bars in this figure suggest the precise and even nature of the responses given by members of all the three groups.

In order to further investigate the prima facie impressions, let us examine the table below showing the difference between groups and its significance level.

Table 78

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE18 and PTU18

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
PTE18	Low Proficiency	Medium Proficiency	364.0377*	124.08	.017	52.46	675.61

		High Proficiency	453.5531*	124.08	.002	141.98	765.13
	Medium Proficiency	Low Proficiency	-364.0377*	124.08	.017	-675.61	-52.46
		High Proficiency	89.52	124.08	1.000	-222.06	401.09
	High Proficiency	Low Proficiency	-453.5531*	124.08	.002	-765.13	-141.98
		Medium Proficiency	-89.52	124.08	1.000	-401.09	222.06
PTU18	Low Proficiency	Medium Proficiency	37.62	25.19	.432	-25.62	100.87
		High Proficiency	10.24	25.19	1.000	-53.00	73.48
	Medium Proficiency	Low Proficiency	-37.62	25.19	.432	-100.87	25.62
		High Proficiency	-27.38	25.19	.853	-90.63	35.86
	High Proficiency	Low Proficiency	-10.24	25.19	1.000	-73.48	53.00
		Medium Proficiency	27.38	25.19	.853	-35.86	90.63

In the table above, the results of pairwise comparisons between proficiency groups for the two items, PTE18 and PTU18, are presented. The table includes mean differences, standard errors, significance levels (Sig.), and 95% confidence intervals.

In the case of PTE18, the English item, the groups behaved quite differently from one another. The mean difference between the Low Proficiency and Medium Proficiency groups is 364.04 with a standard error of 124.08. The result is statistically significant (Sig. = 0.017), indicating a significant difference. The 95% confidence interval ranges from 52.46 to 675.61. When comparing the Low Proficiency and High Proficiency groups, a mean difference of 453.55 is observed, with a highly significant result (Sig. = 0.002), indicating a significant difference. The 95% confidence interval ranges from 141.98 to 765.13. The mean difference between the Medium Proficiency and Low Proficiency groups is -364.04, with a standard error of 124.08. The result is statistically significant (Sig. = 0.017), indicating a significant difference. The 95% confidence interval ranges from -675.61 to -52.46. The mean difference between the Medium Proficiency and High Proficiency groups is 89.52, with a non-significant result (Sig. = 1.000). The 95% confidence interval ranges from -222.06 to 401.09.

In the case of the corresponding Urdu item, PTU18, the mean difference between the Low Proficiency and Medium Proficiency groups is 37.62 with a standard error of 25.19. The result is not statistically significant (Sig. = 0.432). The 95% confidence interval ranges from -25.62 to 100.87. When comparing the Low Proficiency and High Proficiency groups, a mean difference of 10.24 is observed, with a non-significant result (Sig. = 1.000). The 95% confidence interval ranges from -53.00 to 73.48. The mean difference between the Medium Proficiency and High Proficiency groups is -27.38, with a non-significant result (Sig. = 0.853). The 95% confidence interval ranges from -90.63 to 35.86.

The contents of the above table further solidify the impression that partial priming took place across the groups in the case of the Urdu item while it happened only in the case of the medium and the high proficiency groups while responding to the English item.

In the light of the above discussion, it can be concluded that all the three groups displayed some effects of partial priming in case of the Urdu item (Urdu being their native language). No priming effects could be seen in case of the low proficiency group in response to the English item (PTE18). However, the medium and the high proficiency groups did show some priming effects while responding to this item. This, again, suggests that the phenomenon of breaking down morphologically complex words in the second language is not exclusive to the high proficiency group. The medium proficiency group can also display such potential in certain cases.

4.4.19 PTE19 vs. PTU19

This pair of items along with the previous and the next one is related to the compound words. As discussed earlier, this section of the experiment was designed to see if any priming takes place in the case of compound words both in English and Urdu.

The prime in the Urdu item was a compound noun *bol chaal* which means *conversation* in English. It is made up of two nouns, *bol* and *chaal* which mean *to talk/utterance* and *manner*, respectively.

Table 79

Prime and Target for PTU19

Code	Item No.	Prime	Target

PTU19	62	بول چال	بول

The target in this Urdu item, *bol*, meaning *utterance*, is one of the two nouns making up the compound noun.

Table 80

Prime and Target for PTE19

Code	Item No.	Prime	Target
PTE19	62	doorbell	BELL

In the case of English item, the target word was a compound noun, *doorbell*, and the target word was *bell*, which is a noun.

As mentioned earlier, this part of the experiment was designed to find out whether any priming effects take place in the case of Urdu (the native language of the respondents) and English (the second language of the respondents).

Let us examine the table below to see how the three groups responded to both these items.

Table 81

Descriptive Statistics for PTE19 and PTU19

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE19	Low Proficiency	981.26	71.52	836.22	1126.31
	Medium Proficiency	917.04	71.52	771.99	1062.08
	High Proficiency	707.02	71.52	561.97	852.06
PTU19	Low Proficiency	690.86	19.62	651.08	730.64
	Medium Proficiency	710.72	19.62	670.94	750.50

High Proficiency	727.22	19.62	687.44	767.01

The above table shows how the three groups responded to the two items under discussion, namely, PTE19 and PTU19.

In response to the English item, PTE19, the mean response time for the Low Proficiency group in PTE19 is 981.26, with a standard error of 71.52. The 95% confidence interval for the mean response time ranges from 836.22 to 1126.31. The mean response time for the Medium Proficiency group is 917.04, with a standard error of 71.52. The 95% confidence interval for the mean response time ranges from 771.99 to 1062.08. In the High Proficiency group, the mean response time is 707.02, with a standard error of 71.52. The 95% confidence interval for the mean response time ranges from 561.97 to 852.06.

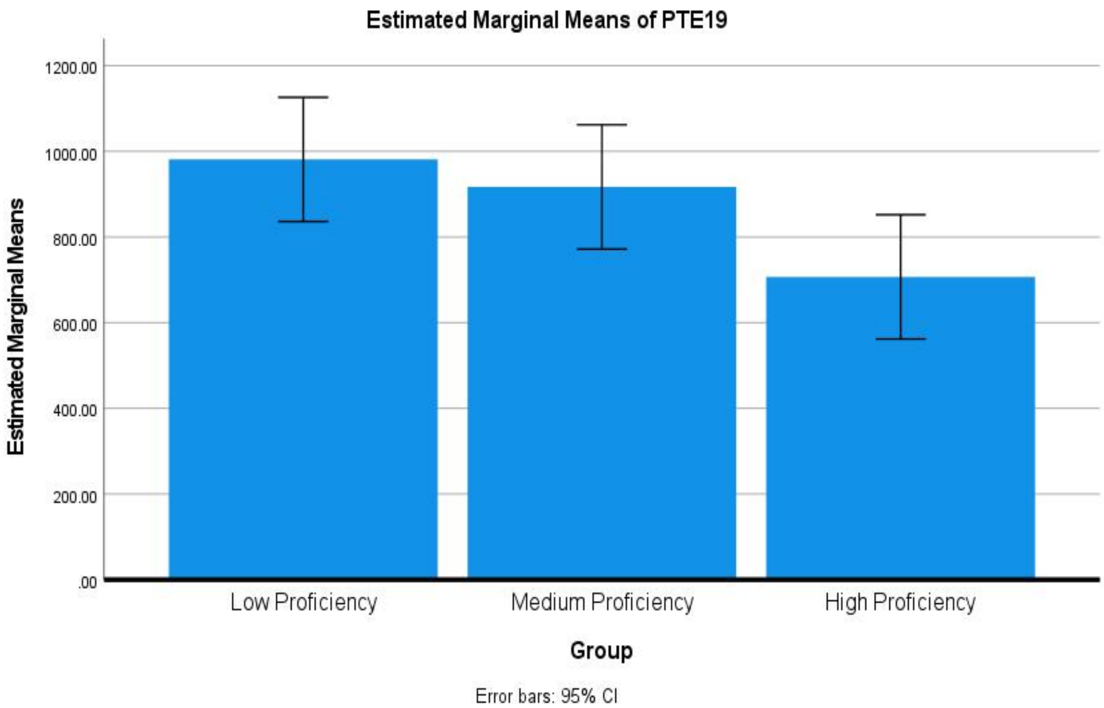
In the case of the corresponding Urdu item, PTU19, the mean response time for the Low Proficiency group in PTU19 is 690.86, with a smaller standard error of 19.62. The 95% confidence interval for the mean response time ranges from 651.08 to 730.64. The mean response time for the Medium Proficiency group is 710.72, with a standard error of 19.62. The 95% confidence interval for the mean response time ranges from 670.94 to 750.50. In the High Proficiency group, the mean response time is 727.22, with a standard error of 19.62. The 95% confidence interval for the mean response time ranges from 687.44 to 767.01.

The statistics above create an impression that the high proficiency group responded to the English item in a very similar response time to that of all the groups responding to the Urdu item. This suggests priming effects in the Urdu item in case of all the groups while in the English item, only the high proficiency group showed the priming effects.

The following bar graphs will further clarify the situation.

Figure 40

Estimated Marginal Means for PTE19

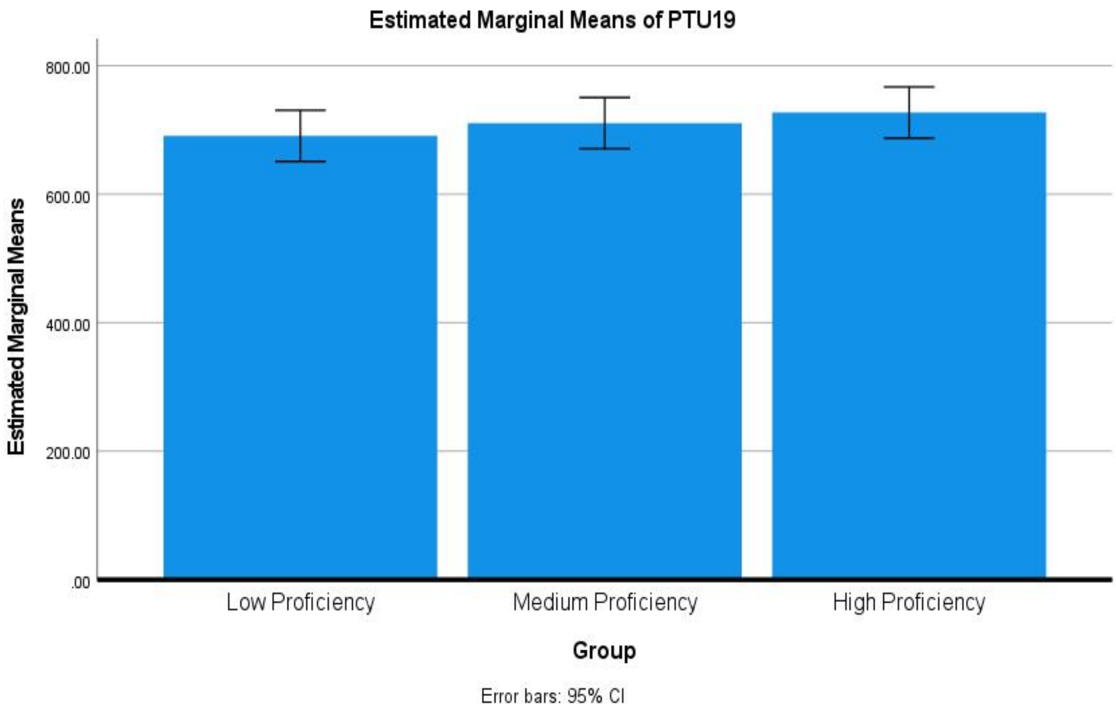


The above bar graph shows that the high proficiency group took considerably less time as compared to the other two groups in their response to the English item (PTE19). The higher error bar on the top of the bar belonging to the high proficiency group is clearly below the lower error bar belonging to the low proficiency group. The medium proficiency group's response seems to be somewhere between that of the low and the high proficiency groups. This means that many members of the medium proficiency group also experienced some priming effects. However, in the case of the high proficiency group, it seems to be quite evident that there was some priming experienced by its members.

Let us now consider the case of the Urdu item (PTU19):

Figure 41

Estimated Marginal Means for PTU19



The above bar graph shows the gradual increase in the mean response times from the low proficiency group towards the high proficiency group. The variations are slight as there is no significant difference between the mean response times. The bars and their respective error bars overlap with one another as well as with the line showing the overall mean response times. The small sizes of the error bars in this figure suggest the precise and even nature of the responses given by members of all the three groups.

The table containing the contrast results below will further clarify the situation.

Table 82

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE19 and PTU19

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PTE19	Low Proficiency	Medium Proficiency	64.23	101.14	1.000	-189.74	318.20
		High Proficiency	274.2485*	101.14	.031	20.28	528.22

	Medium Proficiency	Low Proficiency	-64.23	101.14	1.000	-318.20	189.74
		High Proficiency	210.02	101.14	.135	-43.95	463.99
	High Proficiency	Low Proficiency	-274.2485*	101.14	.031	-528.22	-20.28
		Medium Proficiency	-210.02	101.14	.135	-463.99	43.95
PTU19	Low Proficiency	Medium Proficiency	-19.86	27.74	1.000	-89.52	49.79
		High Proficiency	-36.37	27.74	.595	-106.02	33.29
	Medium Proficiency	Low Proficiency	19.86	27.74	1.000	-49.79	89.52
		High Proficiency	-16.50	27.74	1.000	-86.16	53.16
	High Proficiency	Low Proficiency	36.37	27.74	.595	-33.29	106.02
		Medium Proficiency	16.50	27.74	1.000	-53.16	86.16

The table presents the results of pairwise comparisons between proficiency groups for the two items, PTE19 and PTU19. These comparisons include mean differences, standard errors, significance levels (Sig.), and 95% confidence intervals, focusing on the mean response time as the dependent variable.

In the case of PTE19, the English item, the mean difference in mean response time between the Low Proficiency and Medium Proficiency groups is 64.23 units, with a standard error of 101.14. This difference is not statistically significant (Sig. = 1.000), and the 95% confidence interval ranges from -189.74 to 318.20. When comparing the Low Proficiency and High Proficiency groups, the mean response time difference is 274.25 units. This result is statistically significant (Sig. = 0.031), indicating a significant difference, with a confidence interval ranging from 20.28 to 528.22. The mean response time difference between the Medium Proficiency and High Proficiency groups is 210.02 units, but it shows marginal significance (Sig. = 0.135), with a confidence interval from -43.95 to 463.99.

Responding to the Urdu item, PTU19, the mean response time difference between the Low Proficiency and Medium Proficiency groups is -19.86 units, which is not statistically significant (Sig. = 1.000), with a confidence interval ranging from -89.52 to 49.79. When comparing the Low Proficiency and High Proficiency groups, the mean response time difference is -36.37 units, and it is not statistically significant (Sig. =

0.595), with a confidence interval from -106.02 to 33.29. The mean response time difference between the Medium Proficiency and High Proficiency groups is -16.50 units, and it is not statistically significant (Sig. = 1.000), with a confidence interval from -86.16 to 53.16.

The contents of the above table further solidify the impression that partial priming took place across the groups in the case of the Urdu item while it happened only in case of the high proficiency group while responding to the English item.

In the light of the above discussion, it can be concluded that all the three groups displayed some effects of partial priming in case of the Urdu item (Urdu being their native language). No priming effects could be seen in cases of the low and medium proficiency groups in response to the English item (PTE19). The high proficiency group did show robust priming take place while recording the response.

4.4.20 PTE20 vs. PTU20

This is the third pair of items that was included, along with the previous two, to judge whether any priming takes place in the case of compound words in both Urdu and English. In the previous two pairs of items, we saw mixed types of results. Let us find out the results in this case.

Table 83

Prime and Target for PTU20

Code	Item No.	Prime	Target
PTU20	63	تنگ و تاریک	تاریک

The prime in the Urdu item was a compound adjective *tang o tareek* which means *narrow and dark* in English. It is made up of two adjectives, *tang* and *tareek* which mean *narrow* and *dark*, respectively. The target in this Urdu item, *tareek*, meaning *dark*, is one of the two nouns making up the compound noun. As discussed above in PTU18, the *o* between the two combining adjectives is frequently used in such constructions having Persian origin.

This pair of Urdu prime and target is different from the previous two Urdu items as it is a compound adjective. The previous two items dealt with compound nouns.

Table 84

Prime and Target for PTE20

Code	Item No.	Prime	Target
PTE20	63	driveway	WAY

In the case of English item, the target word was a compound noun, *driveway*, and the target word was *way*, which is a noun.

As mentioned earlier, this part of the experiment was designed to find out whether any priming effects take place in the case of Urdu and English compound words.

Let us examine the table below to see how the three groups responded to both these items.

Table 85

Descriptive Statistics for PTE20 and PTU20

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE20	Low Proficiency	856.65	42.81	769.83	943.46
	Medium Proficiency	892.15	42.81	805.33	978.96
	High Proficiency	802.39	42.81	715.58	889.21
PTU20	Low Proficiency	765.52	20.74	723.45	807.58
	Medium Proficiency	723.22	20.74	681.16	765.29
	High Proficiency	762.14	20.74	720.07	804.20

The above table provides information about the two items experimented upon, PTE20 and PTU20, including group means, standard errors, and 95% confidence intervals.

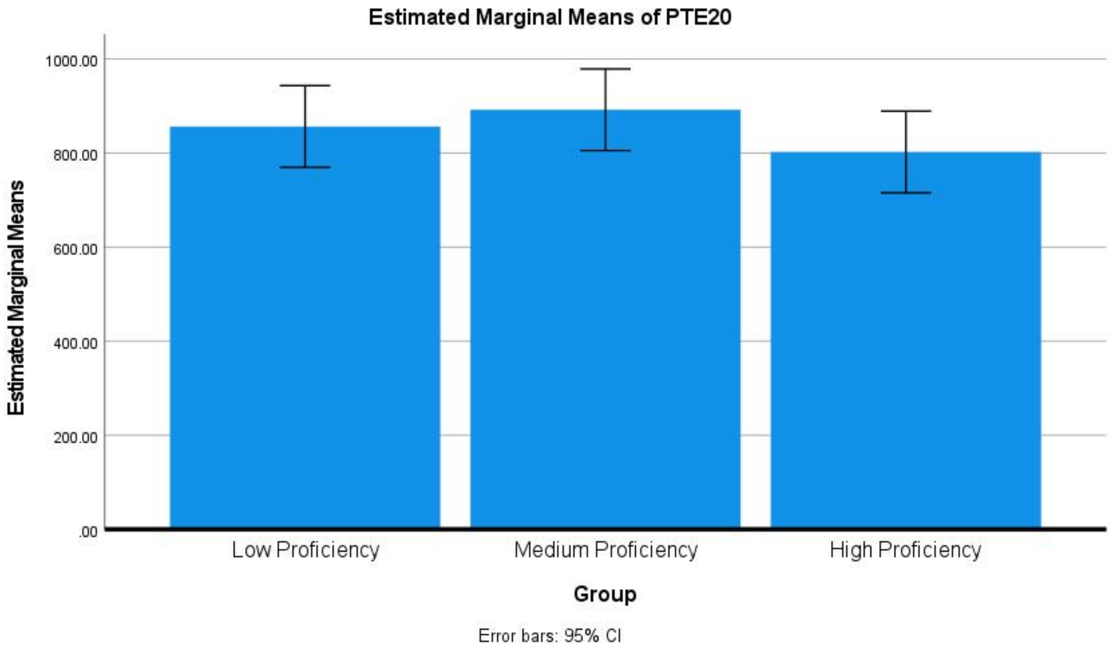
As far as the English item, PTE20, is concerned, the mean response time for the Low Proficiency group in PTE20 is 856.65, with a standard error of 42.81. The 95% confidence interval for the mean response time ranges from 769.83 to 943.46. The mean response time for the Medium Proficiency group is 892.15, with a standard error of 42.81. The 95% confidence interval for the mean response time ranges from 805.33 to 978.96. In the High Proficiency group, the mean response time is 802.39, with a standard error of 42.81. The 95% confidence interval for the mean response time ranges from 715.58 to 889.21.

On the other hand, responding to the corresponding Urdu item, PTU20, the mean response time for the Low Proficiency group in PTU20 is 765.52, with a smaller standard error of 20.74. The 95% confidence interval for the mean response time ranges from 723.45 to 807.58. The mean response time for the Medium Proficiency group is 723.22, with a standard error of 20.74. The 95% confidence interval for the mean response time ranges from 681.16 to 765.29. In the High Proficiency group, the mean response time is 762.14, with a standard error of 20.74. The 95% confidence interval for the mean response time ranges from 720.07 to 804.20.

The comparison between the following figures further elaborate the comparison.

Figure 42

Estimated Marginal Means for PTE20

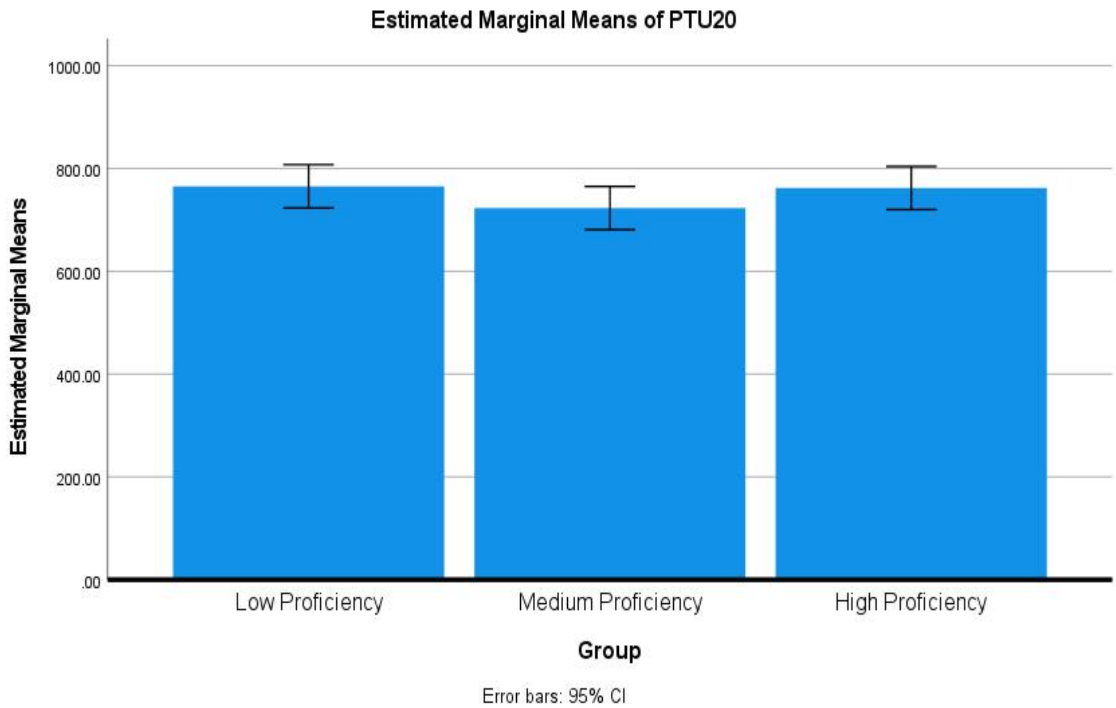


The above bar graph shows that all the groups responded to the item in a similar manner. There is no significant difference either between the mean response time or between the size of the error bars in each case. The significant take from this figure is that all the groups responded to the item in above 800 milliseconds which suggests the absence of any priming effects in this case.

Let us now consider the case of the Urdu item (PTU20):

Figure 43

Estimated Marginal Means for PTU20



The above bar graph shows even nature of the data obtained in response to this Urdu item. It is evident from the figure that all the groups responded to the item in a very similar fashion. However, the mean response times of all the groups are below the 800-millisecond mark which suggests that the respondents did get some facilitation from the prime in this case. This is suggestive of partial priming in case of the Urdu compound adjective which was the prime in this case.

Prima facie, it seems that priming did not take place in the case of the English item. All the groups responded in a similar manner and took more time to recognize the target words. In case of the Urdu item, however, there seems to be quite strong evidence suggesting the occurrence of priming. The responses are very precise, excluding the medium proficiency group, and the mean response times are similar to the response times in cases where partial priming took place. Also, all the groups responded in a very similar time which was expected of them as Urdu is their first language. The table containing the contrast results below will further clarify the situation.

Table 86

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE20 and PTU20

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PTE20	Low Proficiency	Medium Proficiency	-35.50	60.54	1.000	-187.51	116.51
		High Proficiency	54.26	60.54	1.000	-97.75	206.27
	Medium Proficiency	Low Proficiency	35.50	60.54	1.000	-116.51	187.51
		High Proficiency	89.76	60.54	.441	-62.25	241.77
	High Proficiency	Low Proficiency	-54.26	60.54	1.000	-206.27	97.75
		Medium Proficiency	-89.76	60.54	.441	-241.77	62.25
PTU20	Low Proficiency	Medium Proficiency	42.30	29.33	.474	-31.36	115.95
		High Proficiency	3.38	29.33	1.000	-70.28	77.03
	Medium Proficiency	Low Proficiency	-42.30	29.33	.474	-115.95	31.36
		High Proficiency	-38.92	29.33	.579	-112.57	34.74
	High Proficiency	Low Proficiency	-3.38	29.33	1.000	-77.03	70.28
		Medium Proficiency	38.92	29.33	.579	-34.74	112.57

The table presents the results of pairwise comparisons between the proficiency groups for the two items, PTE20 and PTU20, with a focus on the mean difference in response time as the dependent variable.

In the case of the English item, PTE20, the mean response time difference between the Low Proficiency and Medium Proficiency groups is -35.50 units, with a standard error of 60.54. This difference is not statistically significant (Sig. = 1.000), and the 95% confidence interval ranges from -187.51 to 116.51. When comparing the Low Proficiency and High Proficiency groups, the mean response time difference is 54.26 units. This result is not statistically significant (Sig. = 1.000), with a confidence interval ranging from -97.75 to 206.27. The mean response time difference between the Medium

Proficiency and High Proficiency groups is 89.76 units, but it is not statistically significant (Sig. = 0.441), with a confidence interval from -62.25 to 241.77.

In the context of the Urdu item, PTU20, the mean response time difference between the Low Proficiency and Medium Proficiency groups is 42.30 units, with a standard error of 29.33. This difference is not statistically significant (Sig. = 0.474), and the 95% confidence interval ranges from -31.36 to 115.95. When comparing the Low Proficiency and High Proficiency groups, the mean response time difference is 3.38 units. This result is not statistically significant (Sig. = 1.000), with a confidence interval ranging from -70.28 to 77.03. The mean response time difference between the Medium Proficiency and High Proficiency groups is -38.92 units, and it is not statistically significant (Sig. = 0.579), with a confidence interval from -112.57 to 34.74.

In summary, the table reveals the mean response time differences between proficiency groups for the two experiments. None of the comparisons show statistically significant differences, and the confidence intervals provide a range for the potential mean response time differences.

The contents of the above table strongly suggest the absence of priming in the case of the English item. However, the response times difference in the case of the Urdu item suggests that priming did happen across the board.

In the light of the above discussion, it can be concluded that all the three groups displayed some effects of partial priming in case of the Urdu item (Urdu being their native language). No priming effects could be seen in case of the English item (PTE20).

4.4.21 PTE21 vs. PTU21

The last two pairs of items in both the experiments, this and the next one, had unrelated primes and targets. As discussed earlier in this chapter and in the previous one, both these experiments were divided into various sections. Each section of the experiment (both in the Urdu and the English experiments) contained some items wherein the primes were completely unrelated to the targets. The purpose of including this type of items, as discussed many times above, was to provide the results for absence of priming comparable to the ones where priming did take place.

Table 87

Prime and Target for PTU21

Code	Item No.	Prime	Target
PTU21	64	سلام دعا	درد

The prime in this item was *salaam dua* meaning *hello hi* in English. It is a compound noun in Urdu. The target word in this item was *dard* which means *pain* in English. It is a noun in Urdu.

The prime and target of the 21st item in the English experiment were also completely unrelated. The prime in the item was *well-built* which is a compound adjective. The target was *known* which is a verb/adjective in English.

Table 88

Prime and Target for PTE21

Code	Item No.	Prime	Target
PTE21	64	Well-built	KNOWN

As in all other items, there were the same three groups consisting of 13 members each responding to these items as well. The following table illustrates how the three groups responded to these items.

Table 89

Descriptive Statistics for PTE21 and PTU21

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE21	Low Proficiency	926.97	56.42	812.55	1041.38
	Medium Proficiency	979.04	56.42	864.62	1093.46
	High Proficiency	829.66	56.42	715.25	944.08

	Low Proficiency	835.32	26.92	780.73	889.91
PTU21	Medium Proficiency	861.30	26.92	806.71	915.89
	High Proficiency	886.66	26.92	832.07	941.25

The above table displays the mean, standard error, and 95% confidence intervals for the mean response times in the two items, PTE21 and PTU21, across different proficiency groups.

As far as the English item, PTE21, is concerned, the mean response time for the Low Proficiency group in PTE21 is 926.97, with a standard error of 56.42. The 95% confidence interval for the mean response time ranges from 812.55 to 1041.38. The mean response time for the Medium Proficiency group is 979.04, with a standard error of 56.42. The 95% confidence interval for the mean response time ranges from 864.62 to 1093.46. In the High Proficiency group, the mean response time is 829.66, with a standard error of 56.42. The 95% confidence interval for the mean response time ranges from 715.25 to 944.08.

This pair of prime and target was not related. Hypothetically, it was expected that no priming effect would take place in this item. The response time patterns confirm that the respondents did not get facilitated by the prime and took a lot of time recognizing the target word. The variation in the response times that makes the standard deviation high also indicates the same.

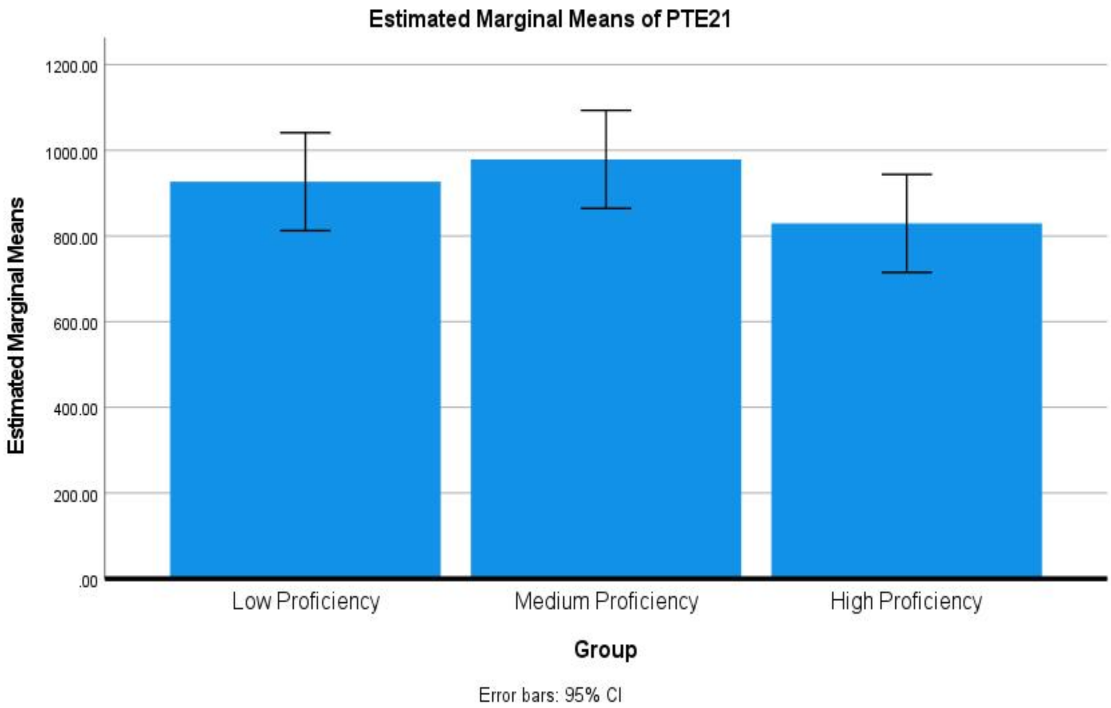
The situation is not very different in the corresponding Urdu item, PTU21. The mean response time for the Low Proficiency group in PTU21 is 835.32, with a smaller standard error of 26.92. The 95% confidence interval for the mean response time ranges from 780.73 to 889.91. The mean response time for the Medium Proficiency group is 861.30, with a standard error of 26.92. The 95% confidence interval for the mean response time ranges from 806.71 to 915.89. In the High Proficiency group, the mean response time is 886.66, with a standard error of 26.92. The 95% confidence interval for the mean response time ranges from 832.07 to 941.25.

It is evident from the haphazard response in case of the Urdu item (PTU21), that the prime did not facilitate the responses. Therefore, it can be concluded that no priming took place in the case of this item. The absence of priming was expected because the prime and target were not related in any way in this item.

This situation is further illustrated by the following bar charts.

Figure 44

Estimated Marginal Means for PTE21

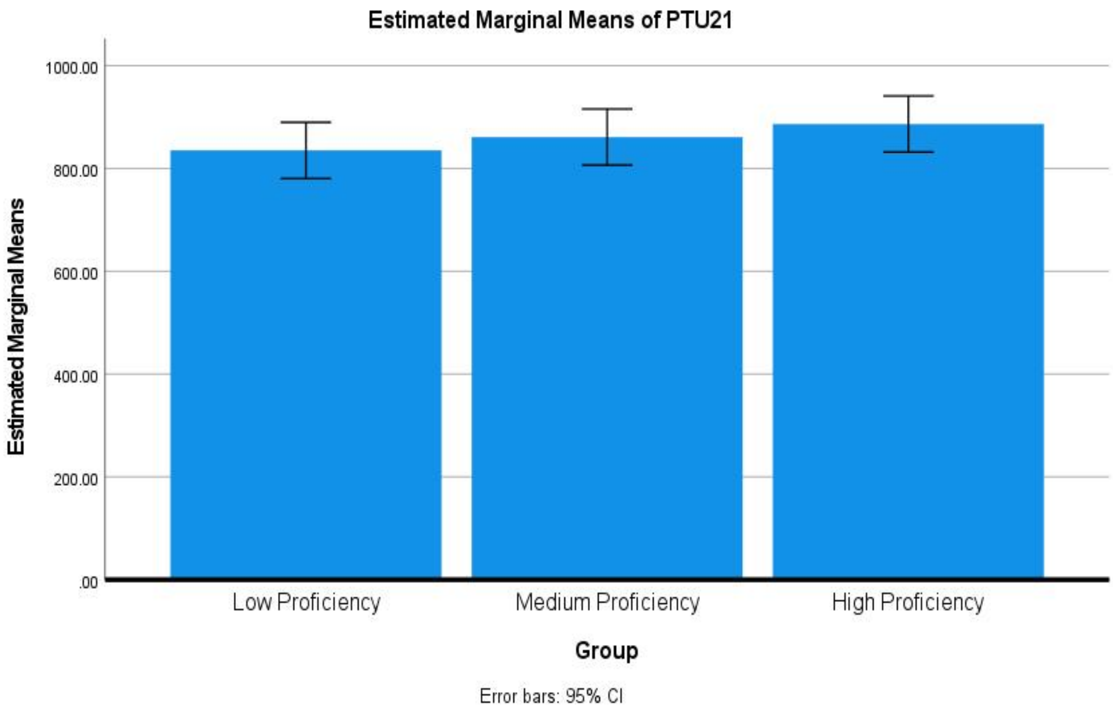


The above bar chart shows that all the three groups responded in a very similar way to this item (PTE21). The error bars of all the groups overlap across the chart. The error bars in the case of this item are quite big in sizes which indicates the variation in the response times of the respondents of each group. If the bars and the error bars are seen together, there is a lot of overlapping and that is why there is a strong suggestion that priming did not take place which was expected.

Let us now consider the bar chart pertaining to the Urdu item (PTU21).

Figure 45

Estimated Marginal Means for PTU21



This bar chart confirms the earlier discussion that there is no significant difference between the mean response times between the groups. The low proficiency group responded to this Urdu item relatively quicker than the other two groups but if the variation (indicated by the error bars) is brought into account, the mean responses of this group still overlap. That is why the analysis indicates that there is no difference in the response times between the groups as far as PTU21 is concerned.

There seems to be no significant difference in the mean response times as per the above discussion. In order to confirm this prima facie hypothesis, let us take a look at the table below.

Table 90

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE21 and PTU21

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PTE21	Low	Medium	-52.07	79.78	1.000	-252.41	148.27

	Proficiency	Proficiency					
		High Proficiency	97.30	79.78	.692	-103.04	297.64
	Medium Proficiency	Low Proficiency	52.07	79.78	1.000	-148.27	252.41
		High Proficiency	149.38	79.78	.208	-50.96	349.72
	High Proficiency	Low Proficiency	-97.30	79.78	.692	-297.64	103.04
		Medium Proficiency	-149.38	79.78	.208	-349.72	50.96
PTU21	Low Proficiency	Medium Proficiency	-25.98	38.07	1.000	-121.57	69.60
		High Proficiency	-51.34	38.07	.557	-146.93	44.24
	Medium Proficiency	Low Proficiency	25.98	38.07	1.000	-69.60	121.57
		High Proficiency	-25.36	38.07	1.000	-120.94	70.22
	High Proficiency	Low Proficiency	51.34	38.07	.557	-44.24	146.93
		Medium Proficiency	25.36	38.07	1.000	-70.22	120.94

The table presents the results of pairwise comparisons between proficiency groups for the two items under focus, PTE21 and PTU21, with a focus on the mean difference in response time as the dependent variable.

Let us see the results for PTE21, the English item, first. The mean response time difference between the Low Proficiency and Medium Proficiency groups is -52.07 units, with a standard error of 79.78. This difference is not statistically significant (Sig. = 1.000), and the 95% confidence interval ranges from -252.41 to 148.27. When comparing the Low Proficiency and High Proficiency groups, the mean response time difference is 97.30 units. This result is not statistically significant (Sig. = 0.692), with a confidence interval ranging from -103.04 to 297.64. The mean response time difference between the Medium Proficiency and High Proficiency groups is 149.38 units, but it is not statistically significant (Sig. = 0.208), with a confidence interval from -50.96 to 349.72.

In the case of the Urdu item, PTU21, the mean response time difference between the Low Proficiency and Medium Proficiency groups is -25.98 units, with a standard error of 38.07. This difference is not statistically significant (Sig. = 1.000), and the 95% confidence interval ranges from -121.57 to 69.60. When comparing the Low Proficiency and High Proficiency groups, the mean response time difference is -51.34 units. This result is not statistically significant (Sig. = 0.557), with a confidence interval ranging from -146.93 to 44.24. The mean response time difference between the Medium Proficiency and High Proficiency groups is -25.36 units, and it is not statistically significant (Sig. = 1.000), with a confidence interval from -120.94 to 70.22.

The table illustrates that there is no significant difference in the way the participants responded to both these Urdu and the English items. Both these items (PTE21 and PTU21) had unrelated primes and targets. Therefore, it was expected that the respondents would take similar time to respond to them as there was no facilitation possible because of the unrelated primes.

4.4.22 PTE22 vs. PTU22

The last items in both the experiments, like the second-last one, had completely unrelated primes and targets. Hypothetically, no priming effects were expected in these items because of no similarity between the primes and the targets. However, it was necessary to put such items on the list of the experiments because they would provide the non-priming effect results which could be compared with those showing full or partial priming effects.

Table 91

Prime and Target for PTU22

Code	Item No.	Prime	Target
PTU22	65	کھلونا گاڑی	بہار

The prime in the Urdu item was *khilona gari* meaning *toy car* in English. It is a compound noun in Urdu. The target word in this item was *bahaar* which is a noun in Urdu meaning *spring (season)* in English.

The prime in the corresponding English item was *building* which is the present participle form of the verb *build* and can be used as a noun too. The target was *term* which is a noun in English.

Table 92

Prime and Target for PTE22

Code	Item No.	Prime	Target
PTE22	65	Building	TERM

It can be seen that the primes and targets in both the Urdu and English item are completely unrelated. Because of the dissimilarity between the primes and the targets in both cases, no priming effect was expected in these items. Let us examine the table below.

Table 93

Descriptive Statistics for PTE22 and PTU22

	Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PTE22	Low Proficiency	1078.81	65.87	945.21	1212.41
	Medium Proficiency	988.45	65.87	854.86	1122.05
	High Proficiency	841.36	65.87	707.76	974.96
PTU22	Low Proficiency	866.75	21.40	823.35	910.15
	Medium Proficiency	870.19	21.40	826.79	913.59
	High Proficiency	910.57	21.40	867.17	953.97

The above table presents the descriptive statistics for the mean response times in the two items, PTE22 and PTU22, across the three proficiency groups.

There seems to be no variation in the response times of the three proficiency groups in the case of the English item, PTE22. The mean response time for the Low Proficiency group in PTE22 is 1078.81, with a standard error of 65.87. The 95% confidence interval for the mean response time ranges from 945.21 to 1212.41. The mean response time for the Medium Proficiency group is 988.45, with a standard error of 65.87. The 95% confidence interval for the mean response time ranges from 854.86 to 1122.05.

In the High Proficiency group, the mean response time is 841.36, with a standard error of 65.87. The 95% confidence interval for the mean response time ranges from 707.76 to 974.96.

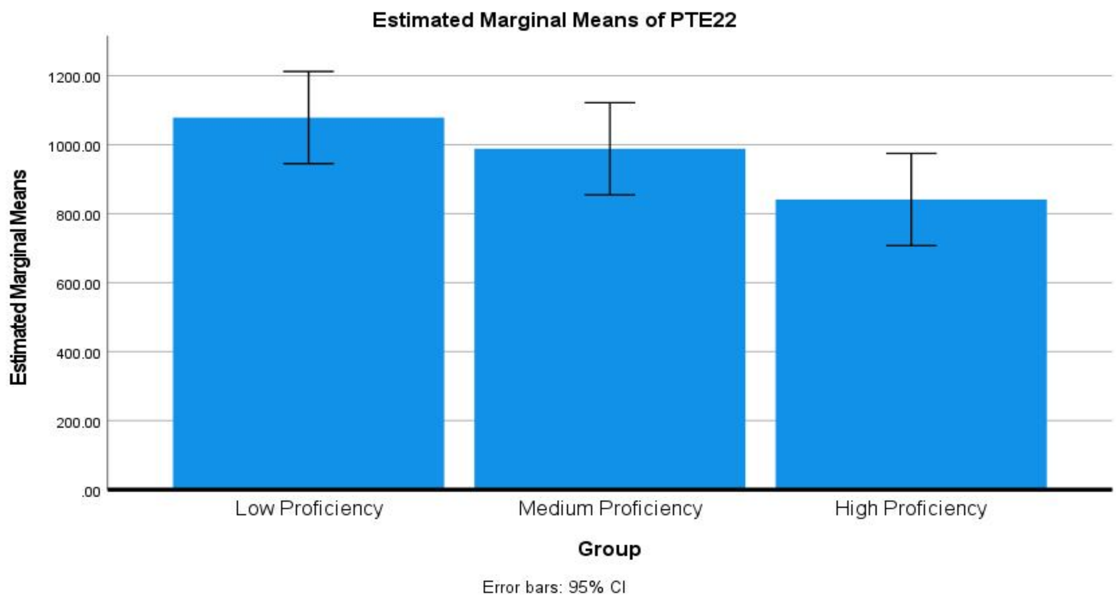
The case of the corresponding Urdu item, PTU22, is not different. The mean response time for the Low Proficiency group in PTU22 is 866.75, with a smaller standard error of 21.40. The 95% confidence interval for the mean response time ranges from 823.35 to 910.15. The mean response time for the Medium Proficiency group is 870.19, with a standard error of 21.40. The 95% confidence interval for the mean response time ranges from 826.79 to 913.59. In the High Proficiency group, the mean response time is 910.57, with a standard error of 21.40. The 95% confidence interval for the mean response time ranges from 867.17 to 953.97.

These response times indicate that no priming took place in any of the two items be it the English or the Urdu item. As discussed earlier in this subsection, the priming was not expected because the primes and targets in both the items were totally unrelated.

The following bar graphs will further illustrate the situation. Let us take a look at the figure pertaining to the English item (PTE22) first.

Figure 46

Estimated Marginal Means for PTE22

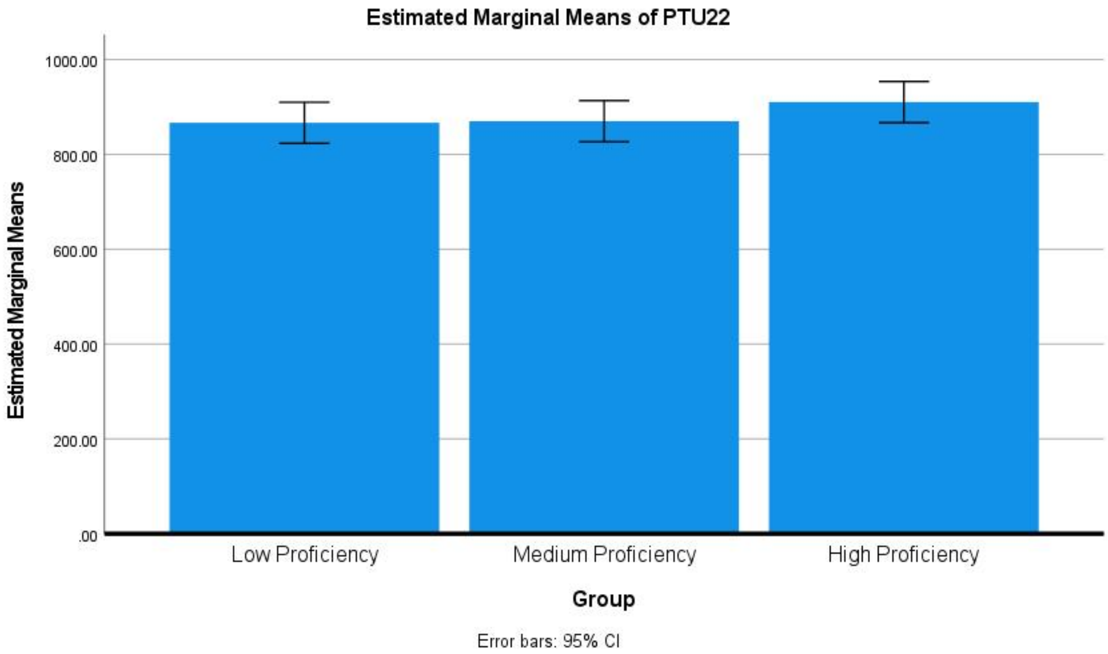


This figure shows that the low proficiency group took more time in responding to the item as compared to the other two groups and there is a gradual decrease in the mean response times towards the high proficiency group that took the least time to respond. However, the error bars in each case overlap with one another indicating that the difference might not be statistically significant.

Let us look at the figure pertaining to the corresponding Urdu item (PTU22):

Figure 47

Estimated Marginal Means for PTU22



As discussed earlier, the responses to this item were quite random in nature. The haphazard nature of the responses is evident from the structure of this figure too. The size of the error bars in each group is quite big which shows the randomness of the data in the backdrop. Although the average response time of the high proficiency group can be seen to be a bit higher as compared to the other two groups, and that of the medium proficiency group to be a bit lower in comparison with the other two groups, there seems to be no significance in it as the error bars are overlapping across the board. The overall mean response time is also well above 800 milliseconds which indicates the absence of priming in this case.

Let us examine the table below containing contrast results between the high proficiency group and the other two groups.

Table 94

Post Hoc Analysis (Bonferroni) Across the Proficiency Groups for PTE22 and PTU22

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PTE22	Low Proficiency	Medium Proficiency	90.36	93.16	1.000	-143.57	324.29
		High Proficiency	237.4516*	93.16	.046	3.52	471.38
	Medium Proficiency	Low Proficiency	-90.36	93.16	1.000	-324.29	143.57
		High Proficiency	147.09	93.16	.369	-86.83	381.02
	High Proficiency	Low Proficiency	-237.4516*	93.16	.046	-471.38	-3.52
		Medium Proficiency	-147.09	93.16	.369	-381.02	86.83
PTU22	Low Proficiency	Medium Proficiency	-3.44	30.26	1.000	-79.43	72.55
		High Proficiency	-43.82	30.26	.469	-119.81	32.17
	Medium Proficiency	Low Proficiency	3.44	30.26	1.000	-72.55	79.43
		High Proficiency	-40.38	30.26	.571	-116.37	35.61
	High Proficiency	Low Proficiency	43.82	30.26	.469	-32.17	119.81
		Medium Proficiency	40.38	30.26	.571	-35.61	116.37

In this table, the results of pairwise comparisons for mean differences in response times between different proficiency groups in the two items under focus, PTE22 and PTU22, are presented:

In the case of PTE22, the English item, there is a statistically significant difference between the way the high proficiency group and the low proficiency group responded. The mean difference in response time between the Low Proficiency and Medium Proficiency groups is 90.36 units. However, this difference is not statistically significant (Sig. = 1.000), with a 95% confidence interval ranging from -143.57 to 324.29. When comparing the Low Proficiency and High Proficiency groups, the mean difference in response time is 237.45 units, and it is statistically significant (Sig. = 0.046). The 95%

confidence interval for this difference ranges from 3.52 to 471.38. When comparing the Medium Proficiency and High Proficiency groups, the mean difference in response time is 147.09 units, but it is not statistically significant (Sig. = 0.369). The 95% confidence interval for this difference ranges from -86.83 to 381.02.

In the case of the corresponding Urdu item, PTU22, there seems to be no statistically significant difference between any of the groups. The mean difference in response time between the Low Proficiency and Medium Proficiency groups is -3.44 units, which is not statistically significant (Sig. = 1.000), with a 95% confidence interval ranging from -79.43 to 72.55. When comparing the Low Proficiency and High Proficiency groups, the mean difference in response time is -43.82 units, and it is not statistically significant (Sig. = 0.469). The 95% confidence interval for this difference ranges from -119.81 to 32.17. When comparing the Medium Proficiency and High Proficiency groups, the mean difference in response time is -40.38 units, and it is not statistically significant (Sig. = 0.571). The 95% confidence interval for this difference ranges from -116.37 to 35.61.

The high proficiency group responded the quickest to the English item. However, their mean response time is still well above 800 milliseconds which suggests the absence of priming of any sort in this case. Indeed, the members of the high proficiency group were the quickest to recognize the word but because they were not quick enough, there seems to be no priming. As a matter of fact, there is no way that the completely unrelated prime would have facilitated any of the responding individuals in responding to the item. Hence, no priming!

The above discussion suggests that no priming effect was seen among all the participants in both the Urdu and English experiments when the primes and the targets were unrelated.

4.5 Section-Wise Analysis of the Experiments

The items in both the English and Urdu experiments were placed in a particular manner in order to examine the presence or absence of full priming, partial priming, and no priming. In this section of the chapter, an analysis of these items according to the different sections of the experiments is presented.

In contrast to the previous section of this chapter where individual items were compared, the related items in each experiment will be compared and contrasted together in this section, with the purpose of gauging the effects of priming.

Let us start by analyzing and discussing the various sections of the Urdu experiment.

4.5.1 The Urdu Experiment

The Urdu experiment had its items belonging to various categories. The first category of the items was the one in which the same words were used both as primes and targets. This is called identity priming. Usually, full priming effects are displayed by the partaking individuals in such cases. Then there were items in which inflections were used as primes while the corresponding non-inflected forms of the inflections were used as targets, with the purpose of gauging partial priming. Another category in the experiment had items with derived words as primes while the source words of the derivations as the target words. This, again, had a purpose: finding out the priming effects in case of derivations.

There were three compound words used as primes in a set of three items which targeted at observing the priming effects in the case of compound words, if any. Finally, there were eight items, with unrelated primes and targets aimed at providing the results for the absence of priming effects. We shall discuss each of these sections with detail in the following parts of this section of the chapter. Let us begin with the section containing the primes with identical primes and targets.

4.5.1.1 Items with Identical Primes and Targets

There were three items in the Urdu experiment containing identical primes and targets:

Table 95

Items with Identical Primes and Targets (Urdu)

Code	Prime	Target
PTU1	چہرہ	چہرہ
PTU2	امتحان	امتحان

PTU3	بچہ	بچہ

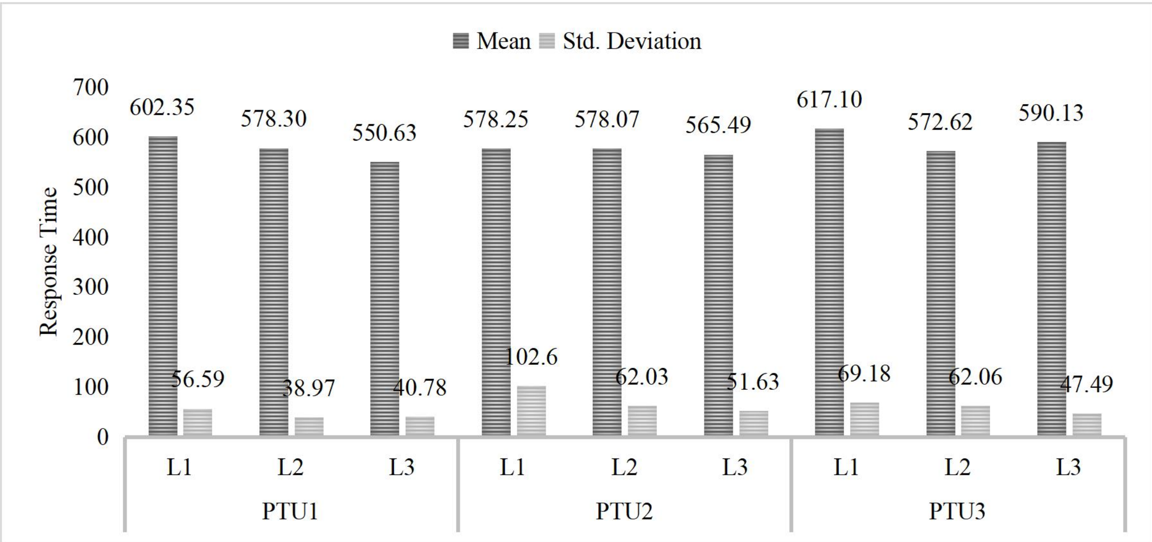
The word used as both the prime and target in the first item on the above list, PTU1, was *chehra* (face). The second item, PTU2, used *imtehan* (test/examination) as both its prime and target. In the third item, PTU3, *bacha* (child) was used as both the prime and the target. All the three words are nouns in Urdu.

As mentioned above, the purpose behind this setting was to observe the full priming effects expected in the case of identical primes and targets.

The following figure illustrates the response times of the partaking individuals belonging to all three (low proficiency, medium proficiency, and high proficiency) groups in case of the three items.

Figure 48

Items with Identical Primes and Targets (Urdu)



The above figure shows the mean response times of the three groups (in milliseconds) in response to the three items wherein the primes and targets were identical. The vertical axis shows the three items, PTU1, PTU2, and PTU3, and the response times of all the three groups corresponding to each of these three items. The horizontal axis shows the mean response times of each group in response to each of these items in solid bars while the corresponding standard deviation is shown by the dotted bars next to each group. The mean response times and standard deviation figures are written next to each bar in the figure.

In the case of PTU1, the low proficiency group (L1) responded with a mean score of 602.35 milliseconds. The standard deviation in their response times was 56.59. The medium proficiency group (L2) responded to this item with a mean score of 578.30ms with 38.97 as the standard deviation. The high proficiency group (L3) was the quickest in responding, albeit by a very slight margin. They responded with a mean score of 550.63ms while the standard deviation within the group was 40.78.

In the case of the second item with identical prime and target (PTU2), the low proficiency group took an average of 578.25 milliseconds in response while the standard deviation among the group was 102.60. The medium proficiency group took almost the same time as the low proficiency group. Their average response time was 578.07 milliseconds. However, the standard deviation was much less in comparison (62.03 as compared to 102.60). The high proficiency group responded to this item with an average of 565.49ms which is a bit better/quicker than how the other two groups responded. The standard deviation among the high proficiency group in this item was also much less (51.63).

In response to PTU3, the low proficiency group's mean response time was 617.10ms which is quite similar to the way the same group responded to the corresponding English item. The standard deviation in the group while responding to this item was 69.18. The medium proficiency group responded to the item with a group average (mean response time) of 572.62 millisecond. The standard deviation among the group in terms of their response times was 62.06ms. The high proficiency group took a little more time than the medium proficiency group by taking 590.13 milliseconds to respond, on average. The standard deviation amongst the members of the high proficiency group in response to this item was 47.49.

It is evident from the above figure that all the groups responded similarly not only to each item but to all the three items being discussed here. The difference between the mean response times of the three groups is marginal in case of each item. The minimum mean response time in the figure is 550.63 by the high proficiency group in PTU1 while the maximum mean response time is 617.10 milliseconds by the low proficiency group in case of PTU3. The difference between the two cases is a mere 67 milliseconds which denotes the similarity of responses across the three items.

The low standard deviation also shows the precise response by the partaking individuals. The highest standard deviation is displayed by the low proficiency group in the case of PTU2 and is 102.6.

Most of the mean response times were in the range of below 600 milliseconds which is quite quick and denotes the effect of priming to the full. Only two mean response times exceeded 600 milliseconds, although marginally, in case of the low proficiency group responding to PTU1 and PTU3.

Since all the respondents were Urdu native speakers, the difference across the groups was not expected of them. These respondents were divided into three groups on the basis of their proficiency in English and not in Urdu. Urdu being their first language, the respondents were expected to respond similarly to all the Urdu items. It can be seen from the above discussion that they did respond very similarly not only to one item but also to the three similar items being discussed here.

It can be safely concluded that full priming effects were observed in case of the identical primes and targets in all the three items placed for the same purpose. These full priming effects and the resulting statistics would help in analyzing the cases where partial or no priming effects were observed. There is another significance of the full priming effects being displayed here. These results add to the validity of the experiment's settings and operations. It means that the experiment was logically well built and the timings for which the primes were shown were correct.

4.5.1.2 Items with Plural Inflections of the Indigenous Urdu Construction

The second section of the Urdu experiment dealt with inflections. There were four items in this section that involved plural inflections. There were two types of plural inflections used in the experiment. Two of the items used plural inflections of purely Urdu origin. These inflectional constructions in Urdu do not have any Arabic, Persian, or Hindi origin as is the case with most inflections in Urdu. The other two items used in this section were also plural inflections, but they had an Arabian origin. We shall discuss the two items having the indigenous Urdu construction first.

Table 96

Indigenous Urdu Inflections

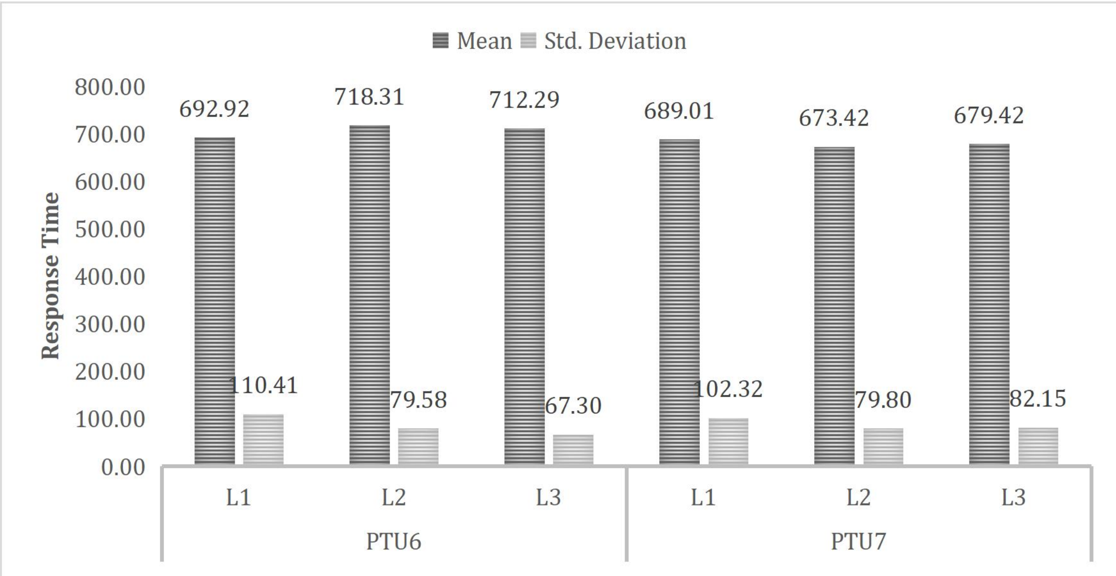
Code	Prime	Target
PTU6	باتوں	بات
PTU7	دوستوں	دوست

In the first of these two items, PTU6, the prime was *baaton* meaning *news* which is the plural inflection of *baat* meaning *a piece of news*. The second item, PTU7, involved a similar construction. The prime in this item was *doston* which means *friends.* The target was the singular form of the prime, *dost*, meaning *a friend*.

The following figure shows how the three groups responded to these two items:

Figure 49

Indigenous Urdu Inflections



The figure above shows that almost all the participants responded to both the items in a very similar way. The minimum mean response time was taken by the low proficiency group in case of PTU6 and the maximum average response time was taken by the medium proficiency group responding to the same item, PTU6. The difference between the minimum and the maximum mean response times is 82 milliseconds which seems negligible.

In the case of PTU6, as shown by the table above, almost all the groups responded in a similar way to the corresponding Urdu item consisting of a plural inflection as its prime and the corresponding singular form of it as its target. The low proficiency group took the least time of all by taking an average response time of 692.92 milliseconds. Their standard deviation (110.41) was on the higher side though. The medium proficiency group responded in a similar way by taking 718.31 milliseconds, on average, with a standard deviation of 79.58. The high proficiency group also responded in a very similar mean response time (712.84 milliseconds) with their standard deviation being a mere 67.30 milliseconds.

The responses in the other item being discussed (PTU7) are quite similar as well where the low proficiency group responded in a mean response time of 689.01 milliseconds, with a standard deviation of 102.32. The medium proficiency group took 673.42 millisecond in their average response and the standard deviation among the group was 79.80ms. The high proficiency group took 679.42 millisecond in their average response and the standard deviation in their responses was 82.15 millisecond. In the case of PTU7 all the groups responded in less than 700 milliseconds and the difference between the minimum and the maximum mean response time is only 18 milliseconds.

We can safely conclude, taking the above discussion into consideration, that in both these cases (PTU6 and PTU7) partial priming did take place. There are two indicators of the phenomenon. First of all, the response times are more than the average response times of the cases where identical primes and targets were used and, as a result, full priming took place. The second indicator is the similar response of all the groups to both these items with relatively lesser standard deviation as compared to the items where there was no priming.

4.5.1.3 Items with Plural Inflections of Arabic Origin

Two items containing inflections of Arabic origin were also included in the experiment. Although there were past tense inflections used in the corresponding English experiment, parallel to these items, I thought it would be worthwhile to see whether the respondents respond to these inflections differently. The details about the items are in the following table:

Table 97

Plural Inflections of Arabic Origin

Code	Prime	Target
PTU8	موضوعات	موضوع
PTU9	احسانات	احسان

In case of PTU8, the prime was *mozuaat* which is a plural of *mozuu*. Both are nouns in Urdu and mean *topics* and *topic* respectively.

The prime used in PTU9 was *ihsanaat* which is the plural inflection of the noun *ihsaan*

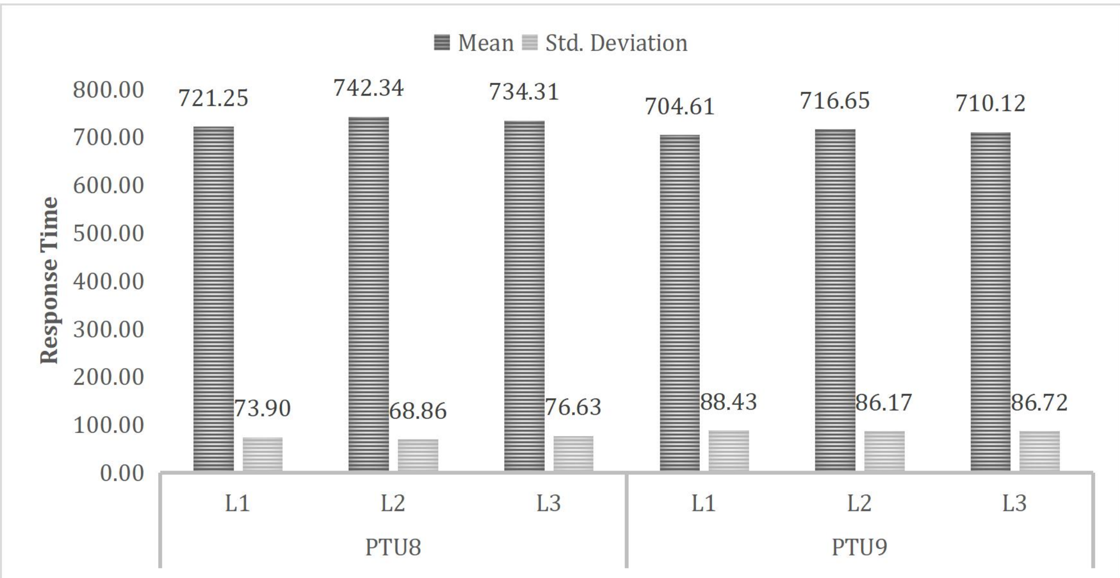
As is evident from the pronunciation, these plural constructions are quite different from the ones discussed in the previous subsection. These words came into Urdu from Arabic and that is why the plural inflections still follow the Arabic traditions.

As discussed above, the purpose behind inclusion of these two items was twofold; one, to see whether any priming takes place in the case of inflections, and two, whether there is any difference between the participants' responses to inflections of indigenous Urdu and Arabic origin.

The following figure illustrates the responses given by the three groups of respondents in the case of both these items.

Figure 50

Plural Inflections of Arabic Origin



According to the above figure, responding to the Urdu item, PTU8, the 13 participants belonging to the low proficiency group took 721.25 milliseconds on average while their standard deviation was 73.90. The same number of respondents in the medium proficiency group responded to the item in the mean response time of 742.34 millisecond. The standard deviation among the medium proficiency group was 68.86.

The high proficiency group took a similar time to respond to the Urdu item. Their mean response time was 734.31 millisecond. The high proficiency group had a standard deviation of 76.63 as well.

As far as PTU9 is concerned, the 13 participants belonging to the low proficiency group took 704.61 milliseconds on average while their standard deviation was 88.43 which is on the lower side denoting the similarity of responses. The 13 respondents in the medium proficiency group responded to the item in an average response time of 716.65 milliseconds. The standard deviation among the medium proficiency group was 86.17, which is quite low and shows the consistency among the response times of the group. The high proficiency group took a similar time to respond to the Urdu item. Their mean response time was 710.12 milliseconds. The high proficiency group had a standard deviation of 86.72.

The figure shows similar responses to both these items in most cases. The response times are quite low and the standard deviation statistics are also under the 100 mark. This suggests that priming took place across the board in these two items. This goes on to prove that the native speakers of a language do break down the morphologically complex words before storing them in their mental lexicons.

4.5.1.4 Adjectival Derivations of Indigenous Urdu Construction

There were two items, included in the experiment, dealing with the adjectives derived from nouns in Urdu. These two pairs of primes and targets included indigenous Urdu derivative used for converting nouns into adjectives.

Table 98

Indigenous Urdu Derivations

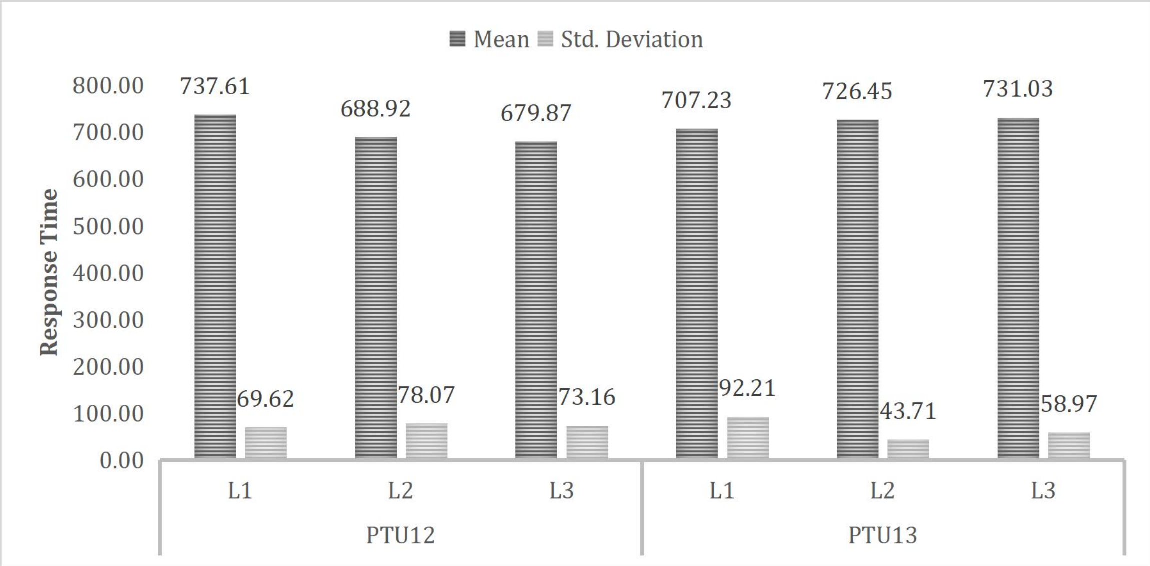
Code	Prime	Target
PTU12	اسلامی	اسلام
PTU13	عقلی	عقل

The first item, PTU12, had *Islami* as the prime which is an adjective derived from a noun *Islam* (which was the target word in the item) and means *Islamic*. In the second one, PTU13, *aqli* was used as the prime and *aqal* as the target. These words mean *reasonable* and *reason* respectively.

The following bar graph illustrates how the three groups responded to both these items in the Urdu experiment.

Figure 51

Indigenous Urdu Derivations



The statistics visualized in the above figure strongly suggest priming effects on all the partaking individuals in case of the indigenous Urdu adjectival derivations. It can be seen that almost all the groups responded not only similarly to the individual items but their response to both the items seems quite similar.

Responding to PTU12, the 13 participants belonging to the low proficiency group took 737.61 milliseconds on average while their standard deviation was 69.62. The same number of respondents in the medium proficiency group responded to the item in the mean response time of 688.92 millisecond. The standard deviation among the medium proficiency group was 78.07. The high proficiency group took a bit less time to respond to the Urdu item. Their mean response time was 679.87 milliseconds. The high proficiency group had a standard deviation of 73.16.

The participants' response to PTU13 was strikingly similar. The participants belonging to the low proficiency group took 707.23 milliseconds on average while their standard deviation was 92.21. The same number of respondents in the medium proficiency group responded to the item in the mean response time of 726.45 millisecond.

The standard deviation among the medium proficiency group was 43.71. The high proficiency group took a similar time to respond to the Urdu item. Their mean response time was 731.03 millisecond. The high proficiency group had a standard deviation of 58.97.

The above discussion suggests that there was consistent partial priming across the participants in the case of the native Urdu adjectival derivations. The response times were very similar. The lowest amount of time was taken by the high proficiency group in case of PTU12 (679.87 milliseconds) and the highest mean response time (737.61 milliseconds) was taken by the low proficiency group while responding to the same item. The difference between the two is only 58 milliseconds. In the other item, PTU13, the difference between the minimum and the maximum mean response times is even smaller (24 milliseconds). The standard deviation in both the items is less than 100 across the board. This indicates the evenness and precision of the response times and indirectly authenticates the data. The average response times are around 700 milliseconds which also indicates the onset of partial priming in both these items.

Let us now consider the case of adjectival derivations of Persian origin.

4.5.1.5 Adjectival Derivations of Persian Origin

There were two adjectival derivations used in this regard. Both the derivations involve a prefix (of Persian origin) *pur* which, semantically, is very close to the English suffix *-ful*.

Table 99

Derivations of Persian Origin

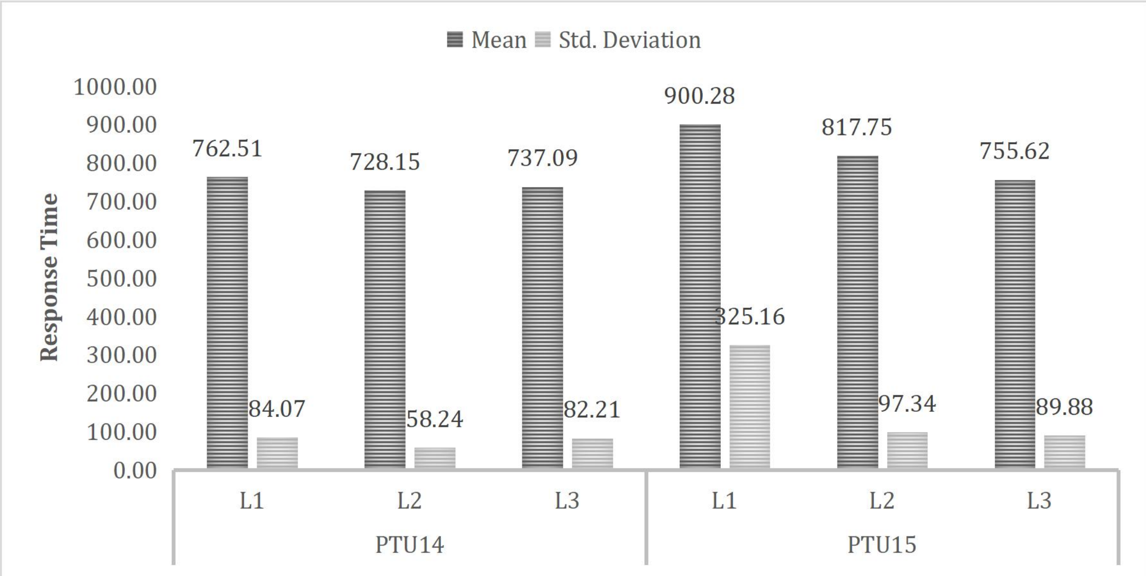
Code	Prime	Target
PTU14	پرلطف	لطف
PTU15	پرنم	نم

In PTU14, the prime was *pur-lutf* which means *full of fun/enjoyment* while the target word was *lutf* which means *fun/enjoyment*. The prime used in PTU15 was *pur-nam* which means *moist* while the target was *nam* which means *moisture*.

The following figure illustrates how the participants of the experiment responded to these adjectival derivations of Persian origin.

Figure 52

Derivations of Persian Origin



The above figure indicates a haphazard response to the second item (PTU15) under discussion. Not only are the response times high but the standard deviation is also high in most cases. In the case of PTU14, the similar responses and low standard deviation statistics are suggestive of the onset of partial priming.

Responding to PTU14, the low proficiency group took 762.51 milliseconds on average while their standard deviation was 84.07. The same number of respondents in the medium proficiency group responded to the item in the mean response time of 728.15 millisecond. The standard deviation among the medium proficiency group was 58.24. The high proficiency group took a similar time to respond to the Urdu item. Their mean response time was 737.09 milliseconds. The high proficiency group had a standard deviation of 82.21.

Responding to PTU15 the 13 participants belonging to the low proficiency group took 900.28 milliseconds on average while their standard deviation was very high at 325.16 which is very high and was not expected as the respondents were native speakers of Urdu. The same number of respondents in the medium proficiency group responded to the item in the mean response time of 817.75 millisecond. The standard deviation among the medium proficiency group was 97.34. The high proficiency group took a bit less time to respond to the Urdu item. Their mean response time was 755.62 millisecond. The high proficiency group had a standard deviation of 89.88.

As mentioned above, the statistics being visualized do not suggest the occurrence of partial priming in the case of PTU15. In the case of PTU14, all the three proficiency groups responded in less than 750 milliseconds and their respective standard deviation is also less than 100 milliseconds. This indicates the occurrence of across-the-board partial priming in the case of PTU14. As far as the other derivation of Persian origin (PTU15) is concerned, there seems to be no indication of the onset of priming among the low and the medium proficiency groups. The high proficiency group responded in less than 800 milliseconds which indicates that the respondents were helped by the prime in this case and it can be used as conclusive evidence of the occurrence of partial priming.

Let us now move on towards the compound words in Urdu and see whether any priming took place in them.

4.5.1.6 Urdu Compound Words

There were three compound words used in the Urdu experiment. Two of these three compound words were compound nouns while the third one was a compound adjective. It is worthwhile mentioning here that all the three compound words used in the Urdu experiment were both orthographically and semantically transparent.

Table 100

Urdu Compound Words

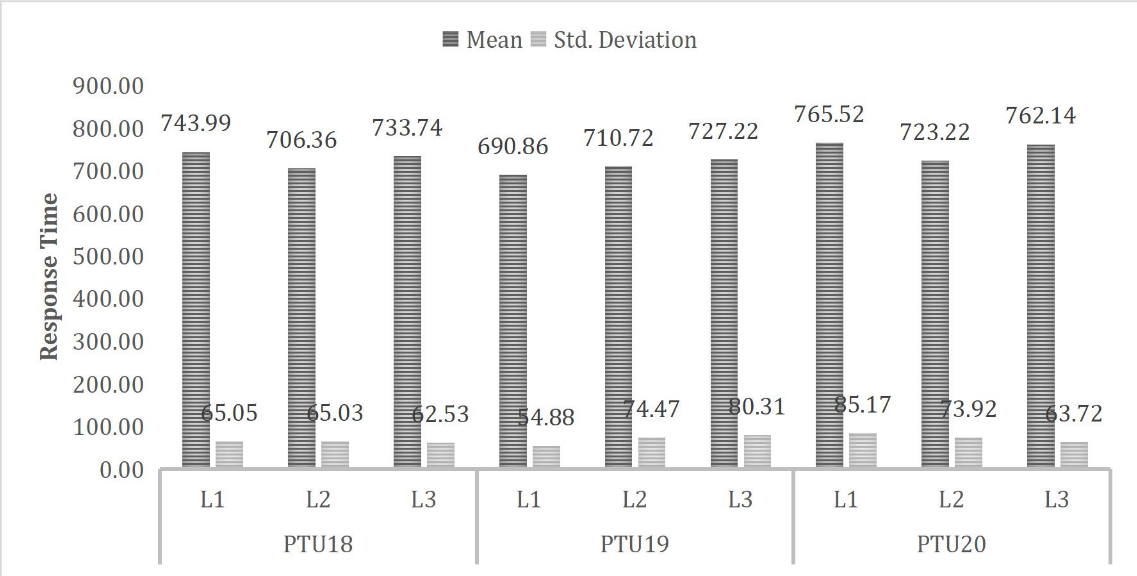
Code	Prime	Target
PTU18	شوروغل	شور
PTU19	بول چال	بول
PTU20	تنگ و تاریک	تاریک

In PTU18, the prime was a compound noun *shor-o-ghul* which means *noise*. Interestingly, the target word in the item, *shor*, also means the same. The target word is also a noun. In PTU19, the prime was, again, a compound noun, *bol chaal*, which means *conversation*, whereas the target was *bol* which means *utterance/words* and is a noun in Urdu. The third item on the list, PTU20, had a compound adjective as its prime. The compound adjective was *tang-o-tareek* meaning *narrow and dark* while the target was another adjective, *tareek*, which means *dark*.

The following figure illustrates the participants' responses to these three items.

Figure 53

Urdu Compound Words



Prima facie, the data shown in the above chart is strongly suggestive of the occurrence of partial priming in all the three items under focus here. Not only are the mean response times around 750 milliseconds in all the cases but the standard deviation is also very low.

Responding to the first compound noun on the list (PTU18) the 13 participants belonging to the low proficiency group took 743.99 milliseconds on average while their standard deviation was 65.05. The same number of respondents in the medium proficiency group responded to the item in the mean response time of 706.36 milliseconds. The standard deviation among the medium proficiency group was 65.03. The high proficiency group took similar time to respond to the Urdu item. Their mean response time was 733.74 milliseconds. The high proficiency group had a standard deviation of 62.53.

Responding to the second Urdu compound noun (PTU19) the 13 participants belonging to the low proficiency group took 690.86 milliseconds on average while their standard deviation was only54.88. The same number of respondents in the medium proficiency group responded to the item in the mean response time of 710.72

milliseconds. The standard deviation among the medium proficiency group was 74.47. The high proficiency group took similar time to respond to the Urdu item. Their mean response time was 727.22 millisecond. The high proficiency group had a standard deviation of 80.31.

Responding to the Urdu compound adjective (PTU20) the low proficiency group took 765.52 milliseconds on average while their standard deviation was 85.17. The respondents in the medium proficiency group responded to the item with the mean response time of 723.22 milliseconds. The standard deviation among the medium proficiency group was 73.92. The high proficiency group took similar time to respond to the Urdu item. Their mean response time was 762.14 millisecond. The high proficiency group had a standard deviation of 63.72.

The above figures and discussion suggest that partial priming did take place in case of both the compound nouns in Urdu. The mean response times are well below the 775 milliseconds mark which suggests that the respondents did get facilitated by the compound nouns used as primes in these items. The corresponding standard deviations are also quite low and suggest the precise nature of the data being presented.

The case of PTU20, where a compound adjective was used as the prime, is a wee bit different. Here, the average response times are a little bit higher compared to the other two items. However, the response times and the corresponding standard deviation statistics are strongly suggestive of the onset of partial priming in all the three groups in this case as well.

4.5.1.7 Unrelated Primes and Targets

There were eight items in the Urdu experiment which had unrelated primes and targets. These items were made part of the experiment in order to see the patterns of data generated by them. As per the expectation, the respondents should take more time, on average, to recognize the target words presented in these items as there is no facilitation provided by the unrelated primes.

Since the data of all the 8 items in question cannot be shown in one graph, they have been divided in two sets of four items each. The codes belonging to these items are not in sequence. This is because these items were placed in different sections of the experiment. Here, for the sake of showing the similarities (and/or differences) of the response times, they have been put and presented together.

The discussion begins with the first four of these items here.

Table 101

Unrelated Primes and Targets 1 (Urdu)

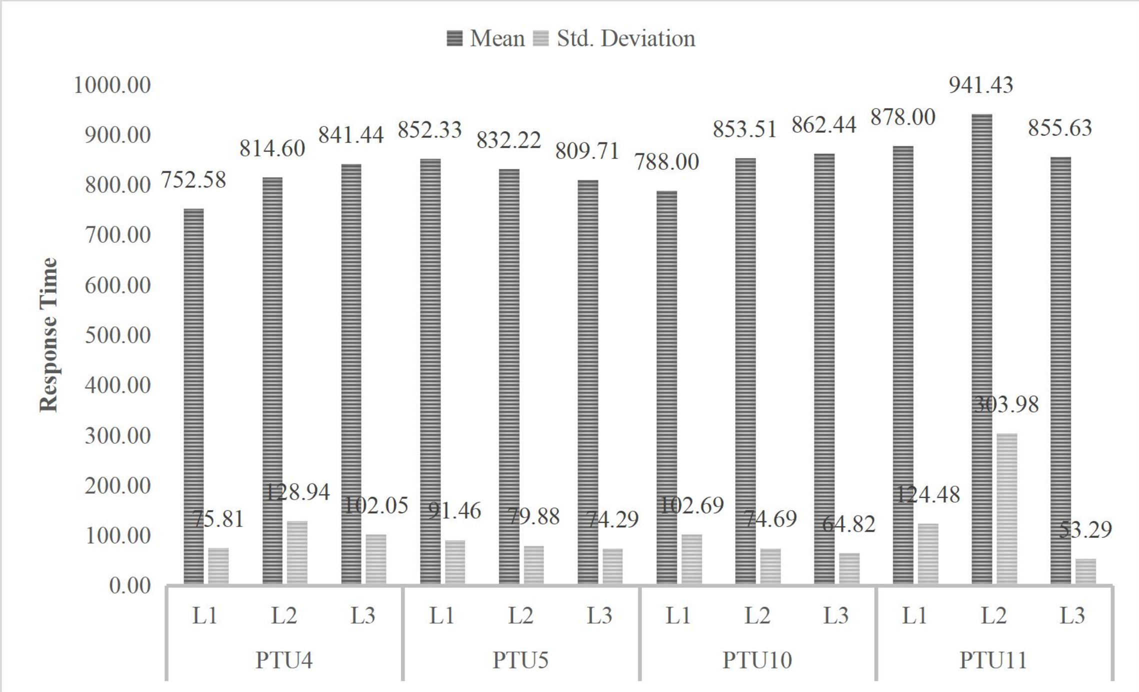
Code	Prime	Target
PTU4	برسات	جانور
PTU5	خلاصہ	بلبل
PTU10	سنتا	کھانا
PTU11	سوچتا	چلنا

The first item on the list, PTU4, had *barsaat* as its prime which is a noun and means *rain* in English. The target in the item was *janwar* which, again, is a noun meaning *animal* in English. The second item on the list, PTU5, used *khulasa* as its prime. It is a noun and means *summary* in English. The target word in the item was *bulbul* which is the name of a local bird similar to nightingale. In the third item on the list, PTU10, the prime was *sunta* which is the past tense inflection of the verb *sun-na* meaning *to hear/listen*. The target word in the item was *khana* which is both used as a verb meaning *to eat* and a noun meaning *meal*. In the fourth item under discussion (PTU11), the prime was *sochta* which is the past tense form of the verb *sochna* meaning *to think*. The target in the item was both a verb and a noun *chalna* which means *walk/to walk*.

The following figure shows how the respondents belonging to all the three groups responded to these items.

Figure 54

Unrelated Primes and Targets 1 (Urdu)



The figure shows the haphazard nature of responses by the participants responding to these items with unrelated primes and targets.

In case of PTU4, the low proficiency group took the least time (Mean=752.58 milliseconds). The standard deviation in the group was 75.81 milliseconds. The medium proficiency group responded to the item in 814.60 milliseconds and the variation in the response time was also relatively high (Std. Deviation=128.94). The high proficiency group took 841.44 milliseconds, on average, to respond to the item. The standard deviation in the group was 102.05.

In response to PTU5, the low proficiency group's mean response time was 852.33 milliseconds. The standard deviation among the group was 91.46. The case with the medium proficiency group was similar with the mean response time being 832.22 milliseconds and the standard deviation being 79.88 milliseconds. The high proficiency group performed relatively better in response to PTU5 by responding in 809.71 milliseconds on average with a standard deviation of 74.29.

While responding to PTU10, the low proficiency group's mean response time was 788.00 milliseconds. The standard deviation among the group was 102.69. The case with the medium proficiency group took a little more time with their mean response time being 853.51 milliseconds and the standard deviation being 74.69 milliseconds. The high proficiency group performed relatively slowly in response to PTU10 by responding in 862.44 milliseconds on average. The standard deviation in the group was 64.82.

In the case of PTU11, the low proficiency group's mean response time was 878.00 milliseconds. The standard deviation among the group was 102.69. The case with the medium proficiency group took a little more time with their mean response time being 941.43 milliseconds and the standard deviation being 303.98 which is quite high. The high proficiency group performed relatively similarly in response to PTU11 by responding in 855.63 milliseconds on average. However, the standard deviation in the group was 53.29.

The above statistics and discussion show that there was a mixed response to the items with unrelated primes and targets. The average response times are way above 800 milliseconds which suggests that there was no facilitation whatsoever by the primes as expected. The higher average response times in these cases also validate the relatively lower average response times in cases where partial or full priming effects took place. In addition to the higher response times, the corresponding standard deviations are also high denoting the random responses by the participants.

The only case worth mentioning here is the mean response time shown by the low proficiency group in case of PTU4. The mean response time is less than 800 milliseconds with a relatively low standard deviation. However, it is certainly not the case of priming as it was impossible. Somehow, the low proficiency group recognized the word quicklier than other groups. The reason may be the frequency of the target word as it is very commonly used in written and spoken Urdu.

In the following part of this subsection, the remaining four items with unrelated primes and targets are discussed. These four items were as follows.

Table 102

Unrelated Primes and Targets 2 (Urdu)

Code	Prime	Target
PTU16	پرسوز	رشتہ
PTU17	فلاحی	سایہ

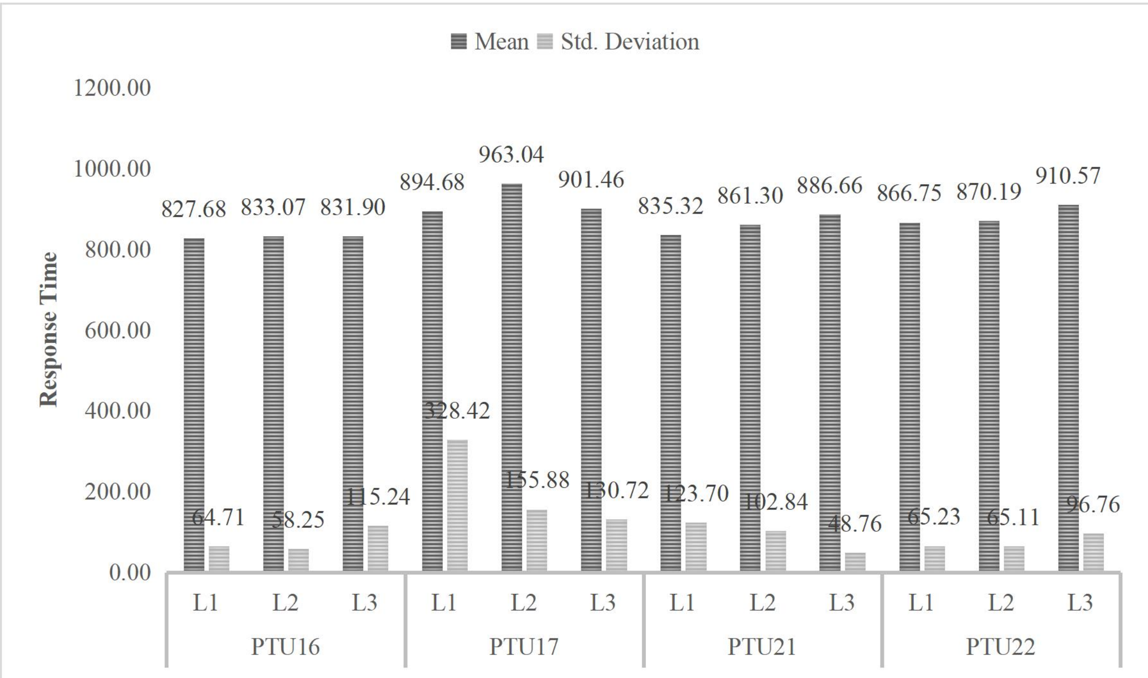
PTU21	سلام دعا	درد
PTU22	کھلونا گاڑی	بہار

The first item on the list, PTU16, had *pur-soz* as its prime which is an adjectival inflection and means *melancholic* in English. The target in the item was *rishta* which is a noun meaning *relation/relationship* in English. The second item on the list, PTU17, used *falahi* as its prime. It is an adjectival inflection and means *related to welfare* in English. The target word in the item was *saya* which is a noun and means *shadow*. In the third item on the list, PTU21, the prime was *salam dua* which is a compound noun meaning *hello hi*. The target word in the item was *dard* which is a noun and means *pain* in English. In the fourth item under discussion (PTU22), the prime was *khilona gaari* which is a compound noun in Urdu meaning *toy vehicle*. The target in the item was a noun *bahaar* which means *spring (season)*.

The following figure shows how the respondents belonging to all the three groups responded to these items.

Figure 55

Unrelated Primes and Targets 2 (Urdu)



A cursory look at the above figure yields very similar thoughts to the ones related to the figure previously discussed. All the response times in all the four items were generally higher than 800 milliseconds showing the absence of priming as expected.

In response to the first item on the list (PTU16), the low proficiency group's mean response time was 827.68 milliseconds. The standard deviation among the group was 64.71. The medium proficiency group took a little more time with their mean response time being 833.07 milliseconds and the standard deviation being mere 58.25 which shows the even nature of the response. The high proficiency group performed relatively similarly in response to PTU16 by responding in 831.90 milliseconds on average. The standard deviation in the group was 115.24.

Responding to the second item on the list, PTU17, the low proficiency group took the least time (Mean=894.68 milliseconds). The standard deviation in the group was 328.42 indicating a random response. The medium proficiency group responded to the item in 963.04 milliseconds. However, the variation in the response time was relatively low (Std. Deviation=155.88). The high proficiency group took 901.46milliseconds, on average, to respond to the item. The standard deviation in the group was 130.72.

The response times in the third Urdu item on the list (PTU21) are also very similar. The low proficiency group took 835.32 milliseconds, on average. The standard deviation in the group was 123.70 which denotes a random response manner. The medium proficiency group responded to the item in 861.30 milliseconds and the variation in the response time was also relatively low (Std. Deviation=102.84). The high proficiency group took 886.66 milliseconds, on average, to respond to the item. The standard deviation in the group was 48.76.

The last item on the list is PTU22. In response to the item, the low proficiency group's mean response time was 866.75 milliseconds. The standard deviation among the group was 65.23. The medium proficiency group took a little more time with their mean response time being 870.19 milliseconds and the standard deviation being 65.11 which is very similar to that of the low proficiency group. The high proficiency group performed relatively similarly in response to PTU22 by responding in 910.57 milliseconds on average. The standard deviation in the group was 96.76.

It can be safely concluded from the above presented data and discussion that the respondents in all the cases took a lot more time to recognize the target word because no priming facility was available in these items. All the mean response times are well above 800 milliseconds which suggests that the respondents were on their own to recognize the target words. It also proves, albeit indirectly, that in the cases where the respondents took less time, there was facilitation of some sort available in the shape of the primes.

4.5.1.8 Conclusion

The above discussion on the data generated by the Urdu experiment shows that strong priming effects were observed in case of the items wherein identical primes and targets were used. However, this type of priming is always expected and signifies the correct setting of the experiment and the right amount of time and manner set for displaying the primes in the experiment.

In the case of the plural inflections, there was strong evidence suggestive of priming effects in both the native Urdu plural inflections and those of Arabic origin.

There were good partial priming effects observed in case of the adjectival derivations of native Urdu construction. However, there were no such effects observable in the adjectival derivations of Persian origin, in the case of the respondents belonging to the low proficiency group.

As far as the Urdu compound words are concerned, strong priming effects were observed in both compound nouns and compound adjectives.

Concluding the section-wise analysis and discussion of the Urdu experiment, we are now moving on to analyze and discuss the various sections of the English experiment and the data generated through it.

4.5.2 The English Experiment

The English experiment was also carefully designed with various section in order to observe priming effects on individuals using English as a second language. The three groups, namely the low proficiency group, the medium proficiency group, and the high proficiency group, were constituted on the basis of their proficiency in English. The purpose behind the classification was to observe whether the priming effects in the second language relate to the proficiency of the individuals or not.

There were many sections of the English experiment. However, the sections of the experiment which pertained to the current study and were included in the data analysis are discussed in this part of the document. The first section which was to be included in the analysis consisted of the items with identical primes and targets. Full priming effects were expected in all the three items included in this section.

There were three items in the experiment wherein the primes and the targets only had orthographic similarity. That is, they were orthographically transparent but there was no (or near) semantic relationship between them. The purpose behind including these items was to see the influence of orthographic transparency and the consequent priming effects.

Two regular plural inflections were also used as primes in two items. The purpose was to observe the partial priming effects on the users of English as a second language, if any. There were two regular past tense inflections placed in the experiment for the same purpose; to see the partial priming effects on the individuals who use English as a second language.

There were two types of derivations placed in the experiment. In this section, there were two adverbs placed which were derived from adjectives using the *-ly* derivative. There were two other derived words included in the experiment. They were nouns derived from verbs using the *-ment* derivative.

In the final section of the experiment, three compound words of English were used. All the three words were compound nouns. They were both orthographically and semantically transparent.

There were five items in the experiment wherein the primes and targets were totally unrelated. They are discussed at the end of this subsection of the document.

Let us see how all the three groups responded to the items belonging to the various sections in the experiment.

4.5.2.1 Items with Identical Primes and Targets

There were three items in the English experiment containing identical primes and targets:

Table 103

Identical Primes and Targets (English)

Code	Prime	Target

PTE1	face	FACE
PTE2	global	GLOBAL
PTE3	child	CHILD

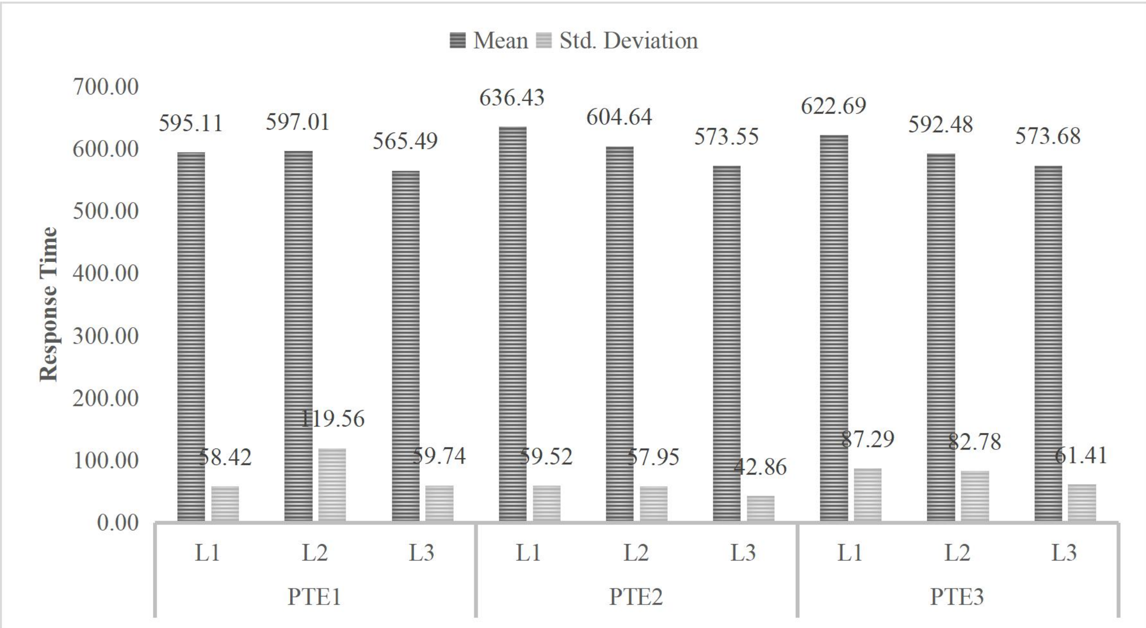
The first item on the list, PTE1, used *face* as both its prime and target. *Global* was used as both prime and target in the second item on the list, PTE2. In the third item in question, PTE3, *child* was used as both prime and target.

As mentioned above, the purpose behind this setting was to observe the full priming effects expected in the case of identical primes and targets.

The following figure illustrates the response times of the partaking individuals belonging to all three (low proficiency, medium proficiency, and high proficiency) groups in case of the three items.

Figure 56

Identical Primes and Targets (English)



The above figure indicates quite a similar response by all the three groups in case of all the three items with identical primes and targets. Full priming effects were expected in this section of the experiment.

In the first English item (PTE1), the low proficiency group (L1) responded in 595.11 milliseconds on average while the standard deviation in the group was 58.42. The medium proficiency group's (L2) average response time was 597.01 which is slightly better than the low proficiency group. The standard deviation was 119.56. The high proficiency group (L3) responded in 565.49 milliseconds on average which is a bit quicker than both the other groups. The standard deviation for the high proficiency group was 59.74.

In response to the second English item on the list, PTE2, the low proficiency group took 636.43 milliseconds on average while the standard deviation inside the group was 59.52. The medium proficiency group took a little less time as compared to the low proficiency group of respondents. They took 604.64 milliseconds on average in responding to the target word and the standard deviation among the group was 57.95. The high proficiency group responded a bit quicker than the medium proficiency group which makes them the best performers in terms of response time. Their mean time in responding to the item was 573.55 milliseconds. The standard deviation among the high proficiency group was 42.86.

While responding to the third item on the list (PTE3), the low proficiency group took 622.69 milliseconds on average while the standard deviation among the 13-member group was 87.29. The medium proficiency group took a little less time by responding to the item in 592.48 milliseconds. The standard deviation from the mean response time in the medium proficiency group was 82.78 which is quite similar to that of the low proficiency group. The high proficiency group responded relatively quicklier to the item by taking 573.68 milliseconds in their response. The standard deviation among the group was 61.41ms which is a bit lesser than that of both the low and medium proficiency groups.

The above data and the discussion allow us to safely conclude that full priming effects took place in all the three items across the three groups of respondents. The average response times are mostly less than 600 milliseconds. The standard deviation among the responses in each case is also quite low making the data even and authentic. The responses shown by the low proficiency group in each case are relatively slower than the other two groups, but the difference is small and insignificant. The overall analysis suggests a strong priming effect that took place across the board in all the three items with identical primes and targets.

Let us now move on to see whether any priming took place in case of orthographically (but not semantically) related primes and targets.

4.5.2.2 Items with Orthographic Transparency

There were three items specifically included in the English experiment in order to judge orthography related priming. Almost all the inflections, derivations, and compound words listed in the experiment were orthographically and semantically transparent. Therefore, these three items were included in the experiment which were only orthographically transparent and there was no (near) semantic relationship between the primes and the targets used in these items.

Table 104

Orthographically Related Primes and Targets (English)

Code	Prime	Target
PTE5	cooker	COOK
PTE10	corner	CORN
PTE16	honeymoon	MOON

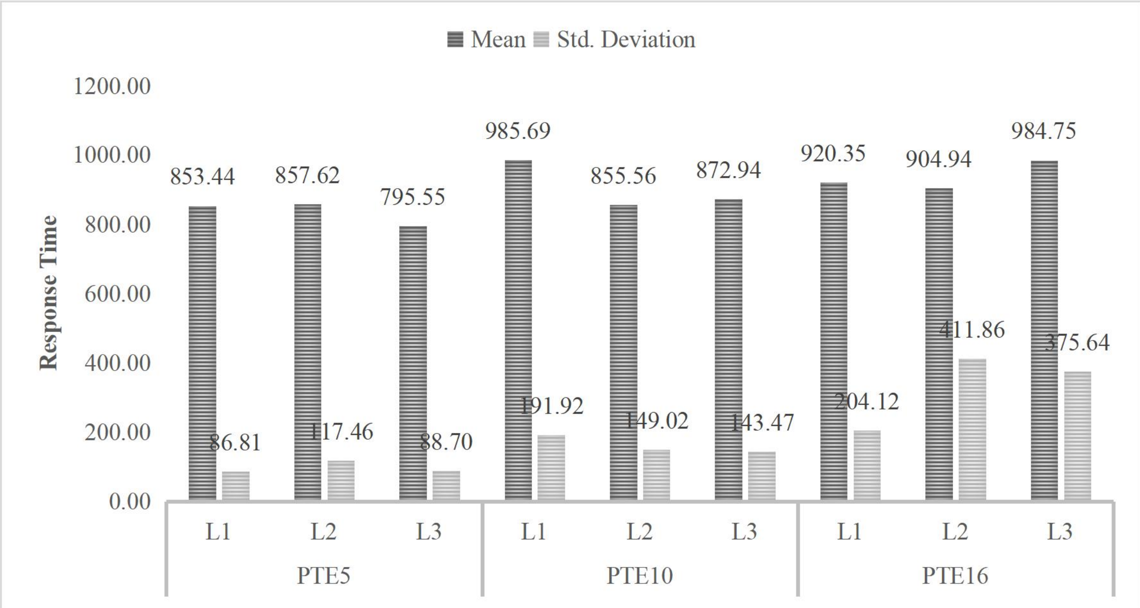
The first item (PTE5) had *cooker* as the prime and *cook* as the target. It is evident that the semantic relationship between the two words is not a close one at all. Orthographically, they are very similar as *cooker* is *cook+er*. The second item, PTE10, is a similar case where *corner* was used as the prime and *corn* as the target. There is absolutely no semantic relationship between the two. However, the orthographic relationship is quite evident as *corner* is *corn+er*. The third item on the list, PTE16, had *honeymoon* as the prime and *moon* as the target. Again, there is no semantic transparency between the prime and the target. However, there is orthographic transparency present between the two as *honeymoon* is *honey+moon*.

These items were included for two purposes. First, to see whether any orthography related priming takes place, and second, to validate the data obtained via other items that were both orthographically and semantically transparent.

The following figure illustrates how the three groups responded to each of these orthographically transparent items.

Figure 57

Orthographically Related Primes and Targets (English)



A prima facie view of the above figure shows that no priming effect occurred in any of the three orthographically transparent items. The responses are haphazard as denoted by the high amounts of standard deviation and the average mean response times are high showing the absence of any priming facilitation.

The above bar graph shows that the low proficiency group's mean time in responding to the English item (PTE5) was 853.44 milliseconds. The standard deviation of the 13-member group was 86.81. The medium proficiency group took 857.62 milliseconds on average in responding to this item which is very similar to the mean response time of the low proficiency group. However, the standard deviation in the medium proficiency group was not very similar to that of the low proficiency group. It was 117.46 as compared to the low proficiency group's 86.81. The high proficiency group took a little less time by responding to the item in 795.55 milliseconds on average. The standard deviation in the high proficiency group's response times to this item was 88.70.

The low proficiency group's mean time in responding to the second English item on the above list (PTE10) was 985.69 milliseconds. The standard deviation of the group was 191.92 which is quite high and denotes a haphazard response. The medium proficiency group took 855.56 milliseconds on average in responding to this item which is a bit less than the mean response time of the low proficiency group. The standard deviation in the medium proficiency group was very similar to that of the low proficiency group. It was 149.02. The high proficiency group took a similar (to that of the medium proficiency groups) time by responding to the item in 872.94 milliseconds on average. The standard deviation in the high proficiency group's response times to this item was 143.47 which is quite similar as compared to the other two groups.

While responding to the third orthographically transparent English item (PTE16) the low proficiency group took 920.35 milliseconds, on average. The standard deviation of the 13-member group was 204.12 which is quite high. The medium proficiency group took 904.94 milliseconds on average in responding to this item which is a bit less than the mean response time of the low proficiency group. The standard deviation in the medium proficiency group was way higher than that of the low proficiency group. It was 411.86. The high proficiency group took a little more time by responding to the item in 984.75 milliseconds on average. The standard deviation in the high proficiency group's response times to this item was 375.64 which is quite high denoting a mixed response.

The data and the accompanying discussion presented above leads to a safe conclusion that no priming effects were observed in case of the items where the primes and targets had (only) orthographic transparency. The conclusion is also important because it validates the rest of the experiment, indirectly. Almost all the items included in the experiment were orthographically transparent at some level. If the three items in question had shown any priming effects, the whole data would have become doubtful because of the presence of orthography related priming.

4.5.2.3 Plural Inflections

Two items in the experiment involved the use of plural inflections as primes. The corresponding singular forms were used as targets in these items. The purpose of the inclusion of these inflected forms was to observe the presence (or absence) of partial priming in these cases. Many studies in the past have found the existence of partial priming in case of non-native users of English (Clahsen, 2008; Zeng et al., 2019). This study also aims at finding out the existence of the mentioned phenomenon in case of individuals divided into three groups according to their proficiency levels in English.

Table 105

Regular Plural Inflections (English)

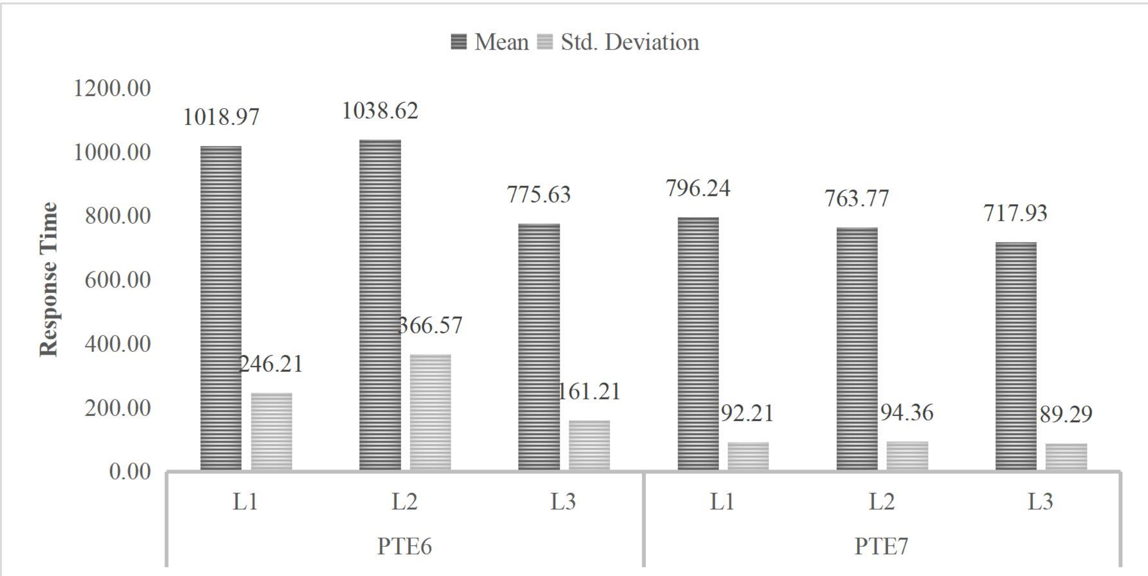
Code	Prime	Target
PTE6	deserts	DESERT
PTE7	years	YEAR

The above table shows that first of the two items involving regular plural inflections, PTE6, used *deserts* as the prime while its singular form *desert* was used as the target. In the case of the second item on the list, PTE7, *years* was used as the prime while the singular form *year* was used as the target. Both the pairs of primes and targets are nouns.

The following figure illustrates how the three groups of the individuals partaking in the experiment responded to these items.

Figure 58

Regular Plural Inflections (English)



A cursory look at the above figure leads the viewer to believe that partial priming did take place across all the groups in the case of PTE7, while it was limited to the high proficiency group only in case of PTE6.

The figure shows that the low proficiency group, while responding to PTE6, took 1018.97 milliseconds on average. Their standard deviation was quite high at 246.21ms. The medium proficiency group responded in an almost identical manner as their mean response time was 1038.62 milliseconds with a very high standard deviation of 366.57. The high proficiency group responded in a remarkably lesser time by taking 775.63 milliseconds on average. Their standard deviation was also much less compared to the other two groups (161.21).

The low proficiency group took 796.24 milliseconds in response to the second item on the list, PTE7. The standard deviation in the group was 92.21. The medium proficiency group was a wee bit quicker to respond. They took 763.77 millisecond, on average, to respond to the English item. The standard deviation among its 13 members was 94.36. The high proficiency group responded with an average of 717.93 milliseconds and the standard deviation in the group was 89.29.

The data and the related discussion presented above lead to the conclusion that partial priming took place in the case of the high proficiency group in the first item on the list, PTE6. This was expected as highly proficient users of second language have been found to display the partial priming effects.

The case of PTE7 is interesting as all the three groups seem to have been facilitated by the plural inflection used as the prime in the item. The mean response times are very similar and the corresponding standard deviations are also not so high, which indicate that the priming did take place across all the three groups, albeit partially. This is very important because previously, partial priming effects were only limited to the highly proficient non-native users of a language.

4.5.2.4 Past Tense Inflections

Two regular past tense inflections were also made part of the experiment. The purpose was the same: to judge the partial priming effects on non-native users of English. As mentioned above, quite a few studies have found highly proficient non-native users of English displaying partial priming effects in experiments involving regular past tense forms of verbs. The current study also aimed at finding out whether partial priming takes place in case of the Urdu-English bilinguals.

Table 106

Regular Verb Inflections (English)

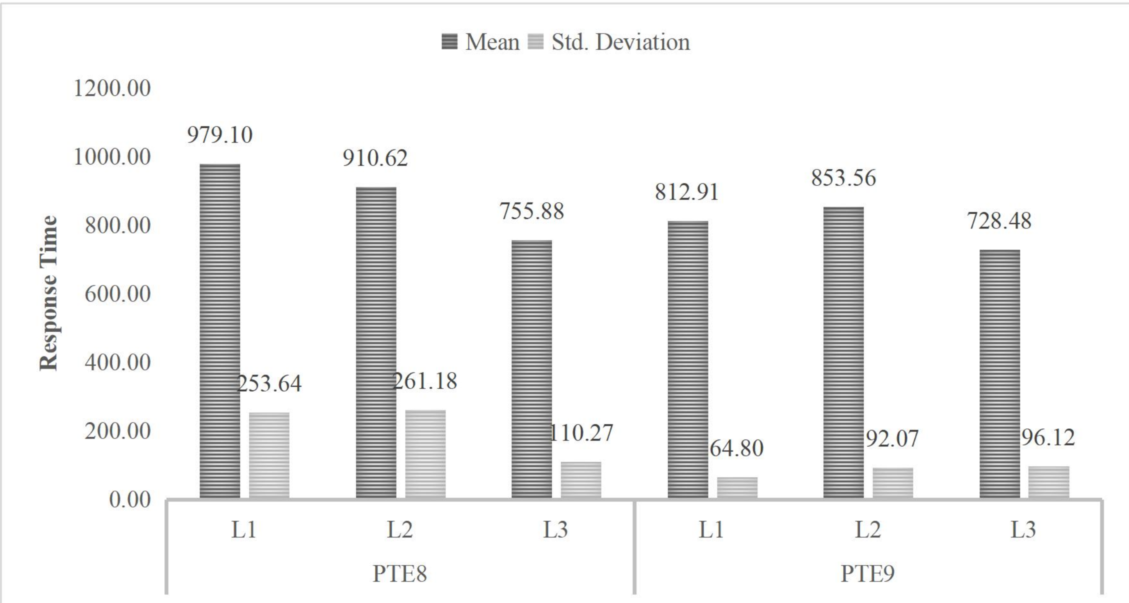
Code	Prime	Target
PTE8	impressed	IMPRESS
PTE9	worked	WORK

The above table shows that the first of the two regular past tense inflections was *impressed* used as the prime in the item PTE8 in the English item. The target word in the item was *impress* which is the present form of the word used as prime. In PTE9, the prime was *worked* which is the past form of *work* used as target in the item.

Let us examine how the respondents belonging to the low, medium, and high proficiency groups responded to these two items.

Figure 59

Regular Verb Inflections (English)



A cursory look at the above bar graph shows that only the high proficiency group displayed some priming effects while responding to both the items in question. The other two groups responded in a haphazard manner and took more time to respond to the item.

The low proficiency group took 979.10 milliseconds while responding to the first item under discussion (PTE8). The standard deviation in the group was 253.64 which is on the higher side. The medium proficiency group's response times averaged 910.62 milliseconds which is a bit less than the average of the low proficiency group. The standard deviation in the medium proficiency group was 261.18 which, again, is quite high. The high proficiency group took considerably less time as compared to the other two groups while responding to this English item. Their mean response time was 755.88 milliseconds and the standard deviation in the group was 110.27 which is also quite less as compared to the other two groups' standard deviation.

In response to the second item involving past tense inflections, PTE9, the low proficiency group took 812.91 milliseconds. The standard deviation in the group was 64.80, which shows a high precision level. The medium proficiency group's average response was 853.56 milliseconds which is higher than the average of the low proficiency group. The standard deviation in the medium proficiency group was 92.07. The high proficiency group considerably less time as compared to the other two groups while responding to this English item. Their average response time was 728.48 milliseconds and the standard deviation in the group was 96.12 which is also quite less and shows similar responses by all the 13 members of the group.

The above discussion leads us to safely conclude that the respondents belonging to the high proficiency group showed the priming facilitation in case of regular past tense inflections. The high proficiency group took less than 755.88 milliseconds on average to respond to PTE8 and 728.48 milliseconds on average while responding to PTE9. The corresponding standard deviation figures are also around 100 mark which denote the even nature of these responses. The other two groups took a lot more time to respond to these items. In most of the cases, the standard deviation was also very high denoting the random nature of responses. In the case of the low proficiency group's response to PTE9, the standard deviation is 64.8 which shows the precise nature of the data. However, the mean response time is high (more than 800 milliseconds) which means that the priming did not take place.

Therefore, it is safe to conclude that the high proficiency group displayed the partial priming effects while responding to items involving regular past tense inflections.

4.5.2.5 Adverbs Derived from Adjectives

Four derivations were also included in the English experiment in order to observe the occurrence (or absence) of priming in case of derivations. Two of these four derivations were nouns derived from verbs involving the derivative suffix *-ment*. These derivations are discussed in the next subsection. In this subsection, we will discuss the two derivations that involved the derivative suffix *-ly* that converts adjectives into adverbs.

The two adverbial derivations included in the experiment were as follows.

Table 107

Adverbs Derived from Adjectives (English)

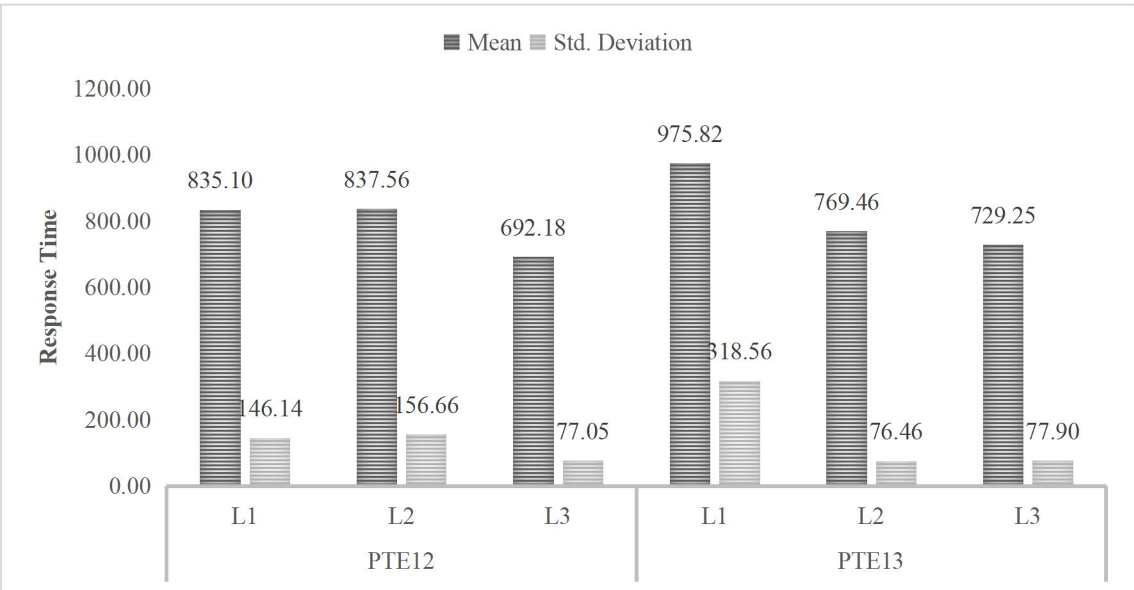
Code	Prime	Target
PTE12	slowly	SLOW
PTE13	politely	POLITE

The first of these two adverbial derivations was *slowly*, used as the prime in the item PTE12. The target in the item was *slow* which is the adjective from which the adverb *slowly* is derived. In PTE13, the target was *politely* which is an adverb derived from an adjective *polite*. *Polite* was used as the target word in the item.

The following figure shows how the three groups of participants responded to both these items.

Figure 60

Adverbs Derived from Adjectives (English)



The figure shows that partial priming effects were observed in the case of the high proficiency group only in response to both the items. The other two groups responded in higher mean times and their corresponding standard deviation was also high in most of the cases.

The low proficiency group took 835.10 milliseconds while responding to the first item in focus (PTE12). The standard deviation in the group was 146.14. The medium proficiency group's mean response time was very similar to that of the low proficiency group and averaged at 837.57 milliseconds. The standard deviation in the medium proficiency group was 156.66 which, again, is very similar to that of the low proficiency group. The high proficiency group took considerably less time as compared to the other two groups while responding to this English item. Their mean response time was 692.18 milliseconds and the standard deviation in the group was 77.05 which is also quite less as compared to the other two groups' standard deviation.

The above figure also shows that the low proficiency group took 975.82 milliseconds while responding to PTE13. The standard deviation in the group was very high 318.56. The medium proficiency group's mean response time was a bit less than that of the low proficiency group and averaged 769.46 milliseconds. The standard deviation in the medium proficiency group was 76.46, which shows the precise nature of the response. The high proficiency group took considerably less time as compared to the other two groups while responding to this English item. Their mean response time was 729.25 milliseconds and the standard deviation in the group was 77.90 which is also quite less as compared to the other two groups' standard deviation.

The high proficiency group responded in a very similar manner to both these items which leads us to conclude that partial priming effects did take place in the high proficiency group's case. The other two groups responded in average mean times that were too high to be considered as cases for partial priming effects. In the case of PTE13, both the medium and the high proficiency groups seem to have experienced the onset of partial priming effects as suggested by the statistics above. This is another example where the medium proficiency group performs very similar to the high proficiency group indicating that breaking down of the morphologically complex words is not exclusive to the high proficiency group only.

In the next subsection the nominal derivations from verbs are discussed.

4.5.2.6 Nouns Derived from Verbs

As discussed in the previous subsection, there were two items that involved nouns derived from verbs using the nominal derivative *-ment*. The purpose, again, was to see whether any priming takes place in derivations in case of Urdu-English bilinguals using English as a second language.

The following table shows the primes and targets used for this purpose.

Table 108

Nouns Derived from Verbs (English)

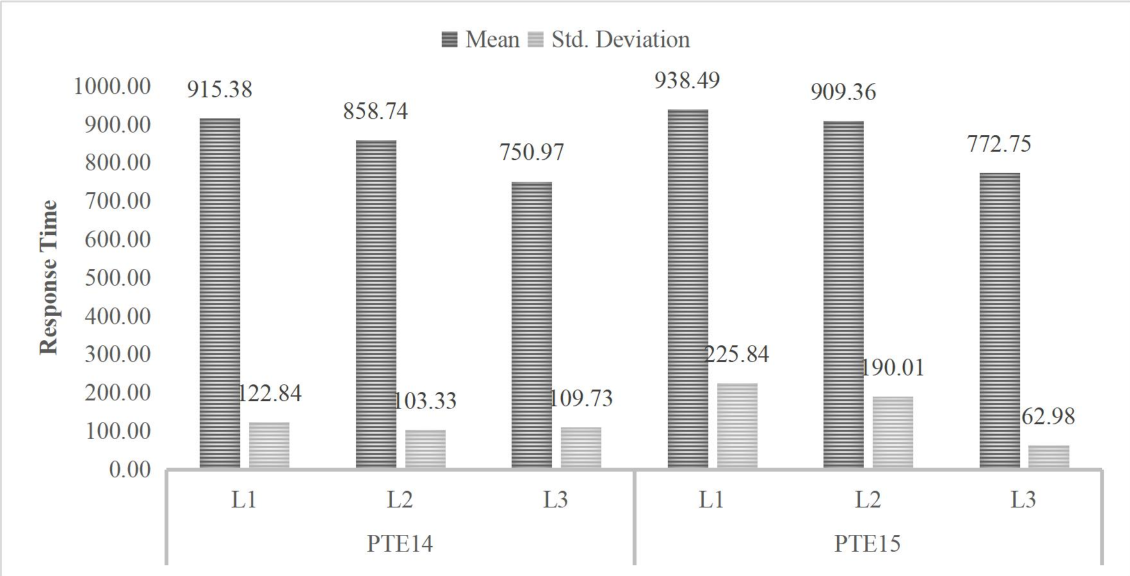
Code	Prime	Target
PTE14	treatment	TREAT
PTE15	adjustment	ADJUST

The above table shows that in the first item on the list, PTE14, *treatment* was used as the prime which is a noun derived from the verb *treat* used as target in the item. The case of the second item PTE15 is also similar. *Adjustment*, which is the nominal derivation from the verb *adjust,* is used as the prime while the verb itself is used as target in the item.

The following figure shows how the three groups of respondents reacted to these nominal derivations.

Figure 61

Nouns Derived from Verbs (English)



The above figure shows how the three groups of respondents reacted to the items with nominal derivations as primes and the corresponding source words (verbs in these cases). A bird eye view of the chart shows the high proficiency group took considerably less time while responding to both these items compared to the other two groups.

The above figure shows that the low proficiency group took 915.38 milliseconds while responding to the first item (PTE14) being discussed here. The standard deviation in the group was 122.33. The medium proficiency group's mean response time was a bit more than that of the low proficiency group and averaged at 858.74 milliseconds. The standard deviation in the medium proficiency group was 103.33 which, again, is very high. The high proficiency group took considerably less time as compared to the other two groups while responding to this English item. Their mean response time was 750.97 milliseconds and the standard deviation in the group was 109.73 which is also quite less as compared to the other two groups' standard deviation.

In response to the second item, PTE15, the low proficiency group took 938.49 milliseconds. The standard deviation in the group was 225.84 which is on the higher side. The medium proficiency group's mean response time was very similar to that of the low proficiency group and averaged at 909.36 milliseconds. The standard deviation in the medium proficiency group was 190.01 which, again, is quite high and denotes a haphazard response. The high proficiency group took considerably less time as compared to the other two groups while responding to this English item. Their mean response time was 772.75 milliseconds and the standard deviation in the group was 62.98 denoting a precise response.

It is safe to conclude, after examining the data and discussion presented above, that priming did not occur in any of the two items in case of both the low and the medium proficiency groups. The high proficiency group was the only group, in both these items, to have displayed the occurrence of partial priming.

4.5.2.7 Compound Words

In the English experiment, three compound words were also included in order to examine the possible onset of priming effects. All the three compound words were compound nouns which is unlike the corresponding section of the Urdu experiment that involved two compound nouns and a compound adjective.

The following table shows the three compound nouns used in the English experiment.

Table 109

English Compound Words

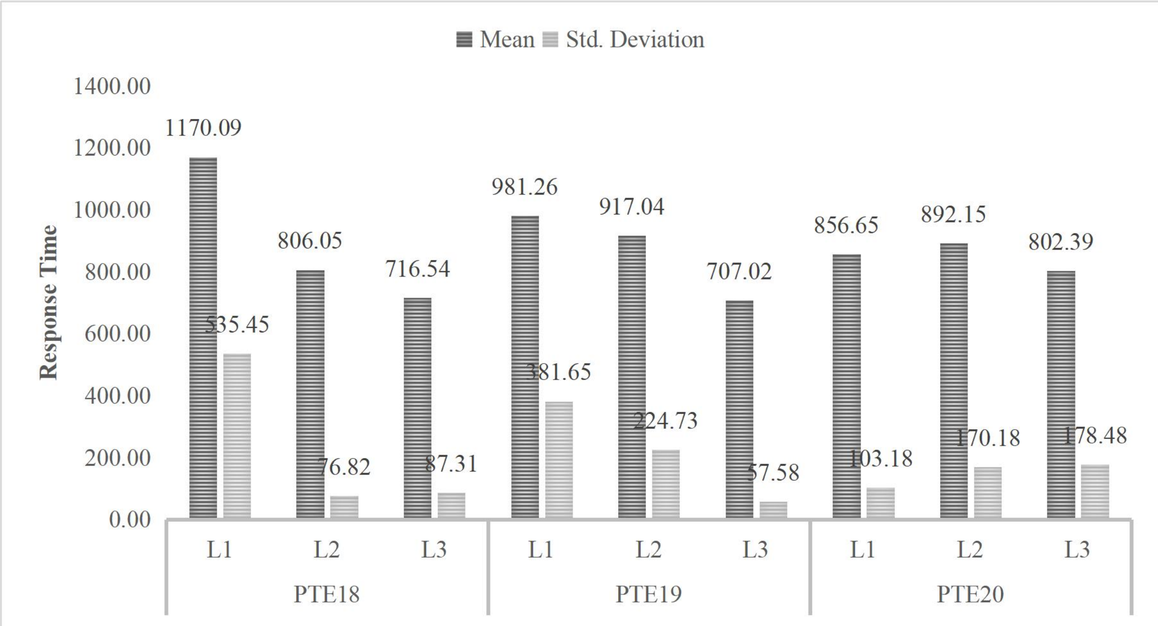
Code	Prime	Target
PTE18	grandmother	MOTHER
PTE19	doorbell	BELL
PTE20	driveway	WAY

The above table shows that *grandmother*, a compound noun, was used as the prime in the item PTE18. The target in the item, *mother*, was one of the two words used in the compound noun. Similarly, in PTE19, *doorbell* was the prime and *bell*, one of the contributing words of *doorbell*, was used as the target. The case of PTE20 is the same where *driveway* was used as the prime whereas *way* served as the target word.

The following bar graph shows how the partaking individuals belonging to the three groups responded to these pairs of primes and target words.

Figure 62

English Compound Words



The figure presented above shows that there are only two cases where partial priming seems to have taken place. One of these cases is the high proficiency group's response to PTE18. The other one is also the high proficiency group's response in the case of PTE19. Apart from these two instances, there seems to be no evidence of priming in the case of compound nouns.

Responding to PTE18, the low proficiency group took 1170.09 milliseconds. The standard deviation in the group was 535.45 which is huge and denotes the very haphazard nature of responses. The medium proficiency group's mean response time was quite less than that of the low proficiency group and averaged at 806.05 milliseconds. The standard deviation in the medium proficiency group was 76.82 which shows the precise and even nature of the responses. The high proficiency group took considerably less time as compared to the other two groups while responding to this English item. Their mean response time was 716.54 milliseconds and the standard deviation in the group was 87.31 which suggests that there was not much variation in the responses.

In response to PTE19, the low proficiency group took 981.26 milliseconds. The standard deviation in the group was 381.65 which is huge and denotes very haphazard nature of responses. The medium proficiency group's mean response time was quite less than that of the low proficiency group and averaged at 917.04 milliseconds. The standard deviation in the medium proficiency group was 224.73 which is, again, high and shows the randomness of the responses. The high proficiency group took considerably less time as compared to the other two groups while responding to this English item. Their mean response time was 707.02 milliseconds and the standard deviation in the group was 57.58 which is less than the standard deviation of the other two groups.

In the case of PTE20, the low proficiency group took 856.65 milliseconds, on average. The standard deviation in the group was 103.18 which denotes a precise nature of responses. The medium proficiency group's mean response time was quite less than that of the low proficiency group and averaged 892.15 milliseconds. The standard deviation in the medium proficiency group was 170.18 which is high and shows the randomness of the responses. The high proficiency group took similar time as compared to the other two groups while responding to this English item. Their mean response time was 802.39 milliseconds and the standard deviation in the group was 178.48 which is higher than the standard deviation of the other two groups.

The above figure and the subsequent discussion about the presented statistics shows the absence of any priming in most of the cases. However, the low response time and standard deviation displayed by the high proficiency group in response to PTE18 is strongly suggestive of the onset of partial priming. The same group responded to PTE19 in a similar manner by taking less than 800 milliseconds on average. However, the high standard deviation in this case makes it difficult to conclude that partial priming took place.

The case of the medium proficiency group with reference to PTE18 is also interesting. The group responded with a mean of 806.05 and a standard deviation of 76.82 which is suggestive of the occurrence of partial priming in the majority of the group members. In terms of the mean response time, their response is very similar to the way the high proficiency group responded to PTE20. These two cases suggest that some of the respondents present in the group did feel the priming effects while others were not affected by it.

4.5.2.8 Items with Unrelated Primes and Targets

There were five items in the English experiment which had unrelated primes and targets. As mentioned in the discussion about the items with unrelated primes and targets in the Urdu experiment, these items were made part of the experiment in order to see the patterns of data generated by them. As per the expectation, the respondents should take more time, on average, to recognize the target words presented in these items as there is no facilitation provided by the unrelated primes.

The codes belonging to these items are not in sequence. This is because these items were placed in different sections of the experiment. Here, for the sake of showing the similarities (and/or differences) of the response times, they have been put and presented together.

There were five items in the English experiment having unrelated primes and targets.

Table 110

Unrelated Primes and Targets (English)

Code	Prime	Target
PTE4	truck	BECOME
PTE11	provided	SUMMARY
PTE17	new	KIND
PTE21	Well-built	KNOWN
PTE22	Building	TERM

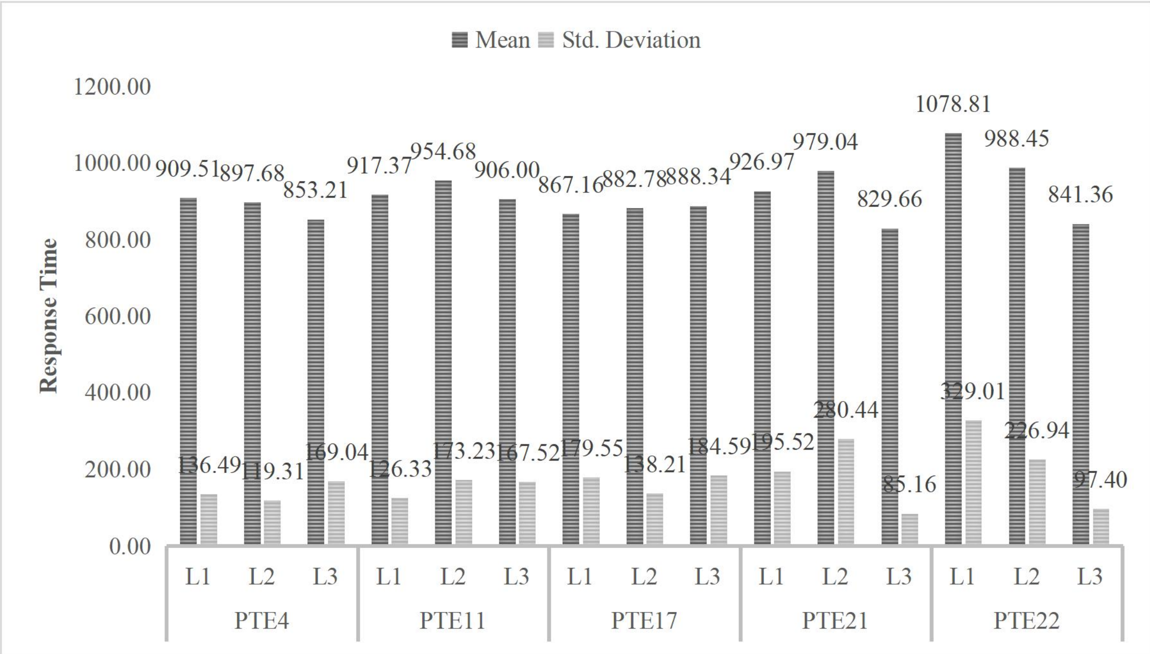
The above table shows the five items wherein the primes and targets had no relationship. The first item on the list, PTE4, had *truck* as its prime and *become* as the target word. The second item, PTE11, used *provided* as its prime and *summary* as its target. In the third item, PTE17, *new* was used as the prime while *kind* served as the target word. The fourth item on the list, PTE21, *well-built* was the prime and *known* was the target word. The fifth and the last item on the list, PTE22, used *building* as the prime and *term* as the target word.

It can be seen that there is no relationship between the primes and targets in these items. They were carefully designed to keep any negative priming out of question.

The following figure shows the responses given by all the three groups to these items.

Figure 63

Unrelated Primes and Targets (English)



The first look at the above figure suggests the absence of priming of any sort, as expected because of no relationship between the primes and targets in each case. The mean response times are high above the 800-millisecond mark which shows that the respondents took a lot of time in recognizing the target words.

The above figure shows that the low proficiency group responded to the item, PTE4, in 909.51 milliseconds, on average. The standard deviation in the group was 136.49. The 13 respondents in the medium proficiency group took 897.68 milliseconds on average to respond to the item. The standard deviation in the medium proficiency group was 119.31 milliseconds which is quite high. The high proficiency group responded to the item in 853.21 milliseconds and the standard deviation among its 13 members was 169.04 which is on the higher side.

The low proficiency group's mean time in responding to the second item (PTE11) was 917.37 milliseconds. The standard deviation of the group was 126.33. The medium proficiency group took 954.68 milliseconds on average in responding to this item which is a bit more than the mean response time of the low proficiency group. The standard deviation in the medium proficiency group was a bit high as compared to that of the low proficiency group. It was 173.23. The high proficiency group took a little less time, compared to the medium proficiency group, by responding to the item in 906.00 milliseconds on average. The standard deviation in the high proficiency group's response times to this item was 167.52.

As far as PTE17 is concerned, the low proficiency group, consisting of 13 members (N=13), responded in 867.16 milliseconds, on average. The standard deviation in the group was 179.55. The 13 respondents in the medium proficiency group took 882.78 milliseconds on average to respond to the item. The standard deviation in the medium proficiency group was 138.21 milliseconds which is lower than both the low and high proficiency groups. The high proficiency group responded to the item in 888.34 milliseconds and the standard deviation among its 13 members was 184.59 milliseconds which is on the higher side.

While responding to PTE21, the low proficiency group responded to the item in 926.97 milliseconds, on average. The standard deviation in the group was 195.52. The respondents in the medium proficiency group took 979.04 milliseconds on average to respond to the item. The standard deviation in the medium proficiency group was 280.44 milliseconds which is quite high. The high proficiency group responded to the item in 829.66 milliseconds and the standard deviation among its 13 members was 85.16 milliseconds which is comparatively on the lower side.

The above table shows that the 13-member low proficiency group's mean time in responding to the English item, PTE22, was 1078.81 milliseconds. The standard deviation of the group was 329.01 which is quite high and denotes low precision. The medium proficiency group took 988.45 milliseconds on average in responding to this item which is a bit less than the mean response time of the low proficiency group. The standard deviation in the medium proficiency group was low as compared to that of the low proficiency group. It was 226.94. The high proficiency group took a little less time by responding to the item in 841.36 milliseconds on average. The standard deviation in the high proficiency group's response times to this item was 97.40.

The figures and statistics presented above illustrate how the respondents belonging to the three groups responded to the items wherein the primes and targets were totally unrelated. The data generated through these items is very significant as it provides the statistics required to be used for contrasting the data generated via pairs of related primes and targets.

4.5.2.9 Conclusion

The above discussion shows that there was strong priming observed in the items of the English experiment that used identical primes and targets. The statistics show the occurrence of full priming effects across the three groups in items with identical primes and targets.

The data yielded by the three items included in the English experiment in order to gauge orthography related priming shows that no orthography related priming was observed in any case whatsoever.

The case of regular plural inflections is peculiar as all the three groups of participants displayed partial priming effects in one of the two items in the section. PTE7 was one of the two items involving regular plural inflections. In PTE7, *years* was used as the prime while *year* was the target. Interestingly enough, all the three groups showed robust signs of partial priming effects in this item. Whereas only the high proficiency group displayed partial priming effects in the other item (PTE6) involving regular plural inflections. The case of PTE13 is also interesting where both the medium and the high proficiency groups displayed partial priming effects. This means that the breaking down of morphologically complex words in the second language is not exclusive to the high proficiency individuals. It is a progressive phenomenon available to all the learners of the language.

In the item involving regular past tense inflections, the high proficiency group was the only group displaying the partial priming effects. The participants belonging to the other two groups did not get any facilitation from the inflected forms of the target words.

As far as the derivations are concerned, the high proficiency group did display partial priming in the items involving adverbial derivations from adjectives using the adverbial derivative *-ly*. However, none of the responding groups showed any signs of priming in the nominal derivations from verbs using the *-ment* derivative.

In compound words, there were no priming effects observed for the most part. However, the high proficiency group did display good priming effects in case of only one compound word (grandmother). This word was used as prime in PTE18 where the target word was *mother.*

4.6 Conclusion

The data and its interpretation presented in this chapter leads to the conclusion that the native speakers of Urdu displayed priming effects in case of inflections and compound words. In the case of derivations, they showed some priming effects responding to the derived words of indigenous Urdu constructions. However, there was no evidence of any priming effects in case of derivations where a Persian origin adjectival derivative was used. This proves that native speakers of a language break down words before storing them in their lexicon.

As far as English as a second language is concerned, the only group of respondents showing consistent onset of priming in the Urdu-English bilinguals was the high proficiency group. The respondents who were highly proficient in English, showed priming effects in case of regular plural inflections, regular past tense inflections and adverbial derivations using the *-ly* derivative. The high proficiency group did not show any priming effects in the *-ment* derivations and compound words.

The low and the medium proficiency groups also showed some priming effects in one item involving regular plural inflections. The time these two groups took in responding to the items was lower than their usual response time in other items. However, their responses were not quick enough to be termed as robust evidence of priming.

CHAPTER 5

FINDINGS AND DISCUSSION

This chapter provides the findings of the study. It also corroborates the findings with reference to the studies already conducted in the area of processing of morphologically complex words in both L1 and L2. The first half of the chapter provides the findings of the study, and the latter half of the chapter provides a discussion on the findings of the study.

5.1 Findings

This section of the chapter relates to the findings of the study. The section is divided into two subsections. In the first subsection, findings related to the Urdu experiment are discussed. The second subsection of the chapter pertains to the English experiment and the consequent findings.

5.1.1 Urdu Experiment

The Urdu experiment used three types of morphologically complex words. These included inflections, derivations, and compound words. In this subsection the outcome of the experiment and the subsequent analysis is discussed.

It is pertinent to mention here that the participants of this experiment were native speakers of Urdu and, therefore, they were expected to demonstrate the maximum priming effects in the items included in the experiment. The division of the participants into three groups was according to their proficiency in English and not in Urdu so that division had no significance in this experiment.

In response to the inflections, the participants of the experiment demonstrated sturdy partial priming effects. There were four items in total involving inflections. Two of these items contained inflections of the indigenous Urdu origin. The other two inflections had Arabic origin. The respondents belonging to all the three groups showed consistent priming effects in the cases involving indigenous Urdu inflections. Naturally, as native speakers, they were expected to demonstrate partial priming in these cases. In response to the items involving plural inflections of Arabic origin, all the groups showed partial priming effects except one in one of the two items. The one group not showing any priming effects was the high proficiency group. The group showed a very haphazard response in one of the two items containing plural inflections of the Arabic origin in Urdu. The error rate was quite high in the response of the group, and, therefore, it can be attributed to erratic responses. This conclusion is further strengthened by the fact that the same group reacted perfectly naturally in the other item involving plural inflection of Arabic origin.

It can be safely concluded that the participants responded to the inflections the way they should have. Since all the participants were native speakers of Urdu, they were expected to demonstrate partial priming effects while processing inflections in their first language. This phenomenon further strengthens the dual mechanism theory of processing morphologically complex words as the theory posits that the native speakers of a language do not store the inflected forms of words separately in their lexicons. Instead, they break down the inflected forms into combining morphemes and save them in their mental dictionaries.

Two types of derivations were included in the experiment containing two items each. Two of these four items included adjectival derivations of indigenous Urdu origin while the other two involved a derivational prefix of Persian origin in Urdu. As per the research pertaining to the theory of dual mechanism in processing of morphologically complex words, there is less evidence of native speakers showing partial priming effects in response to derivations. This is partly because derivations are words belonging to a different grammatical category than their original source of derivations, and partly because the derived words have a different lexical category and are expected to be treated as independent words. That may be why derivations have a separate dictionary entry as well in lexicography.

Responding to the derivations in Urdu, the participants showed a consistent trend of priming effects to the derivations of indigenous Urdu origin. This priming was consistent and robust in both the items across all the three groups. The response to the items involving a derivative prefix of Persian origin was a mixed one. In one of the items, only the high proficiency group showed some signs of the occurrence of priming effects while the other two groups did not show any such signs. In the other derivation involving the Persian origin derivative, the medium and the high proficiency groups showed consistent signs of partial priming effects, whereas the low proficiency group did not demonstrate any such effects. The division of the groups here is not significant because all the participants were native Urdu speakers. However, the consistent demonstration of partial priming effects in case of native Urdu derivations and some signs of priming in responding to derivations involving derivative of Persian origin indicates that the separate existence of the various morphemes of derivations in native speakers is a fact. It is the existence of these morphemes that helps the native speakers of a language to recognize the derivations faster than the words with unrelated primes.

The experiment also involved three compound words in Urdu. Two of these compound words were nouns while the third one was a compound adjective. All the three compound words were transparent which means that the meanings of each compound words were the combined meaning of the combining words.

The participants showed consistent priming effects in response to these items. The responses were even across all the participants and the error rates were low. This shows that native speakers do see the contributing words separately in the compound words. Thus, the dual mechanism theory seems consistent for compound words in Urdu.

To conclude, the native speakers of Urdu do store inflected words after breaking them down into the contributing morphemes. This was given at the time of commencement of the present study though. It was like testing the theory of dual mechanism of processing of morphologically complex words in native language. What is new is that the native speakers of Urdu do break down some of the derivations and compound words while storing them in their mental lexicons. However, the study involved a very limited number of inflections, derivations, and compound words which cannot be generalized for all the morphologically complex words in Urdu.

5.1.2 English Experiment

In the previous section of this chapter the outcomes of the Urdu experiment were discussed. Urdu being the native language of the participants of the experiment, many of the outcomes were expected. As far as the English experiment is concerned, the partaking individuals in the experiment were not native speakers of English. In fact, they were the same individuals who had participated in the Urdu experiment and English was their second language. As repeatedly mentioned above, the participants were divided into three groups based on their level of proficiency in English. In the following paragraphs of this subsection, the findings of the English experiment and the subsequent data analysis are discussed.

There were three items included in the experiment in order to validate the whole experiment. These three items were orthographically transparent but did not have any semantic transparency. The three items had *cooker/cook, corner/corn,* and *honeymoon/moon* as pairs of primes and targets. These items were made part of the experiment in order to see the role of orthographic priming in the experiment. That is, if the priming is orthography related, the findings become dubious as almost all the morphologically complex words were orthographically transparent. Thus, any signs of orthography-related priming would invalidate the semantic priming effects in the experiment.

The responses to these items did not show any signs of the onset of priming. All the three groups responded to these orthographically but not semantically transparent items in a way that was not suggestive of any facilitation on the part of the primes. This not only shows that the priming effects observed in this experiment were valid but also shows that the way this experiment was set up was also correct.

The English experiment was very similar to the Urdu experiment. Since the study aimed at gauging the similarities and differences between the processing of morphologically complex words in Urdu and English by Urdu-English bilinguals, it was made sure that both the experiments are very similar. That is why, like the Urdu experiment, inflections, derivations, and compound words were included in the English experiment also.

There were two types of inflections included in the experiment. In total, there were four items included in the experiment involving inflections. Two of these four had plural inflections as the primes and the other two had past tense inflections as their primes. Surprisingly enough, all the three groups demonstrated robust evidence of the occurrence of partial priming effects in one of the plural inflections. The response times were so consistent coupled with consistently low error rates that it was almost impossible to attribute the phenomenon to any factor other than partial priming itself.

In the other item involving regular plural inflections, the high proficiency group was the only one showing signs of the onset of partial priming effects. The low and the medium proficiency groups did not demonstrate any such signs.

As far as the regular past tense inflections were concerned, only the high proficiency group was consistent in displaying partial priming effects. The other two groups responded in a haphazard manner showing no signs of facilitation from the relative primes.

The low and the medium proficiency groups not showing any signs of the occurrence of partial priming effects was expected as hypothetically only the highly proficient users display these effects while processing morphologically complex words. What was unexpected was that the low and the medium proficiency groups did show partial priming effects while responding to one of the items involving regular plural inflections. This is something that needs further investigation. Apart from that, these responses further strengthen the dual mechanism theory of processing morphologically complex words.

Four derivations were also used in the experiment. Two of these derivations were adverbs derived from adjectives while the other two were nouns derived from verbs. The high proficiency group showed consistent signs of the onset of partial priming in the adverbial derivations. However, none of the three groups demonstrated any priming effects in the nominal derivations. As discussed in the findings of the Urdu experiment, this phenomenon is strongly suggestive of proficient users’ perception of derivations as a combination of the combining morphemes rather than new words not related to the contributing morphemes.

Three compound words were also included in the experiment. All of them were nouns. It must be mentioned here that all the three compound nouns were transparent which means that the contributing words retained their meanings in the compound nouns. In response to two of these three compound nouns, the high proficiency group showed strong signs of partial priming. However, the same group of participants failed to show any signs of priming effects in the third item involving compound nouns. The other two groups did not demonstrate any signs of the onset of priming effects in any of the three items under focus here.

The above discussion indicates that the highly proficient users of a second language (English, in this case) do see the individual morphemes in the morphologically complex words. This was seen in the case of inflections, derivations, and now it can be seen in case of compound words as well. As per the dual mechanism theory, the highly proficient users were expected to show priming effects in case of inflections. However, showing priming effects in derivations and compound words, albeit not very consistently, is a sign that highly proficient users do seem to perceive the real morphology of the second language as well as the native users of the language.

5.2 Discussion

In this part of the chapter, the above discussed findings are compared with the findings of the major past studies conducted in the research area selected for this study. The discussion includes processing of morphologically complex words in both L1 and L2 since the experiments in this study investigated the same. In the present study's case, Urdu is the participants' first language while they use English as their second language.

Silva and Clahsen conducted a study in 2008 involving processing of morphologically complex words in L1 and L2. The study employed priming experiments, which is like this study. The study found priming effects for morphologically complex words in L1. However, the study did not find any priming effects for the morphologically complex words in L2. It is also worth mentioning that the study included both inflections and derivations. However, no compound words were included in the study (Silva & Clahsen, 2008). In contrast to the study, the present study found robust evidence of the existence of priming effects in case of highly proficient individuals processing morphologically complex words in L2 (English).

Zeng et. al. (2019) investigated the effect of proficiency on the processing of morphologically complex words in L2 (English) in 2019. They used primes with transposed letters in a masked priming experiment and included all three types of morphologically complex words. The study found that the highly proficient users did show priming effects while processing morphologically complex words in L2. The findings of the study are very similar to the present one. The present study employed masked priming and found that the high proficiency group showed consistent priming effects in the processing of inflections and derivations. The high proficiency group also showed robust priming effects for one of the three compound words used in the experiment.

A very similar study was conducted by Liang & Chen (2014) that focused on the effects of proficiency on the processing of morphologically complex words in L2. The study involved ERPs instead of lexical decision-making used in the present study. The study also concluded that the highly proficient users showed priming effects while processing morphologically complex words in L2.

Ciaccio & Jacob (2019) investigated priming effects for morphologically complex words in both native and non-native German (L1 and L2). The study found evidence for priming effects in the processing of morphologically complex words in both L1 and L2 settings which seems very similar to the current study. Similar to the present study, Ciaccio and Jacob also included some orthographically related primes and targets and concluded that the L2 users did show some orthography related priming effects.

Dawson et al. (2021) investigated orthographically related priming effects in children between 9 and 18 years of age. They found that the children showed some priming effects in orthography-related primes and targets at younger ages. The children of older ages (closer to 19 years) did not show any such priming effects for orthographically related primes and targets. In the present study, however, no such priming effects were observed in any of the three orthographically related pairs of primes and targets.

Another major concern that was not taken into consideration was the frequency of the primes and targets and its impact on the priming effects on the individuals while processing morphologically complex words in both L1 and L2. Bronk et al. (2013) suggest that word frequency does play a role in processing morphologically complex words (Bronk et al., 2013). De Rosa and Crepaldi (2022) conducted a study in order to investigate the impact of frequency on the masked priming experiments with Italian L1 users as participants. The researchers concluded that the frequency of a word/morpheme did not affect the priming effects. This raises some questions on the L1 users not showing any priming effects in one of the derivations used in the Urdu experiment in the present study and asks for further investigation/research in the area.

As far as compound word priming in L2 is concerned, only one of the three compound words witnessed robust priming effects from the high proficiency group in the present study. This relates to a study conducted by Li, Jiang and Gor in 2017 wherein proficient Chinese users of English showed priming effects for compound nouns that were either semantically transparent or opaque. However, no such effects were observed for only orthographically related primes and targets (Li et al., 2017).

The present study witnessed robust partial priming effects for inflections and derivations in both native and non-native settings. As far as native (L1) settings are concerned, morphological decomposition of inflections is well established. De Grauwe et al. (2014) found non-native users to be decomposing complex and derived verbs via fMRI evidence. The researchers concluded that non-native users of a language show strong priming effects while processing inflected and derived verbs (De Grauwe et al., 2014).

The above discussion shows that the findings of the present study are at par with various studies conducted in the past. This not only validates the procedures and outcomes of the present study but also indicates that the gap identified for the study has been filled in a valid and correct manner. Suggestions for further research in the area have been given in the next chapter.

CHAPTER 6

CONCLUSION

The study aimed at investigating the processing of morphologically complex words in Urdu and English by Urdu native speakers. The experiment-based study focused on how the native users of a language process all types of morphologically complex words in their first and second languages and how the processing is similar or different across these languages. In this chapter the findings of the study are discussed in the light of the research questions. The contribution of the present study is also discussed in this chapter. In the final sections of this semester some suggestions and recommendations are put forth for future research in the area/related areas.

It is important to mention here that two experiments were employed in this study, one involving morphologically complex words in Urdu while the other experiment used items based on morphologically complex words in English. Everyone taking part in the study partook in both the experiments. There was not a single case where a participant took part in one of these experiments but not in the other.

The participants were divided into three groups according to their proficiency in English. These groups were named as the low proficiency group, the medium proficiency group and the high proficiency group. Their proficiency in Urdu was taken for granted as Urdu was their mother tongue and they were still using Urdu with their families and friends and even in their workplaces and educational institutions on daily basis for all the purposes.

The research questions of the present study were as follows.

1. What are the differences and/or similarities between the processing of morphologically complex words in Urdu and in English by Urdu-English bilinguals?
2. Why are there differences and/or similarities between processing of morphologically complex words in L1 and L2 by Urdu-English bilinguals?
3. How does the proficiency of second language learners affect their processing of morphologically complex words in L2?

In the following paragraphs, the findings pertaining to these research questions are discussed. The findings related to the first research question are as follows.

The results yielded by the two experiments are quite interesting. The way the participants responded to the Urdu items (Urdu being their first language) and the manner in which they responded to the items in the English experiment have a few striking similarities. There are a few differences too. The similarities are discussed first.

The first similarity between the processing of morphologically complex words in English and Urdu by Urdu-English bilinguals is that they both break down the complex words before storing them in their lexicons. Which means that the dual mechanism theory about morphologically complex words holds water. However, proficiency of English is a factor here.

Analyzing the participants' responses to both Urdu and English plural inflections clearly shows that there is a great deal of similarity in them. However, this similarity is only found between the response times of all the respondents (i.e., all the three groups, namely, the low proficiency group, the medium proficiency group, and the high proficiency group) in the Urdu experiment and the high proficiency group in the English experiment. The response times are short enough to indicate that the respondents recognized the words quickly although the plural and past tense forms were shown to them as primes. This priming effect demonstrates that the participants broke the morphologically complex words down and stored the lexical and inflectional morphemes in different sections of their lexicons. (c.f. 4.5.1)

It is interesting to mention here that while responding to some of the inflections in the English experiment, participants in the low and the medium proficiency groups also showed priming effects. (c.f. 4.4.7) This indicates that proficiency in the second language does not build in a uniform manner. Some areas of the language are developed well even when the overall proficiency is not attained by the second language users.

Another similarity between the processing of these two languages is the mixed response to the derivations in both Urdu and English by the participating individuals. As far as Urdu is concerned, the respondents did show some sturdy priming effects while responding to the items involving indigenous Urdu derivatives. (c.f. 4.5.1) However, no priming effects were observed in the case of derived words involving derivatives of Persian origin. In the case of English items, the high proficiency group showed some priming effects in items containing adverbs derived from adjectives. (c.f. 4.5.2) However, the priming was limited to the high proficiency group only and the other two groups did not display any priming. No priming effects were observed in nouns derived from verbs in the English experiment.

Having discussed the similarities in the processing of the two languages, let us now turn towards the differences in the processing of morphologically complex words in Urdu and English.

The biggest difference in the processing of morphologically complex words was observed in the response to the items involving compound words. In the Urdu experiment, the response times by all the three groups indicated uniform partial priming effects in case of all the three Urdu compound words included in the experiment. (c.f. 4.5.1) In case of English compound words included in the English experiment, however, there was no evidence regarding the occurrence of partial priming. In one of the three compound words, however, the high proficiency group did show some priming effects, which, compared with the corresponding section of the Urdu experiment, does not seem very significant. It does show, nevertheless, that high proficiency also does not guarantee the native-like processing of English (the second language, in this case).

All other differences between the processing of morphologically complex words in Urdu and English pertain mostly to the level of proficiency in English on the part of the participants. This discussion relates to the third research question and is discussed in the later sections of the chapter.

The findings pertaining to the second research question are also very interesting. The second research question aimed at finding out the reasons for the existence of similarities and differences between the processing of morphologically complex words in L1 and L2 settings. The findings are discussed in the following paragraphs.

The strongest reason in this regard is the dual mechanism theory itself. The theory posits that the native speakers of a language always break down the morphologically complex words before storing them in their lexicons. This not only makes the size of the lexicon smaller but also facilitates the language users at the time of retrieval of a word. That is why the response times in case of the native speakers (Urdu, in the case of the present study) are always shorter and more uniform, indicating the occurrence of partial priming effects. Since all the participants of the present study were Urdu native speakers, priming effects were seen in case of inflections, derivations, and compound words. The case of derivations in the present study was a bit ambiguous as no priming could be seen in case of the adjectival derivations involving prefixes of Persian origin (c.f. 4.5.1). Apart from that, all the items of the Urdu experiment witnessed priming effects across all the participants belonging to all the three groups. This indicates that the dual mechanism theory holds water in the case of Urdu as well. This is the first research study testing the hypothesis in the case of Urdu (L1).

This theory not only explains the similarities between the processing of morphologically complex words in Urdu and English by Urdu-English bilinguals, but it also explains the differences. It explains that there will always be differences between how language users use their first and second languages. The dual mechanism theory states that when an individual achieves native-like proficiency in the second language, the breaking down of morphologically complex words while storing them in the lexicon becomes a normal and automatic process for the individual. That is why differences in the processing of morphologically complex words in English can be seen across the three groups in this study. The low proficiency group responded in a haphazard manner to almost all the English items except the ones aimed at gauging identical priming. However, there was one item involving plural inflection in which the low and medium proficiency groups also showed some priming effects. Apart from that, there was nothing that could prove that the low and the medium proficiency groups processed morphologically complex words in both their first and second languages in a similar fashion. This was not unexpected because the dual mechanism theory (and the subsequent research) already explained that proficiency is the key to processing one's second language in a native-like manner.

In the light of the above discussion, it can be safely concluded that the similarities and differences in an individual's processing of morphologically complex words in Urdu and English are directly linked with the individual's proficiency levels in the two languages. In the present study's case, both the similarities and differences in the processing of morphologically complex words by the participating individuals are directly linked to their proficiency levels in English.

The participants of the present study were divided into three groups based on their proficiency in English. This division was deliberate because one of the aims of this study was to see how similarly or differently these individuals processed their first and second languages and whether proficiency in the second language had to do anything with their processing. In the following paragraphs, various sections of the English experiment are discussed in terms of the performance of the three groups. The discussion in the following paragraphs pertains to the third research question of the study.

In case of plural inflections, the high proficiency group consistently displayed partial priming effects. However, the other two groups (the low and medium proficiency groups) showed partial priming effects in one of the items (c.f. 4.5.2). These two groups did not show any priming effects in the other item involving plural inflections.

As far as the past tense inflections are concerned, again, the high proficiency group was the only one showing priming effects. The responses by the other two groups did not indicate any facilitation by the inflected primes in these cases. (c.f. 4.5.2)

The case with the adverbs derived from adjectives was the same. Only the high proficiency group responded in a manner indicative of the occurrence of partial priming effects. The responses by the other two groups did not indicate any priming effects whatsoever. (c.f. 4.5.2)

However, the case with nouns derived from verbs was a bit different as none of the three groups displayed any priming effects. The response times by the high proficiency group were better in these cases but not good enough to be indicative of any priming effects. So, in this regard all the three groups responded similarly. (c.f. 4.5.2)

The case with compound words in English was interesting. In only one of the items, the high proficiency group displayed some evidence of partial priming effects. That, again, is indicative of having an edge in terms of higher-level proficiency. However, all the groups responded more or less in a similar fashion to other items containing compound words. (c.f. 4.5.2)

The above discussion leads us to conclude that proficiency in the second language (English, in this case) is a critical factor when it comes to processing morphologically complex words.

To sum up the discussion regarding the research questions, the findings suggest that there are a great deal of similarities between how individuals process their first and second languages. The evidence from the present study also points out that there are many ways in which processing of morphologically complex words in L1 settings differ from those in L2 settings. The present study also puts forth strong evidence of the role of proficiency in the processing of morphologically complex words in L2 setting. The individuals who achieve higher proficiency levels in the second language tend to process it in a more native-like fashion.

6.1 Contribution of the Study

The biggest methodological contribution of this study is to shift the focus to the bilingual mind. In the past the research mainly focused on one language and experimented upon how native and nonnative users of that language processed it trying to find similarities and differences. In a first, the current study investigated on how individuals process their first and second languages and whether there are any similarities and differences between this processing.

This study was one of the first of its kind involving Urdu-English bilinguals. Investigating language processing is very rare in Pakistan. There are some studies conducted in the area of language processing, but they are neither related to the English language nor involve any online experimentation. Most of them involve offline methods of investigating processing of language. It is also the first study that tests dual mechanism theory in the context of Urdu.

In the past, the majority of the research focused on any one area of word processing. Most of the studies conducted in the past focus only on either plural or past tense inflections. There are only a few studies that investigated the processing of derivations or compound words. This study is one of the very few that includes all types of morphologically complex words and the way they are processed by individuals. This study is also one of the very few that involved parallel and similar experiments investigating the processing of first and second languages.

As far as teaching and learning of English in Pakistan is concerned, this study can provide guidelines to the students, teachers, and syllabus designers alike. Currently, morphology is one of the least focused areas of English Language Teaching in Pakistan. The current study highlights the importance of morphology in processing the language by highlighting the correlation between proficiency and morphological processing. This means that introducing morphology in the English language classes can help the learners attain high level proficiency in the language.

6.2 Limitations of the Study

This study is constrained by several limitations. Firstly, it focuses only on a select few inflectional and derivational morphemes in both Urdu and English, as well as a single pattern of combinational morphology in the case of compound words. This narrow scope may not fully represent the complexities of morphological processing in these languages, as it excludes various other morphological patterns and structures.

In the case of Urdu, the study includes only regular plural morphemes of indigenous Urdu and Arabic origin, as well as derivational morphology from indigenous Urdu and Persian origins. This limited selection of morphemes may not capture the full range of morphological processes present in Urdu, thereby restricting the generalizability of the findings.

Additionally, the study's sample size and composition pose limitations. The participants are residents of two closely situated cities in Pakistan, primarily from Rawalpindi, Islamabad, and Attock. While this geographic diversity provides some variation, the relatively small number of participants from a specific region may not adequately represent the broader population of Urdu-English bilinguals in Pakistan. Therefore, the findings of this study may not be universally applicable beyond the specific context of the participating individuals.

Furthermore, the study primarily focuses on how native speakers of Urdu process morphologically complex words in both Urdu and English. While it offers valuable insights into bilingual language processing, particularly among Urdu-English bilinguals, the findings may not be generalizable to other language pairs or bilingual populations with different linguistic backgrounds.

In summary, while this study provides important insights into morphological processing in Urdu-English bilinguals, its limitations in scope, sample size, and generalizability should be considered when interpreting the findings and applying them to broader contexts of language processing and bilingualism.

6.3 Recommendations for Future Research

The future research in the area of morphological processing should focus on bilingual speakers instead of two sets of individuals speaking the same language. The current study is the first endeavour in this regard. The future research can focus on bilinguals having English, French, German, Chinese, and Spanish as their first language, as most of the past research has been done in these languages.

The area of language processing is quite unexplored in Pakistan. Pakistan being a multilingual community, there is a lot of scope for language research in the country. Language processing is one of the areas which are almost untapped in Pakistan. The number of online language processing studies seems to be next to none. In the light of the findings of the present study, a few suggestions are put forth for further studies in these area/related areas. The focus of these suggestions will move from areas specifically related to the present study to more general areas.

In the present study, it was found that the low and medium proficiency groups showed some signs of the onset of partial priming in processing of inflections in the English experiment. This is suggestive of the participants' higher level of proficiency in some areas of the language although their overall proficiency level is not very high. This area needs further investigation. In future, research may be conducted dividing participants into, say, five proficiency groups rather than three, trying to find how the continuum shows morphological processing capabilities.

The native speakers of Urdu and the highly proficient non-native speakers of English showed robust facilitation from the derivations used as primes in both the Urdu and English experiments. This indicates that although derivations have separate lexical identity, the native speakers and the highly proficient non-native speakers are still able to perceive the individual morphemes contributing to the making of derived words. This area needs research on both native and non-native speakers of various languages.

The case of compound words is very similar to that of derivations. The native speakers of Urdu showed robust priming effects while responding to the compound words while highly proficient users of English showed similar signs to two of the three compound words used in the experiment. This phenomenon is also suggestive of the fact that native and native-like speakers do perceive the individual morphemes in the compound words. It asks for further investigation.

It was observed in the present study that the native Urdu speakers responded to the indigenous Urdu morphological processes more efficiently than those involving morphological variation of Persian and Arabic origin. Urdu lexis and morphology were developed by a mix of people speaking four different languages including Persian, Arabic, Turkish, and Hindi. Whether native Urdu speakers respond to linguistic items originating from all these languages alike, is a big question and should be investigated.

Pakistan is a multiethnic and multilingual society. However, people of almost all the ethnicities learn or try to learn English for various reasons. The comparison of native and non-native language has great scope and potential in Pakistan as it is largely untapped. Research on language processing can be done involving any one language, two languages, and many languages. English may or may not be included on the list.

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Appendix A
Outliers Analysis

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
PTE1	40	100.0%	0	0.0%	40	100.0%
PTE2	40	100.0%	0	0.0%	40	100.0%
PTE3	40	100.0%	0	0.0%	40	100.0%
PTE4	40	100.0%	0	0.0%	40	100.0%
PTE5	40	100.0%	0	0.0%	40	100.0%
PTE6	40	100.0%	0	0.0%	40	100.0%
PTE7	40	100.0%	0	0.0%	40	100.0%
PTE8	40	100.0%	0	0.0%	40	100.0%
PTE9	40	100.0%	0	0.0%	40	100.0%
PTE10	40	100.0%	0	0.0%	40	100.0%
PTE11	40	100.0%	0	0.0%	40	100.0%
PTE12	40	100.0%	0	0.0%	40	100.0%
PTE13	40	100.0%	0	0.0%	40	100.0%
PTE14	40	100.0%	0	0.0%	40	100.0%
PTE15	40	100.0%	0	0.0%	40	100.0%
PTE16	40	100.0%	0	0.0%	40	100.0%
PTE17	40	100.0%	0	0.0%	40	100.0%
PTE18	40	100.0%	0	0.0%	40	100.0%
PTE19	40	100.0%	0	0.0%	40	100.0%
PTE20	40	100.0%	0	0.0%	40	100.0%
PTE21	40	100.0%	0	0.0%	40	100.0%
PTE22	40	100.0%	0	0.0%	40	100.0%
PTU1	40	100.0%	0	0.0%	40	100.0%
PTU2	40	100.0%	0	0.0%	40	100.0%
PTU3	40	100.0%	0	0.0%	40	100.0%
PTU4	40	100.0%	0	0.0%	40	100.0%
PTU5	40	100.0%	0	0.0%	40	100.0%
PTU6	40	100.0%	0	0.0%	40	100.0%
PTU7	40	100.0%	0	0.0%	40	100.0%
PTU8	40	100.0%	0	0.0%	40	100.0%

PTU9	40	100.0%	0	0.0%	40	100.0%
PTU10	40	100.0%	0	0.0%	40	100.0%
PTU11	40	100.0%	0	0.0%	40	100.0%
PTU12	40	100.0%	0	0.0%	40	100.0%
PTU13	40	100.0%	0	0.0%	40	100.0%
PTU14	40	100.0%	0	0.0%	40	100.0%
PTU15	40	100.0%	0	0.0%	40	100.0%
PTU16	40	100.0%	0	0.0%	40	100.0%
PTU17	40	100.0%	0	0.0%	40	100.0%
PTU18	40	100.0%	0	0.0%	40	100.0%
PTU19	40	100.0%	0	0.0%	40	100.0%
PTU20	40	100.0%	0	0.0%	40	100.0%
PTU21	40	100.0%	0	0.0%	40	100.0%
PTU22	40	100.0%	0	0.0%	40	100.0%

Percentiles

		Percentiles						
		5	10	25	50	75	90	95
Weighted Average(Definition 1)	PTE1	438.5925	457.5520	534.4800	587.0050	642.4150	703.0490	794.5090
	PTE2	507.9280	520.5990	562.5675	606.9079	645.7900	704.3260	739.1265
	PTE3	468.0040	477.1260	547.8175	590.3187	656.4525	750.8460	772.9110
	PTE4	667.0605	735.6090	774.2075	870.9500	1016.4550	1133.5190	1196.5515
	PTE5	697.1355	705.0840	778.7625	819.8500	876.3125	1052.5740	1100.1090
	PTE6	562.7675	684.6900	721.3525	843.9850	1099.4075	1474.8890	1545.8415
	PTE7	571.7995	614.0290	709.0875	770.0550	818.7550	902.9760	948.0540
	PTE8	621.2195	688.5190	736.5025	779.4750	1075.2175	1370.8410	1497.6870
	PTE9	625.2765	693.2960	745.8650	781.6050	873.2000	942.4060	991.0635
	PTE10	640.2570	710.9590	807.7575	931.5850	1026.3650	1141.0380	1411.2605
	PTE11	738.4995	754.8390	815.7100	900.9350	1066.4350	1159.3530	1209.4675
	PTE12	575.3680	637.9640	710.3175	757.7850	852.1175	1056.5540	1097.0235
	PTE13	634.9095	675.1290	709.8025	753.9000	853.3825	1309.1070	1420.6985
	PTE14	666.5625	699.2980	727.9175	827.2450	950.4899	1041.7060	1142.8890
	PTE15	667.6105	700.9900	777.6675	822.7800	911.4125	1230.1280	1381.9885
	PTE16	489.0125	597.5970	777.9825	845.0050	1024.9100	1348.3720	1810.1075
	PTE17	699.0550	752.6990	799.8175	834.8550	881.8225	1261.8460	1428.9845
	PTE18	607.0545	642.9170	724.4825	797.1650	878.1925	1449.8020	1995.5360
	PTE19	634.3255	657.0780	702.9400	802.8200	886.9450	1258.1560	1440.4400
	PTE20	605.4005	674.1610	750.9150	834.1700	932.3375	1061.8650	1243.9400
	PTE21	721.4100	759.7810	807.4425	833.1950	928.4925	1376.5430	1416.1235

	PTE22	750.5735	786.3880	823.2725	861.2750	1022.5106	1507.1820	1750.4305
	PTU1	491.3705	528.6570	543.2350	576.6562	616.4800	660.5380	694.3665
	PTU2	426.6925	456.7650	536.1400	575.9700	636.7875	685.1630	719.7680
	PTU3	502.3575	516.3960	550.8700	596.5100	636.4325	684.9530	752.0360
	PTU4	648.9065	700.6230	752.9925	791.4550	838.0300	929.1860	1129.9805
	PTU5	685.4365	744.3020	772.8450	822.4250	886.0875	960.4560	997.1195
	PTU6	537.0470	600.5650	671.4150	701.5850	749.4825	853.9210	887.6355
	PTU7	539.8590	556.1900	621.9025	686.4684	746.3075	831.4100	838.9310
	PTU8	614.2100	639.1510	678.1050	732.8500	786.2025	847.4950	888.0515
	PTU9	588.1690	607.9450	633.8450	711.6614	760.0500	842.3450	875.5235
	PTU10	659.0455	725.9430	792.1475	834.7100	897.2325	947.9720	988.3845
	PTU11	711.0795	781.0060	820.2125	853.4850	921.6300	976.6630	1190.6140
	PTU12	560.1270	602.6400	633.8150	715.7500	759.5000	801.0140	880.4225
	PTU13	611.6065	645.9890	678.3250	721.4550	769.7075	826.9640	883.7585
	PTU14	635.0645	663.9370	692.7900	732.5500	791.2475	858.6300	914.9580
	PTU15	656.8390	676.0520	729.3100	799.9900	868.2032	951.6820	1174.3590
	PTU16	696.0575	737.7730	793.6050	849.5550	889.8825	937.3300	949.6235
	PTU17	638.5325	731.2840	823.0025	891.5900	1018.0400	1198.0090	1458.3460
	PTU18	592.1890	642.5470	685.9425	749.2700	776.8875	796.4620	846.5000
	PTU19	593.9580	607.8000	659.2600	716.4900	770.3725	818.9180	871.4650
	PTU20	617.4115	627.7680	710.9025	753.8400	814.8500	849.9180	879.2320
	PTU21	674.1815	721.9380	793.2250	879.9350	933.6446	998.3010	1046.8215
	PTU22	770.5545	794.4570	831.3925	877.6650	933.1800	994.0090	1083.7490
Tukey's Hinges	PTE1			534.9100	587.0050	640.6600		
	PTE2			563.6050	606.9079	643.2800		
	PTE3			549.9750	590.3187	653.9250		
	PTE4			778.6850	870.9500	1004.5700		
	PTE5			779.1550	819.8500	875.8950		
	PTE6			723.3450	843.9850	1094.7850		
	PTE7			713.3750	770.0550	818.5700		
	PTE8			738.6050	779.4750	1074.1550		
	PTE9			746.1400	781.6050	867.8900		
	PTE10			809.8250	931.5850	1021.1200		
	PTE11			816.5300	900.9350	1059.2600		
	PTE12			710.7350	757.7850	847.3950		
	PTE13			711.2450	753.9000	852.3550		
	PTE14			731.6150	827.2450	947.1866		
	PTE15			778.8950	822.7800	906.4950		
	PTE16			778.5850	845.0050	1009.5800		
	PTE17			800.2650	834.8550	881.3750		

	PTE18			724.5550	797.1650	875.6450		
	PTE19			704.7400	802.8200	885.6600		
	PTE20			752.1100	834.1700	931.8650		
	PTE21			808.3350	833.1950	921.9550		
	PTE22			823.6550	861.2750	1013.1113		
	PTU1			544.0600	576.6562	616.4500		
	PTU2			536.9500	575.9700	629.3750		
	PTU3			551.8300	596.5100	636.2550		
	PTU4			755.5850	791.4550	837.0900		
	PTU5			773.9500	822.4250	884.9550		
	PTU6			672.1100	701.5850	747.5250		
	PTU7			625.4750	686.4684	737.3350		
	PTU8			678.2900	732.8500	785.3050		
	PTU9			634.6400	711.6614	758.1100		
	PTU10			793.6750	834.7100	894.5250		
	PTU11			821.3050	853.4850	918.3700		
	PTU12			634.9200	715.7500	758.2100		
	PTU13			679.0900	721.4550	765.4850		
	PTU14			693.4700	732.5500	790.3950		
	PTU15			730.2700	799.9900	866.9288		
	PTU16			794.2100	849.5550	888.3750		
	PTU17			823.1550	891.5900	994.2600		
	PTU18			686.9350	749.2700	776.6650		
	PTU19			659.4600	716.4900	768.5050		
	PTU20			711.4350	753.8400	814.2600		
	PTU21			795.2200	879.9350	931.1764		
	PTU22			831.5050	877.6650	929.6700		

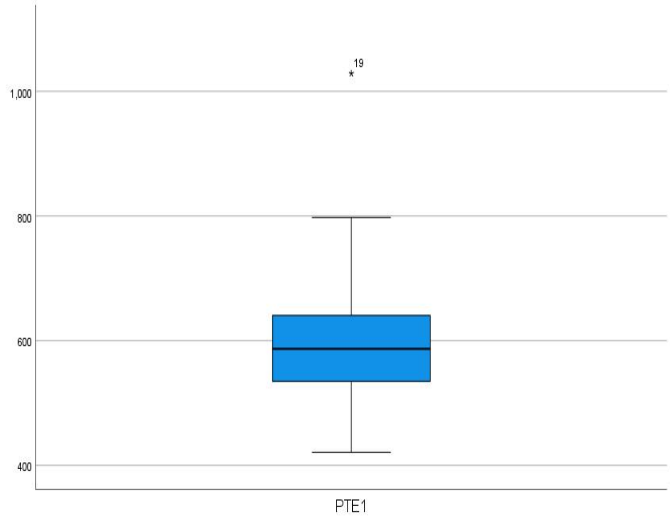
PTE1

```
PTE1 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

3.00        4 .  234
3.00        4 .  578
7.00        5 .  1133344
9.00        5 .  566788889
9.00        6 .  112223334
5.00        6 .  55578
2.00        7 .  03
1.00        7 .  9
1.00 Extremes    (>=1029)

Stem width:    100.00
Each leaf:        1 case(s)
```



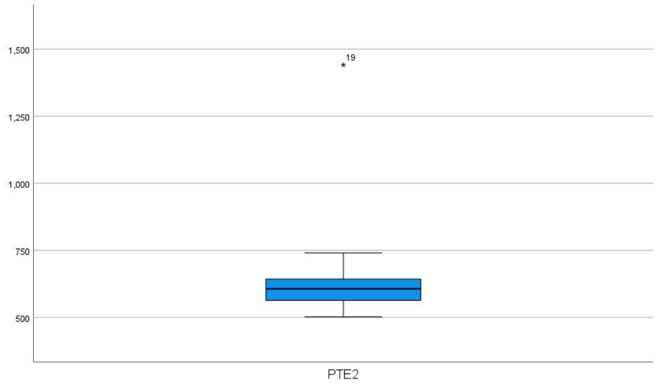
PTE2

```
PTE2 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

8.00        5 .  00122444
11.00        5 .  56677888999
12.00        6 .  011111223334
5.00        6 .  55788
3.00        7 .  014
1.00 Extremes    (>=1441)

Stem width:    100.00
Each leaf:        1 case(s)
```



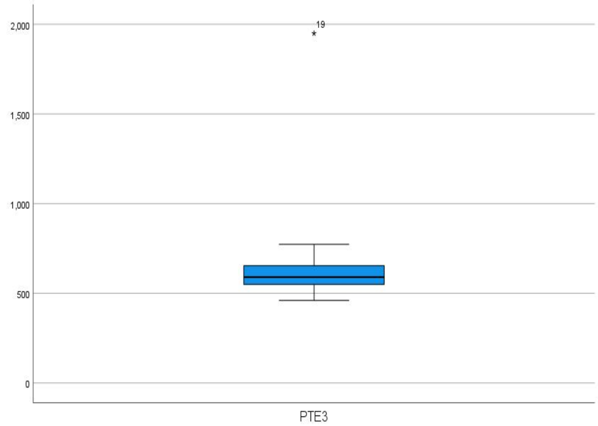
PTE3

```
PTE3 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

4.00        4 .  6677
6.00        5 .  012334
12.00        5 .  556667777899
8.00        6 .  00111234
6.00        6 .  578889
.00        7 .
3.00        7 .  567
1.00 Extremes    (>=1949)

Stem width:    100.00
Each leaf:        1 case(s)
```



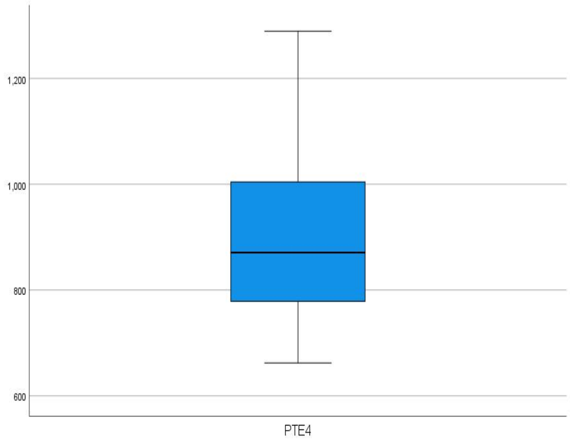
PTE4

```
PTE4 Stem-and-Leaf Plot

Frequency     Stem &   Leaf

2.00          6 .   66
10.00          7 .   2335556688
12.00          8 .   011122667888
6.00          9 .   112278
4.00         10 .   2344
5.00         11 .   02379
1.00         12 .   8

Stem width:     100.00
Each leaf:         1 case(s)
```



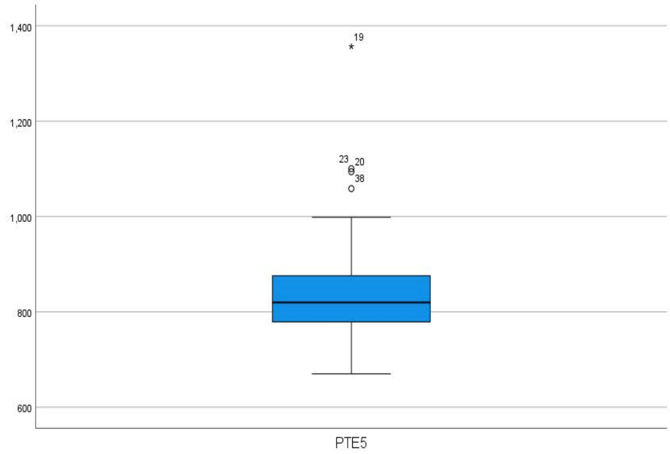
PTE5

```
PTE5 Stem-and-Leaf Plot

Frequency     Stem &   Leaf

2.00          6 .   79
4.00          7 .   0044
8.00          7 .   56677999
12.00          8 .   000011233444
8.00          8 .   55777889
.00          9 .
2.00          9 .   89
4.00 Extremes     (>=1059)

Stem width:     100.00
Each leaf:         1 case(s)
```



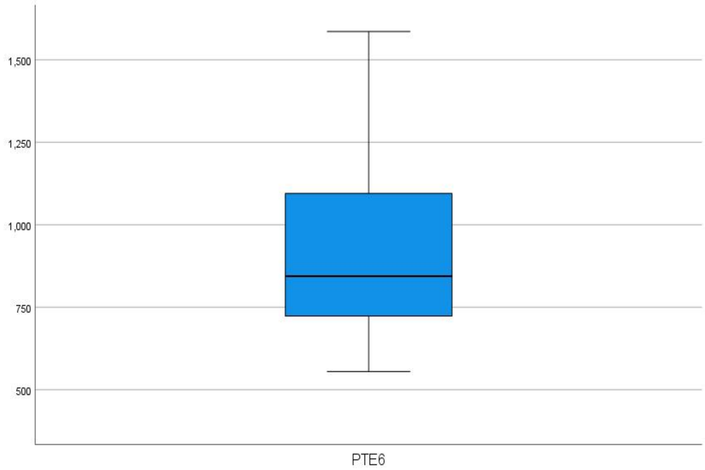
PTE6

```
PTE6 Stem-and-Leaf Plot

Frequency     Stem &   Leaf

2.00          5 .   55
3.00          6 .   789
13.00                   7   .
0001122346799
3.00          8 .   026
5.00          9 .   37779
4.00         10 .   4458
3.00         11 .   057
.00         12 .
1.00         13 .   8
3.00         14 .   667
3.00         15 .   048

Stem width:     100.00
Each leaf:         1 case(s)
```



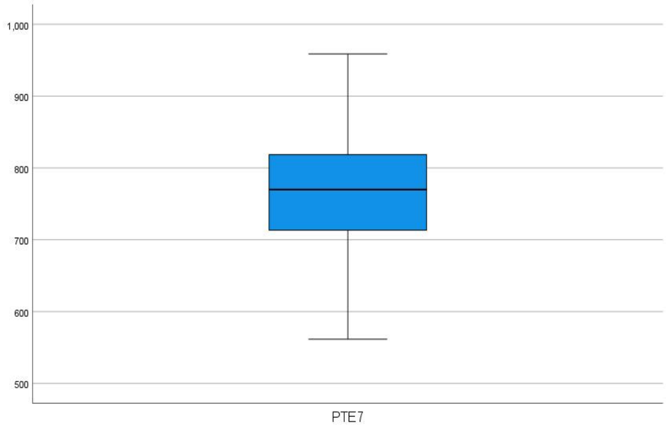
PTE7

```
PTE7 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

3.00          5 .  678
2.00          6 .  12
4.00          6 .  5578
7.00          7 .  0234444
11.00          7 .  55567788888
6.00          8 .  111123
1.00          8 .  6
4.00          9 .  0000
2.00          9 .  55

Stem width:    100.00
Each leaf:        1 case(s)
```



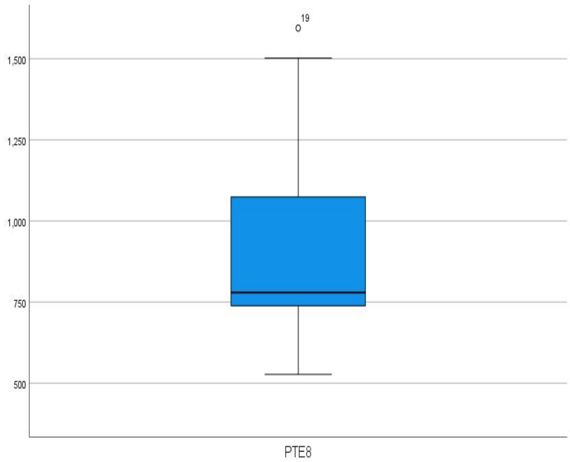
PTE8

```
PTE8 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

1.00          5 .  2
4.00          6 .  1789
18.00          7 .  000234455666777889
5.00          8 .  13999
.00          9 .
5.00         10 .  47789
2.00         11 .  34
.00         12 .
2.00         13 .  47
1.00         14 .  1
1.00         15 .  0
1.00 Extremes    (>=1595)

Stem width:    100.00
Each leaf:        1 case(s)
```



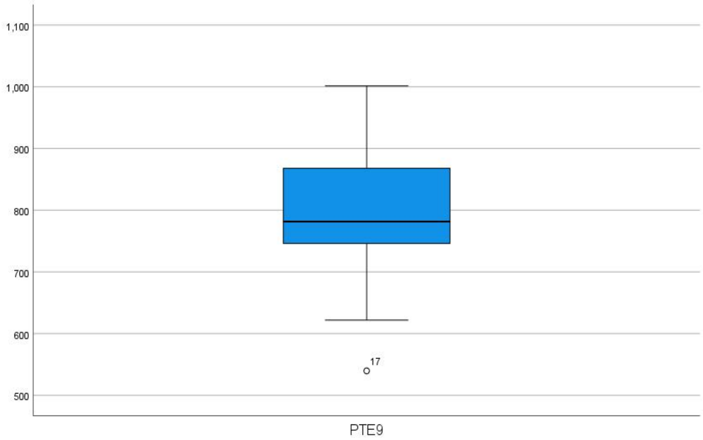
PTE9

```
PTE9 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

1.00 Extremes    (=<540)
1.00          6 .  2
4.00          6 .  9999
6.00          7 .  034444
10.00          7 .  5566777788
7.00          8 .  0122233
3.00          8 .  578
6.00          9 .  122244
1.00          9 .  9
1.00         10 .  0

Stem width:    100.00
Each leaf:        1 case(s)
```



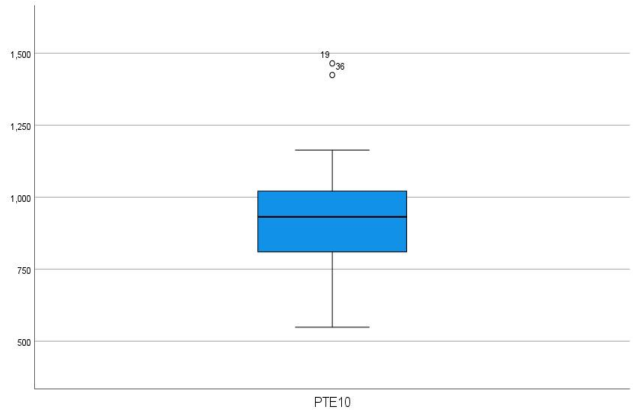
PTE10

```
PTE10 Stem-and-Leaf Plot

Frequency     Stem &  Leaf

1.00         5 .  4
2.00         6 .  44
6.00         7 .  023467
10.00         8 .  0111223367
10.00         9 .  3333444799
6.00        10 .  133588
3.00        11 .  146
2.00 Extremes     (>=1424)

Stem width:    100.00
Each leaf:        1 case(s)
```



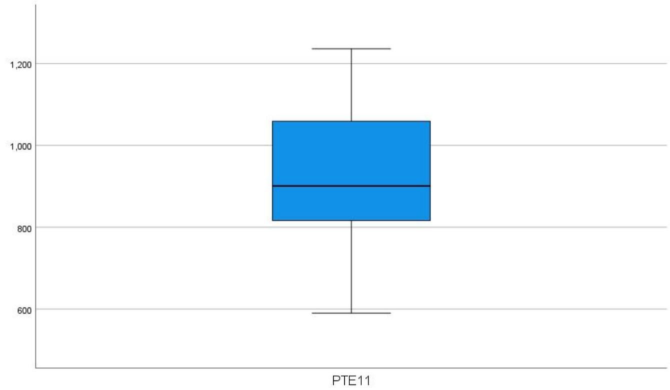
PTE11

```
PTE11 Stem-and-Leaf Plot

Frequency     Stem &  Leaf

1.00         5 .  9
.00         6 .
7.00         7 .  3456789
12.00         8 .  011233445689
6.00         9 .  001288
5.00        10 .  11147
7.00        11 .  0013466
2.00        12 .  13

Stem width:    100.00
Each leaf:        1 case(s)
```



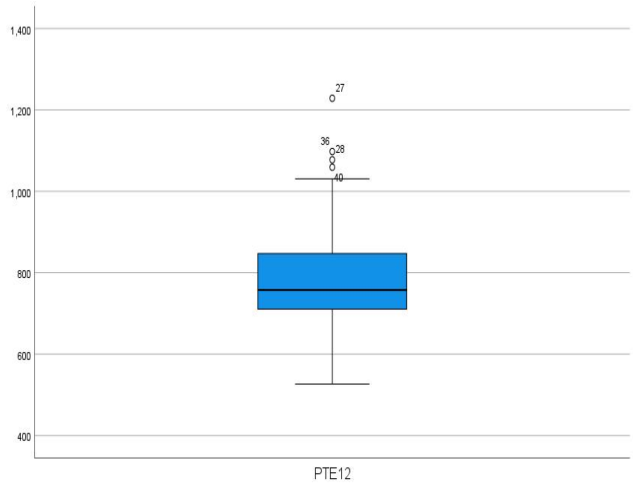
PTE12

```
PTE12 Stem-and-Leaf Plot

Frequency     Stem &  Leaf

1.00         5 .  2
2.00         5 .  77
2.00         6 .  34
1.00         6 .  9
13.00         7 .  0000112233344
8.00         7 .  56778889
3.00         8 .  023
3.00         8 .  577
.00         9 .
2.00         9 .  66
1.00        10 .  3
4.00 Extremes     (>=1059)

Stem width:    100.00
Each leaf:        1 case(s)
```



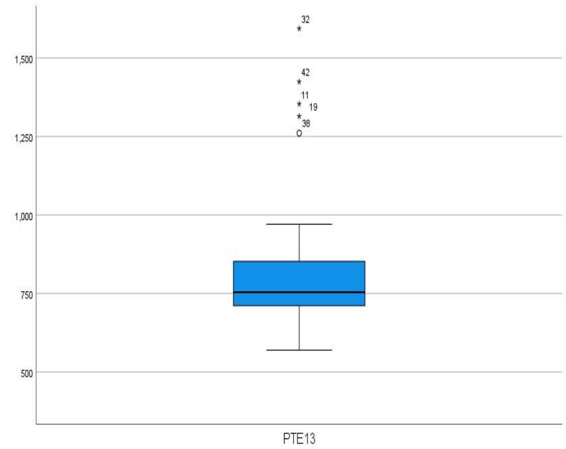
PTE13

```
PTE13 Stem-and-Leaf Plot

Frequency     Stem &  Leaf

1.00         5 .  6
1.00         6 .  3
6.00         6 .  578889
11.00         7 .  00111334444
7.00         7 .  5555799
3.00         8 .  033
4.00         8 .  5569
1.00         9 .  2
1.00         9 .  7
5.00 Extremes    (>=1260)

Stem width:    100.00
Each leaf:        1 case(s)
```



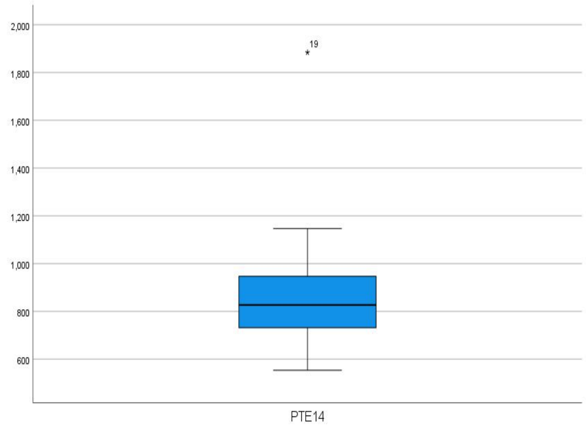
PTE14

```
PTE14 Stem-and-Leaf Plot

Frequency     Stem &  Leaf

1.00         5 .  5
3.00         6 .  699
10.00         7 .  0011223599
13.00         8 .  1112222333479
6.00         9 .  134577
5.00        10 .  02247
1.00        11 .  4
1.00 Extremes    (>=1884)

Stem width:    100.00
Each leaf:        1 case(s)
```



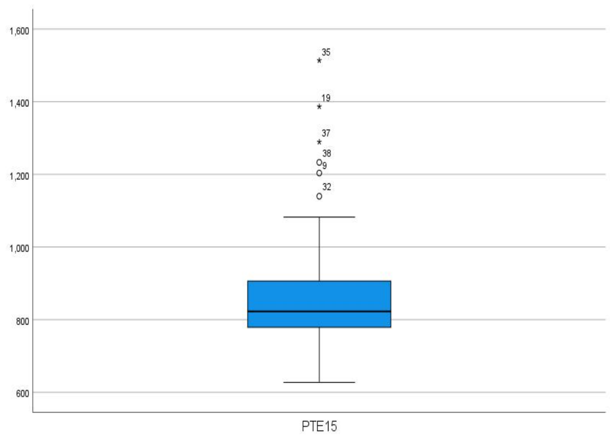
PTE15

```
PTE15 Stem-and-Leaf Plot

Frequency     Stem &  Leaf

1.00         6 .  2
3.00         6 .  689
4.00         7 .  1234
6.00         7 .  778888
11.00         8 .  00111222334
5.00         8 .  56789
1.00         9 .  1
2.00         9 .  88
.00        10 .
1.00        10 .  8
6.00 Extremes    (>=1140)

Stem width:    100.00
Each leaf:        1 case(s)
```



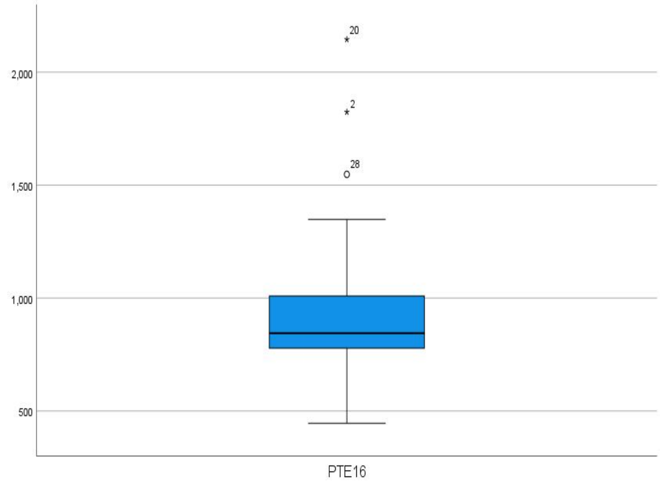
PTE16

```
PTE16 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

2.00        4 .  48
2.00        5 .  28
.00        6 .
9.00        7 .  344677799
13.00        8 .  0022233567999
4.00        9 .  2377
2.00       10 .  46
1.00       11 .  2
1.00       12 .  8
3.00       13 .  044
3.00 Extremes    (>=1548)

Stem width:    100.00
Each leaf:        1 case(s)
```



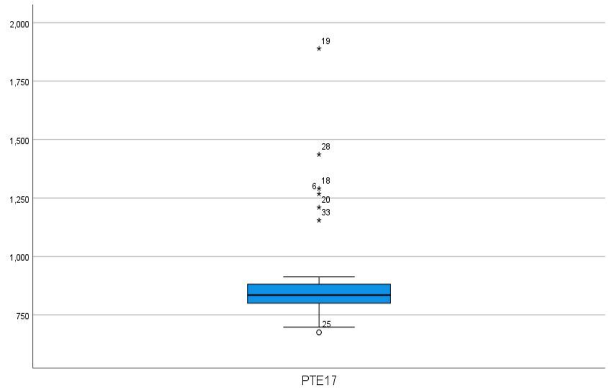
PTE17

```
PTE17 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

1.00 Extremes    (=<675)
1.00        6 .  9
1.00        7 .  2
7.00        7 .  5778999
13.00        8 .  0011112223344
9.00        8 .  556677889
2.00        9 .  01
6.00 Extremes    (>=1154)

Stem width:    100.00
Each leaf:        1 case(s)
```



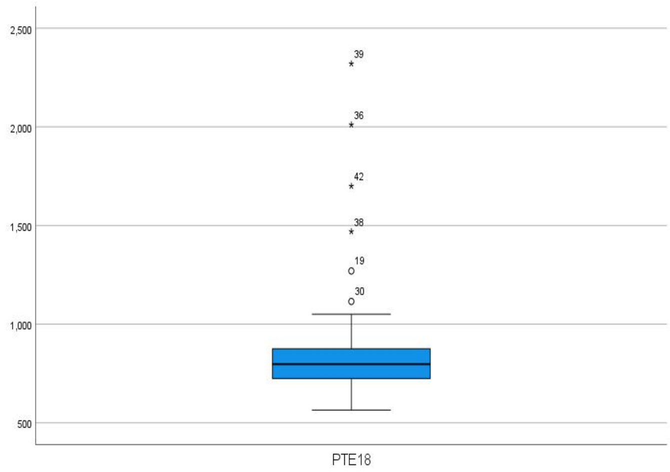
PTE18

```
PTE18 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

1.00        5 .  6
3.00        6 .  023
2.00        6 .  79
7.00        7 .  0012234
8.00        7 .  66667899
6.00        8 .  022334
4.00        8 .  5578
2.00        9 .  01
.00        9 .
.00       10 .
1.00       10 .  5
6.00 Extremes    (>=1115)

Stem width:    100.00
Each leaf:        1 case(s)
```



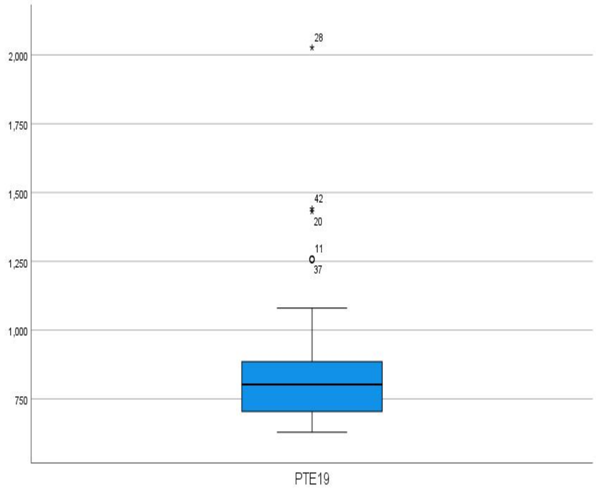
PTE19

```
PTE19 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

2.00        6 .  23
7.00        6 .  5578999
7.00        7 .  0011234
4.00        7 .  5589
7.00        8 .  0223334
4.00        8 .  5688
1.00        9 .  0
.00         9 .
2.00       10 .  23
1.00       10 .  8
5.00 Extremes    (>=1256)

Stem width:    100.00
Each leaf:        1 case(s)
```



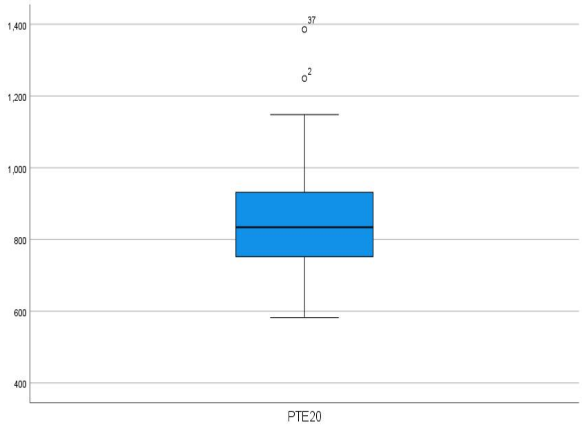
PTE20

```
PTE20 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

1.00        5 .  8
3.00        6 .  057
12.00        7 .  013344589999
12.00        8 .  122234566788
8.00        9 .  03344899
1.00       10 .  6
1.00       11 .  4
2.00 Extremes    (>=1249)

Stem width:    100.00
Each leaf:        1 case(s)
```



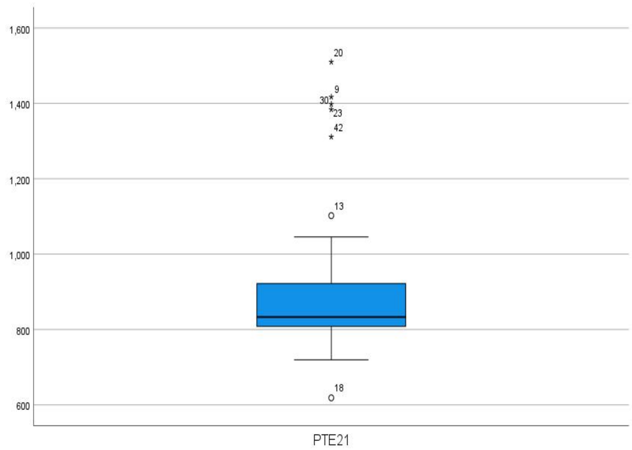
PTE21

```
PTE21 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

1.00 Extremes    (=<619)
1.00        7 .  1
4.00        7 .  5589
17.00                              8    .
00001111111122344
6.00        8 .  667789
2.00        9 .  03
1.00        9 .  7
2.00       10 .  04
6.00 Extremes    (>=1102)

Stem width:    100.00
Each leaf:        1 case(s)
```



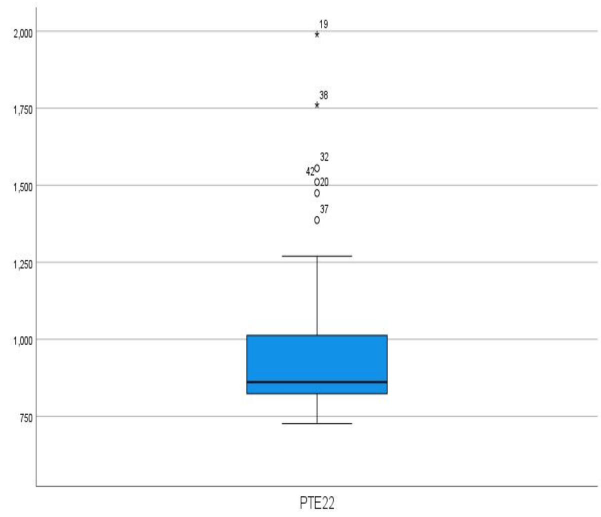
PTE22

```
PTE22 Stem-and-Leaf Plot

Frequency     Stem &   Leaf

2.00          7 .   24
3.00          7 .   789
10.00          8 .   1122222334
12.00          8 .   555666678899
.00          9 .
3.00          9 .   689
1.00         10 .   3
.00         10 .
1.00         11 .   2
.00         11 .
1.00         12 .   0
1.00         12 .   6
6.00 Extremes     (>=1387)

Stem width:    100.00
Each leaf:        1 case(s)
```



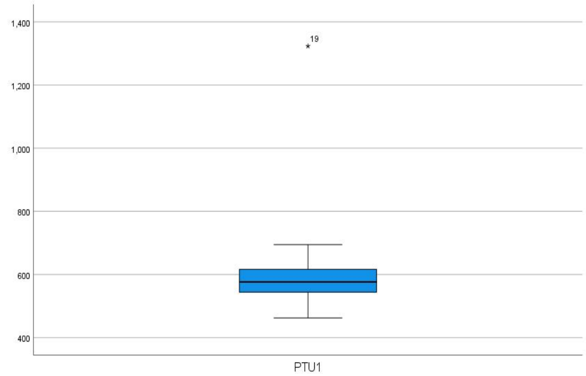
PTU1

```
PTU1 Stem-and-Leaf Plot

Frequency     Stem &   Leaf

2.00          4 .   69
10.00          5 .   0223334444
15.00          5 .   555555677888999
8.00          6 .   00111111
4.00          6 .   5689
1.00 Extremes     (>=1323)

Stem width:    100.00
Each leaf:        1 case(s)
```



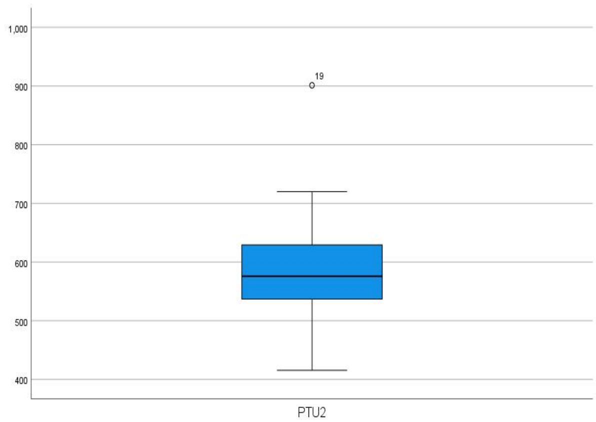
PTU2

```
PTU2 Stem-and-Leaf Plot

Frequency     Stem &   Leaf

3.00          4 .   124
2.00          4 .   57
9.00          5 .   122233344
13.00          5 .   5666677788889
4.00          6 .   0014
6.00          6 .   555778
2.00          7 .   12
1.00 Extremes     (>=901)

Stem width:    100.00
Each leaf:        1 case(s)
```



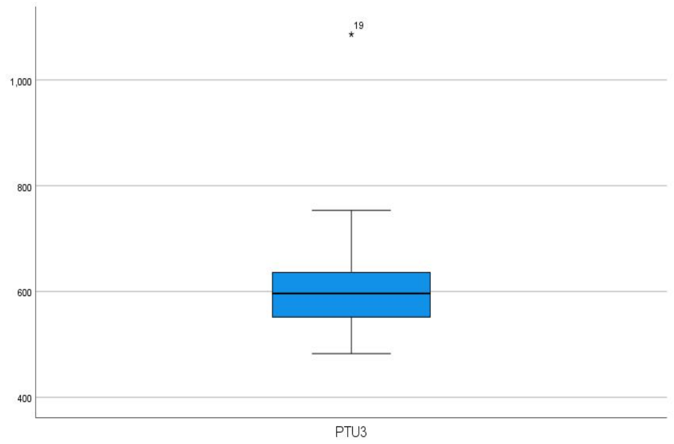
PTU3

```
PTU3 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

1.00        4 .  8
9.00        5 .  011133334
13.00        5 .  5556666799999
10.00        6 .  0002233344
4.00        6 .  5788
1.00        7 .  2
1.00        7 .  5
1.00 Extremes    (>=1086)

Stem width:    100.00
Each leaf:        1 case(s)
```



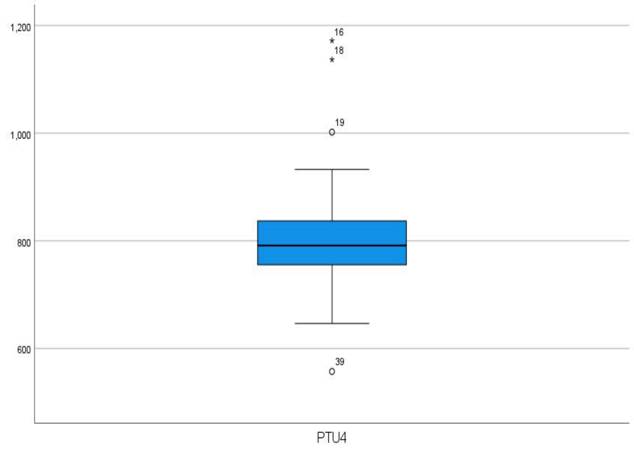
PTU4

```
PTU4 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

1.00 Extremes    (=<557)
1.00        6 .  4
1.00        6 .  9
6.00        7 .  001113
13.00        7 .  5667778888899
10.00        8 .  0002222334
4.00        8 .  5889
1.00        9 .  3
3.00 Extremes    (>=1002)

Stem width:    100.00
Each leaf:        1 case(s)
```



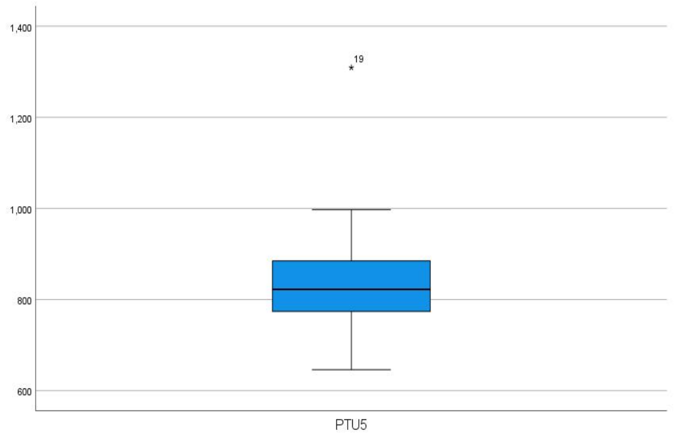
PTU5

```
PTU5 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

1.00        6 .  4
1.00        6 .  8
2.00        7 .  14
12.00        7 .  555557788999
5.00        8 .  00012
10.00        8 .  5666677788
5.00        9 .  01234
3.00        9 .  699
1.00 Extremes    (>=1309)

Stem width:    100.00
Each leaf:        1 case(s)
```



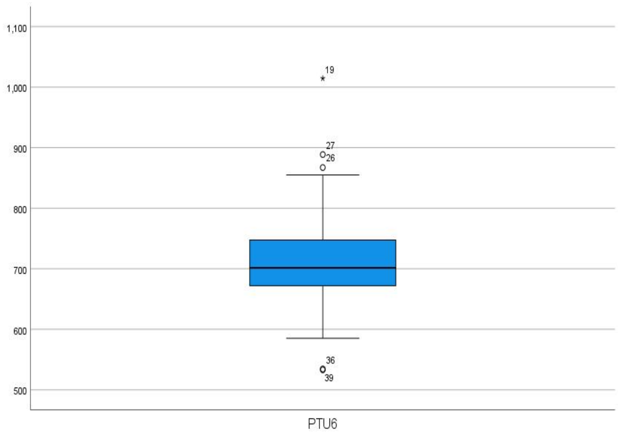
PTU6

```
PTU6 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

2.00 Extremes    (=<535)
2.00        5 .  89
4.00        6 .  1124
12.00        6 .  577788888999
10.00        7 .  0000011224
1.00        7 .  5
5.00        8 .  12234
1.00        8 .  5
3.00 Extremes    (>=867)

Stem width:    100.00
Each leaf:        1 case(s)
```



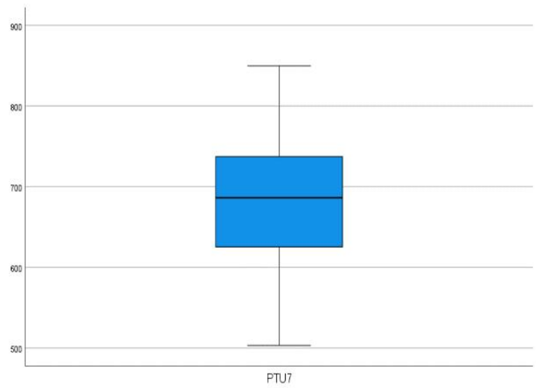
PTU7

```
PTU7 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

3.00        5 .  034
4.00        5 .  5689
6.00        6 .  011334
13.00        6 .  5566888899999
4.00        7 .  0011
5.00        7 .  57778
5.00        8 .  23334

Stem width:    100.00
Each leaf:        1 case(s)
```



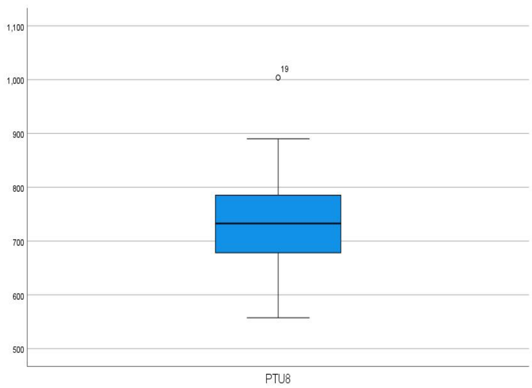
PTU8

```
PTU8 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

1.00        5 .  5
3.00        6 .  133
9.00        6 .  556777789
12.00        7 .  002222333344
6.00        7 .  567788
7.00        8 .  0012344
1.00        8 .  9
1.00 Extremes    (>=1004)

Stem width:    100.00
Each leaf:        1 case(s)
```



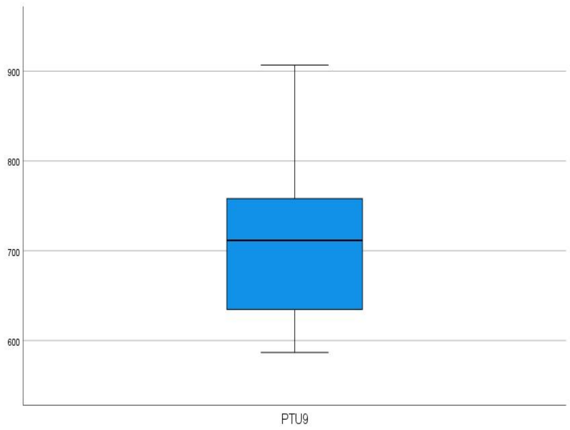
PTU9

```
PTU9 Stem-and-Leaf Plot

Frequency     Stem &  Leaf

2.00         5 .  88
10.00         6 .  0011123334
6.00         6 .  556689
10.00         7 .  0111333444
3.00         7 .  556
6.00         8 .  122344
2.00         8 .  57
1.00         9 .  0

Stem width:    100.00
Each leaf:        1 case(s)
```



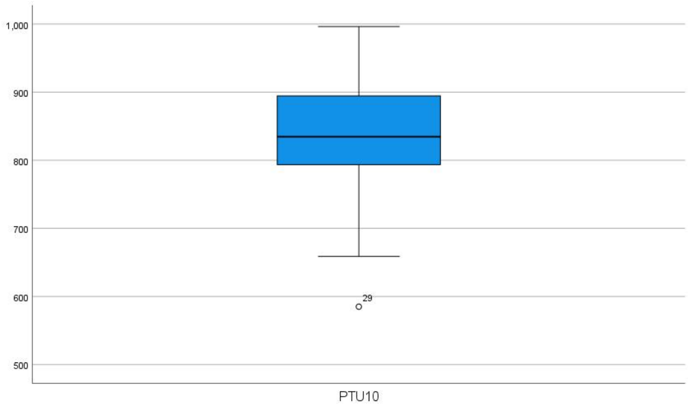
PTU10

```
PTU10 Stem-and-Leaf Plot

Frequency     Stem &  Leaf

1.00 Extremes     (=<585)
2.00         6 .  56
1.00         7 .  2
8.00         7 .  67788999
12.00                       8   .
001122333334
7.00         8 .  5567889
6.00         9 .  000034
3.00         9 .  689

Stem width:    100.00
Each leaf:        1 case(s)
```



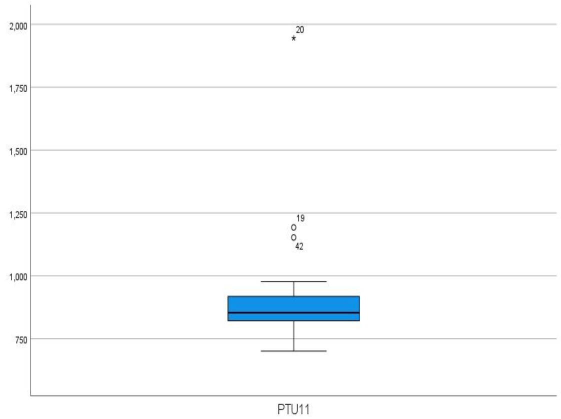
PTU11

```
PTU11 Stem-and-Leaf Plot

Frequency     Stem &  Leaf

2.00         7 .  00
5.00         7 .  78899
10.00         8 .  0112233444
9.00         8 .  555566788
8.00         9 .  00112234
3.00         9 .  577
3.00 Extremes     (>=1153)

Stem width:    100.00
Each leaf:        1 case(s)
```



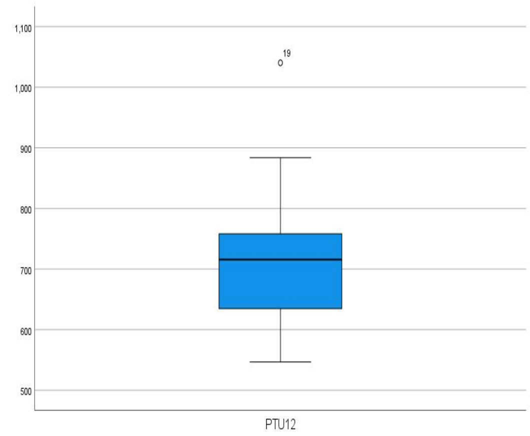
PTU12

```
PTU12 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

1.00        5 .  4
2.00        5 .  56
9.00        6 .  001223333
3.00        6 .  789
14.00        7 .  00001112333344
7.00        7 .  5667789
2.00        8 .  01
1.00        8 .  8
1.00 Extremes    (>=1040)

Stem width:    100.00
Each leaf:        1 case(s)
```



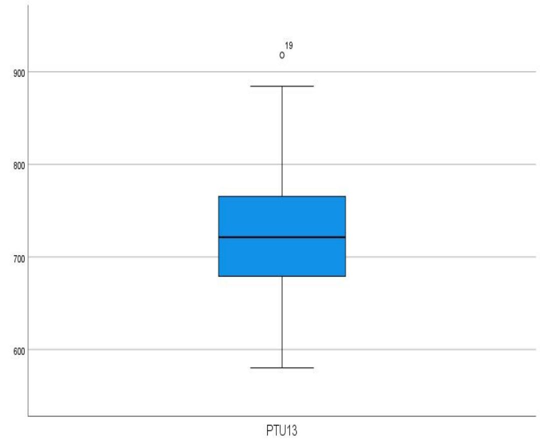
PTU13

```
PTU13 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

1.00        5 .  8
4.00        6 .  1144
9.00        6 .  556778899
15.00        7 .  001111222233344
5.00        7 .  57779
3.00        8 .  122
2.00        8 .  68
1.00 Extremes    (>=918)

Stem width:    100.00
Each leaf:        1 case(s)
```



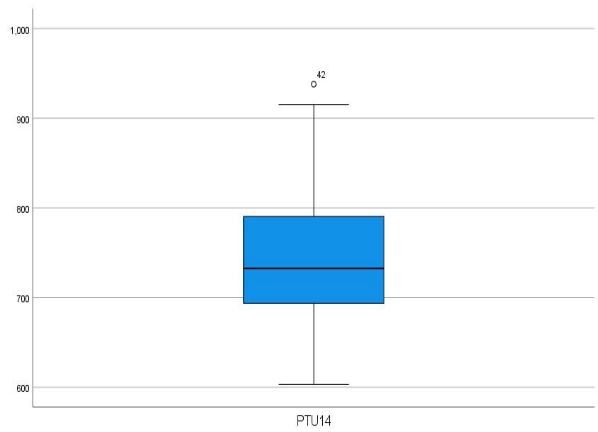
PTU14

```
PTU14 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

3.00        6 .  034
12.00        6 .  668899999999
10.00        7 .  0012333344
7.00        7 .  5678899
3.00        8 .  334
2.00        8 .  55
2.00        9 .  11
1.00 Extremes    (>=938)

Stem width:    100.00
Each leaf:        1 case(s)
```



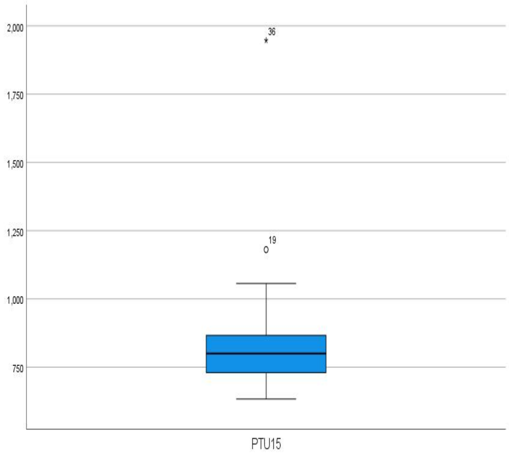
PTU15

```
PTU15 Stem-and-Leaf Plot

Frequency     Stem &  Leaf

1.00         6 .  3
7.00         6 .  5678999
5.00         7 .  22334
7.00         7 .  5567799
9.00         8 .  000012334
3.00         8 .  668
4.00         9 .  1122
1.00         9 .  5
.00         10 .
1.00        10 .  5
2.00 Extremes     (>=1181)

Stem width:    100.00
Each leaf:        1 case(s)
```



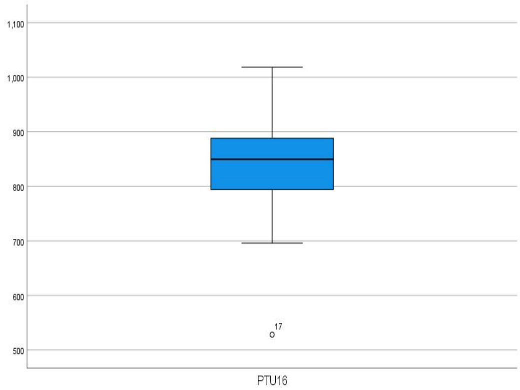
PTU16

```
PTU16 Stem-and-Leaf Plot

Frequency     Stem &  Leaf

1.00 Extremes     (=<528)
2.00         6 .  99
1.00         7 .  3
10.00         7 .  5788899999
6.00         8 .  001124
13.00         8 .  5566667788999
5.00         9 .  02334
1.00         9 .  5
1.00        10 .  1

Stem width:    100.00
Each leaf:        1 case(s)
```



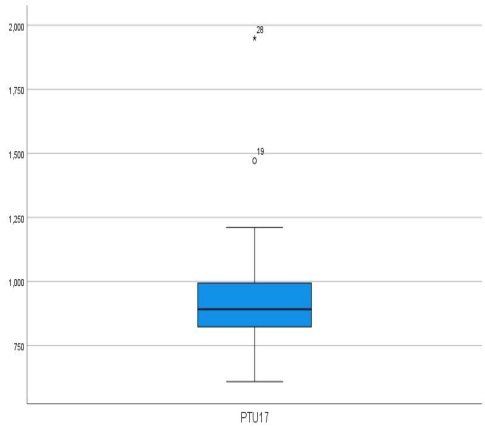
PTU17

```
PTU17 Stem-and-Leaf Plot

Frequency     Stem &  Leaf

2.00         6 .  03
6.00         7 .  024589
16.00         8 .  2222234456789999
6.00         9 .  001144
4.00        10 .  4668
2.00        11 .  04
2.00        12 .  01
2.00 Extremes     (>=1471)

Stem width:    100.00
Each leaf:        1 case(s)
```



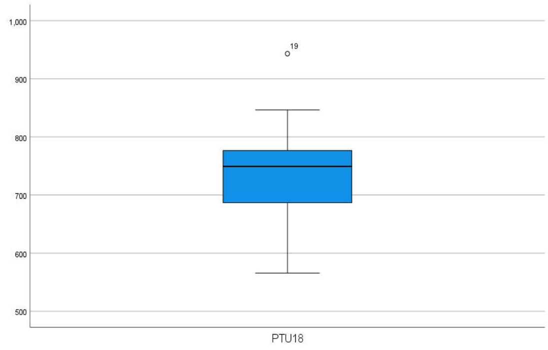
PTU18

```
PTU18 Stem-and-Leaf Plot

Frequency     Stem &   Leaf

2.00         5 .  69
2.00         6 .  24
11.00         6 .  55577888999
5.00         7 .  12344
17.00         7 .  55555667777778899
2.00         8 .  44
1.00 Extremes     (>=943)

Stem width:    100.00
Each leaf:        1 case(s)
```



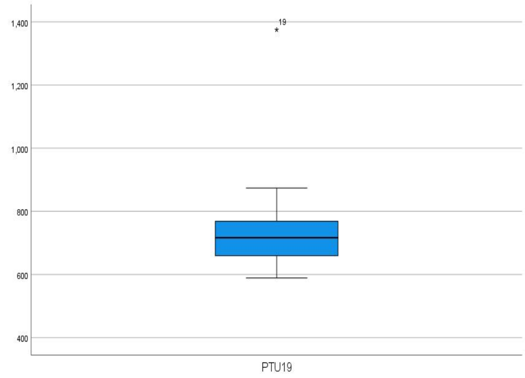
PTU19

```
PTU19 Stem-and-Leaf Plot

Frequency     Stem &   Leaf

2.00         5 .  89
6.00         6 .  001123
9.00         6 .  555677899
12.00         7 .  001222234444
6.00         7 .  677789
3.00         8 .  022
1.00         8 .  7
1.00 Extremes     (>=1375)

Stem width:    100.00
Each leaf:        1 case(s)
```



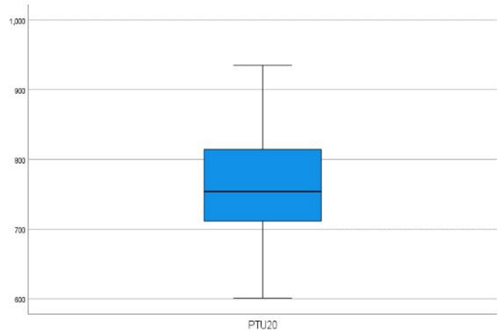
PTU20

```
PTU20 Stem-and-Leaf Plot

Frequency     Stem &   Leaf

5.00         6 .  01122
2.00         6 .  55
11.00         7 .  00111112334
10.00         7 .  5556667899
8.00         8 .  01133444
3.00         8 .  567
1.00         9 .  3

Stem width:    100.00
Each leaf:        1 case(s)
```



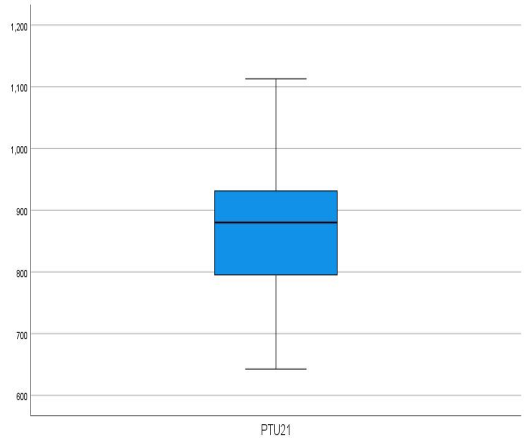
PTU21

```
PTU21 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

1.00        6 .  4
1.00        6 .  7
4.00        7 .  1224
5.00        7 .  57899
6.00        8 .  012334
7.00        8 .  5678899
9.00        9 .  001122344
4.00        9 .  6899
2.00       10 .  04
 .00       10 .
1.00       11 .  1

Stem width:    100.00
Each leaf:        1 case(s)
```



PTU22

```
PTU22 Stem-and-Leaf Plot

Frequency    Stem &  Leaf

5.00        7 .  67799
9.00        8 .  001233344
12.00        8 .  556667778889
8.00        9 .  00223334
3.00        9 .  669
1.00       10 .  0
2.00 Extremes    (>=1088)

Stem width:    100.00
Each leaf:        1 case(s)
```