PHONEMIC COMPARISON OF URDU AND ENGLISH

Hina Munir[*1], Saliha Ifftikhar[2]

[1&2]Lecturer English department Minhaj College For women

[*1]hashim.mul@gmail.com; [2]salihaiftikhar8@gmail.com
Corresponding Author:*

ABSTRACT
While English and Urdu are spoken globally, they hail from distinct language families. English belongs to the West Germanic group, while Urdu stems from the Indo-Aryan lineage. Both languages boast diverse dialects due to geographical spread. Notably, 379 million use English as their primary tongue and another 753 million employ it secondarily, across 104 nations, totaling roughly 1.13 billion speakers (Ethnologue, 2019). Ranked 11th most widely spoken globally, Urdu's significance is undeniable (Ghai & Singh, 2013). With 163 million speakers, it also forms the majority language in Pakistan's most populous province and serves as the nation's official language, sharing this status with 21 others. Despite its prevalence, phonological research on Urdu remains scarce. This study aims to bridge that gap by exploring phonemic differences between English and Urdu, utilizing the Levenshtein algorithm framework. Analyzing the languages' inventories (serving as our research data), the algorithm helps calculate the similarity and difference ratio. Findings reveal a 43.47% phonemic similarity between the two languages, with a 56.52% difference.
Keywords: Urdu, English, IPA, Levenshtein algorithm, Phonemic Differences.

INTRODUCTION
Language is a fascinating and intricate facet of human communication, serving as a dynamic bridge that connects individuals across diverse cultures and regions. Within the realm of linguistics, the study of phonology plays a pivotal role in unraveling the nuances of speech sounds and their organization in different languages. Urdu and English, two distinct languages with rich histories and global significance, exhibit unique phonological features that contribute to their distinct identities.

Urdu and English while both languages of significant global impact; differ markedly in their linguistic characteristics, historical roots, and cultural contexts. Urdu, a language deeply rooted in the Indian subcontinent, belongs to the Indo-Aryan branch of the Indo-European language family. Written in the Perso-Arabic script, Urdu incorporates a rich vocabulary with Persian and Arabic influences, especially evident in its literary and formal registers. The phonetic structure of Urdu is marked by retroflex sounds, nasalized vowels, and linguistic nuances distinct from English.

On the other hand, a large number of speakers around the world speak English (Algeo & Butcher, 2013). English, a West Germanic language (Dufour, 2017) within the Indo-European family, employs the Latin alphabet and has a diverse vocabulary shaped by its historical interactions (Dalton, 2011). The phonetic structure of English features a distinct set of vowel and consonant sounds, contributing to its recognizable oral patterns. English follows a subject-verb-object word order, contrasting with Urdu's subject-object-verb structure.

One essential aspect of phonology is the examination of consonants, the building blocks of spoken language. Their articulatory features and acoustic properties, shaping the auditory landscape of a language, characterize consonants. To comprehend the phonemic intricacies of Urdu and English consonants, a systematic analysis is imperative. This analysis not only unveils the distinctive sounds that form the basis of these languages but also sheds light on the subtle variations and contrasts that define their phonological landscapes.

The present research delve into the phonemic analysis of Urdu and English consonants, aiming to uncover the underlying patterns, similarities, and

differences that shape the sound systems of these languages (Myers-Scotton, 2005). Through this exploration, we hope to contribute valuable insights to the broader field of linguistics and foster a deeper appreciation for the diverse tapestry of human languages.

3-Rationale for the study

The rationale behind selecting the topic, "Phonemic Comparison of English and Urdu Consonants," lies in the pursuit of a comprehensive exploration of the phonological structures of these two significant languages. As vehicles of communication with distinct cultural and historical roots, English and Urdu offer a rich terrain for linguistic inquiry. This study aims to unravel the nuanced phonemic variations in their consonant systems, providing insights into the impact of historical, cultural, and geographical influences on language development. Moreover, the research has practical implications for language education, offering potential enhancements to teaching methodologies and curriculum design for learners navigating between English and Urdu. Furthermore, the exploration of consonantal differences holds potential applications in identifying and addressing speech-related challenges in bilingual individuals, making this research both academically enriching and practically relevant.

4-Significance

The research on the phonemic comparison of English and Urdu consonants holds paramount significance in multiple domains. Firstly, it enhances cross-cultural communication by providing insights into the distinct phonological structures of these languages, aiding language learners, educators, and communicators. The study informs language education practices, allowing for tailored instructional methods and curriculum design, thereby improving the learning experience for those transitioning between English and Urdu. In the broader field of linguistics, the research enriches phonological typology, advancing linguistic theory. Lastly, in a globalized context, where individuals frequently navigate between languages, the findings have practical applications, influencing the development of language resources and tools that cater to the specific linguistic needs of diverse populations. Overall, the research significantly influences language education, cross-cultural

understanding, and the broader landscape of linguistic research and applications.

2-Literature Review

According to Clark et al(2011), and Giegerich(1992) Phonology is "the study of speech sounds within a language". It elucidates its sound system and the formation of words through sound combinations. It also elucidates why certain sounds are crucial for distinguishing words). A phonetic inventory details the sounds present in a language, irrespective of their accurate articulation. It encompasses the sound system of human languages, focusing on the purposes of speech sounds. This term refers to the field of study and the subject of investigation. Phonology addresses the sound systems under investigation, akin to political systems. Phonetics and phonology have a debatable relationship. Each language possesses its phonology, encompassing its entire sound system, including consonants and vowels (Roach, 2009).

A phoneme, as the smallest meaningful unit sound altering one word into another, exemplifies how a single sound difference can distinguish words, such as in "PAT" and "BAT," where only /p/ and /b/ differ (Gimson, 1980). Lan Maddieson (1984) stated that the phonetic inventory encompasses all speech sounds, irrespective of their accuracy in a specific language, or it explicates the various phonemic sounds within a given language's consonantal and vocalic inventories.

According to Roach (2009), consonants are articulated by creating complete closure in the air passage in the mouth, categorized by manner and place of articulation. Sundara (2005) compared Canadian English (CE) and Canadian French (CF), finding differences in voice onset time (VOT) and place of articulation for coronal stops. Renata Gregova's study (2010) on English and Slovak consonant systems highlighted Slovak's rich consonant clusters. Javed (2013) conducted a comparative study of English and Arabic phonetics to aid learners' incorrect pronunciation. Ghani Rahman's study (2016) compared English and Pashto phonemic inventories, revealing similarities in articulation between the two. The current study aims to bridge the gap by comparing English and Urdu phonemic inventories.

According to Gooskens and Schneider (2016), word similarity assessment can be divided into two parts: the "orthographic" part, which focuses on character-

level comparison, and the "phonetic" part, which leverages the phonetic characteristics of individual sounds to calculate similarity indices. Language classification relies on specific structural features such as phonemic inventory, prosodic structures, and rhythmic patterns. Each lexical item is typically represented by a single symbol, with this representation used across various levels of abstraction. The most significant interpretation of a lexical item is its phonetic interpretation, known as transcription, which reveals the organization and realization of sound patterns of a word. Even words with similar transcriptions at a basic level may exhibit differences in phonetics if they belong to dissimilar dialects. Signs may hold different values in various transcriptions, and differences in phonetic representation within a language minimally reflect lexical-semantic contrasts. Phonetic transcription provides a comprehensive set of phonetic details for a lexical item, including phonological contrasts compared to other lexical items.

Schepens et al. (2013) explored the boundaries between diverse stages of abstraction in terms of phonemic and phonetic interchangeability. Phonetic transcriptions serve as fundamental data in databases, enabling comparison and identification of cognates and their forms. However, focusing too narrowly on specific fields may lead to overlooking many differences and similarities. While these fields may not always seem relevant initially, they are crucial for understanding cross-linguistic patterns (Hardcastle & Beck, 2005).

Ghani Rahman (2016) conducted a significant study comparing the consonants and vowel inventories of Pashto (a language spoken in the Khyber Pakhtunkhwa province of Pakistan), and English. The research revealed similarities in the place and manner of articulation between the two languages. However, there remains a gap in the literature regarding a phonemic comparison of English and Punjabi consonants. Therefore, this present study aims to elucidate the differences and similarities between Urdu and English to address this gap.

English relies on 21 consonant letters (: B, C, D, F, G, H, J, K, L, M, N, P, Q, R, S, T, V, W, X, Y, Z) to represent 24 distinct sounds (see Figure 1). These sounds are produced by either blocking airflow (closure) or creating friction, using the tongue against various mouthparts like lips, teeth, and the roof. Different categories group these sounds based on where and how they are made. Additionally, the vibration of vocal cords determines, whether a consonant is voiced or unvoiced (Roach, 2010). In short, English boasts a rich inventory of 24 consonant sounds represented by 21 letters, with distinct characteristics and groupings.

English consonants

	Bilabial	Labio-dental	Dental	Alveolar	Palatal	Velar	Glottal
Stop	p b			t d		k g	
Fricative		f v	θ ð	s z	ʃ ʒ		h
Affricate				tʃ ʤ			
Nasal	m		n			ŋ	
Lateral				l			
approximant	w				r j		

Figure 1: The consonant inventory of English

Both Hindi and Urdu are considered similar phonetically but are different alphabetically and historically. The pronunciation of Urdu diverges concerning the geographical changes in Pakistan.

Urdu boasts a rich soundscape, featuring a diverse array of sounds distinguishable by duration, quality, and nasalization (Rehman, 2006). However, the exact number of consonants in this language remains a subject of debate. Some scholars, like Hussain (1997) and Raza A. A. (2009), posit 36 consonants, while others, such as saleem et al. (2002), proposed

43 or 44, respectively. This discrepancy stems from the inclusion or exclusion of certain "traced consonants," including aspirated nasals, laterals, flaps, and trills (Oxford Urdu English Dictionary, 2013; cited in Saleem et al., 2002). Notably, Urdu possesses a unique Uvular stop /q/ sound and has adopted sounds like /x/, /ɣ/, /f/, and /z/, which are often substituted with /k^h /, /g/, /p^h /, and /dʒ/, respectively, particularly in the speech of educated Pakistanis (cited in Qandeel, 2012; Shackle, 003).

Urdu Consonants

	Bilabial	Labio-dental	Dental	Retro-flex	Alveolar	Palatal	Uvular	Velar	Glottal
Stop	p b pʰ bʰ		t̪ d̪ t̪ʰ d̪ʰ		ʈ ɖ ʈʰ ɖʰ		q	k g kʰ gʰ	ʔ
Fricative		f v	θ ð		s z	ʃ ʒ	x	ɣ	h
Affricate					tʃ dʒ tʃʰ dʒʰ				
Nasal	m mʰ		n nʰ					ŋ	
Lateral					l ɭ				
Trill							r rʰ		
Flap				ɽ ɽʰ					
approximant	w					j			

Figure 2: The consonant inventory of Urdu

The study has framed around the Levenshtein distance (LD), a method for measuring the difference between strings through insertions, deletions, and substitutions, ultimately determining a similarity index. Developed by Russian scientist Vladimir Levenshtein in 1965. This algorithm calculates the distance between strings, with greater LD indicating significant differences, as illustrated by the example of "kitten" and "sitting," which have a difference of three strings.

This study aims to use the Levenshtein algorithm to calculate the similarity and difference percentage among the consonant sounds of both languages. The research questions aim to determine the similarity index and difference index between the consonants of English and Urdu.

According to Maldonado &de Souza (2014), linguistic systems with more than 85% similar sounds are largely considered dialects of the same language. Due to their genetic differences, it is predicted that the percentage of similar sounds between both languages will be less than 85%.

5-Methodology

This study explores the phonetic similarities and differences between English and Urdu, specifically across various regions. It employs a mixed-methods approach, combining quantitative and qualitative techniques. Phonetic inventories of both languages serve as the data source, with the research focusing solely on consonant sounds. An expository approach is implemented to calculate the index of phonetic similarity and difference across regional variations.

6-Framework

This research utilizes the Levenshtein algorithm as a tool to comprehensively evaluate the ratio of both phonemic similarity and disparity between two linguistic systems. This evaluation is achieved by comparing their consonant inventories, transcribed using the International Phonetic Alphabet (IPA). Notably, the Levenshtein algorithm has seen prior application in various studies conducted by Chohan et al. (2020), Chohan & García (2019), Maldonado García & Borges de Souza (2014), Sanders & Chin (2009), and Heeringa (2004).
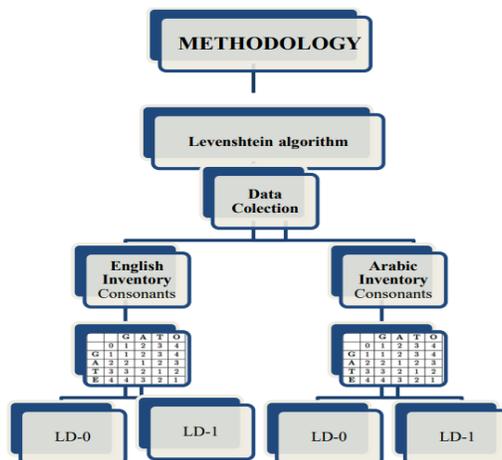
Figure 3: Flow chart of methodology

7-Research questions

Q1: What is the extent of the similarity index between the consonants of English and Urdu language when assessed using the Levenshtein algorithm?

Q2: What is the extent of the difference index between the consonants of English and Urdu language when assessed using the Levenshtein algorithm?

Plosives with Zero Distance (100% Similarity or zero distance)

English and Urdu are diverse languages that belong to two different language families. Despite sharing some similar sounds, the two languages likely have less overall structural similarity, resulting in limited mutual intelligibility. The table below lists the sounds that are identical in both languages

8-Phonemic Comparison of Consonants

Table: Plosives in English and Urdu with zero distance

S. No	Urdu	English	Levenshtein distance
1	/p/	/p/	0
2	/b/	/b/	0
3	/t/	/t/	0
4	/d/	/d/	0
5	/k/	/k/	0
6	/g/	/g/	0
Total			6

An analysis of plosive sounds using the Levenshtein Algorithm is presented in the above table. It reveals zero phonetic difference (distance 0) for six sounds, indicating six common plosives between English and Urdu.

Plosives with Distance 1. (100% different or 1 distance)
Levenshtein algorithm calculated that six plosive sounds in English and Urdu have 0 difference and maximum similarity between both languages, but some sounds have a phonetic difference as well. There are 17 plosive sounds with 01 distance, which are presented in the table below;
Table: Plosives in Urdu and English having distance 1

S.No	Urdu	English	Levenshtein distance
1	/pʰ/	-	1
2	/bʰ/	-	1
3	/ṭ/	-	1
4	/ṭʰ/	-	1
5	/ḍ/	-	1
6	/ḍʰ/	-	1
7	/tʰ/	-	1
8	/dʰ/	-	1
9	/kʰ/	-	1
10	/gʰ/	-	1
11	/ʔ/	-	1
12	/q/	-	1

The above table shows that 12 plosives are different in English and Urdu languages;   /pʰ/,/bʰ, /ṭ/, /ṭʰ/, /ḍ/ /ḍʰ/, /tʰ/, /dʰ/, /kʰ/,/gʰ/ /ʔ/,/q/. Therefore, these sounds do not have 100% similarity in them. According to the above table the following 15 plosive sounds /bʰ, /ṭ/, /ṭʰ/, /ḍ/ /ḍʰ/,   /tʰ/, /dʰ/, /kʰ/,/gʰ/, /ʔ/, /q/,/ □only exist in Urdu language.□ □

Fricatives with Zero Distance (Distance 0 or 100% Similarity)
There are 9 fricatives in both languages (center of Language Engineering & roach, 2009). Both languages share some common fricatives, which are presented in the table below;
Table: Fricatives in Urdu and English having zero distance

S.No	Urdu	English	Levenshtien distance
1	/f/	/f/	0
2	/v/	/v/	0
3	/s/	/s/	0
4	/z/	/z/	0
5	/ʃ/	/ʃ/	0
6	/ʒ/	/ʒ/	0
7	/h/	/h/	0
Total			7

In light of the above table, seven fricative sounds /f/, /v/, /s/, /z/, /ʃ/, /ʒ/, and /h/ are found similar in both languages. Therefore, these sounds have zero distance phonemically between them as per the Levenshtein Algorithm. This means both languages have seven common fricatives.

Fricatives with one distance: Sounds that are different in English and Urdu

As per Levenshtein's algorithm, some fricatives have phonetic differences as well. The sounds, which are different, are given in the following table;

Table: Fricatives in English and Urdu with 1 distance

S.No	Urdu	English	Levenshtien distance
1	/ɣ/		1
2	/x/		1
3		/θ/	1
4		/ð/	1
Total			4

The above table shows that both English and Urdu languages have 2 fricatives with 1 distance. The sounds /ɣ/☐☐☐☐/x/☐only exist in the Urdu Language, whereas, sounds /θ/☐and /ð/☐ only exist in the English Language.

Affricates with 0 distance (Distance 0 or 100% Similarity)

Total 4 affricate sounds exist in both Urdu and English languages and only two affricates are similar in both languages which are given in the following table;

Table: Affricates in English and Urdu with zero distance

S.No	Urdu	English	Levenshtein distance
1	/tʃ/	/tʃ/	0
2	/dʒ/	/dʒ/	0
Total			2

Levenshtein algorithm calculated that two affricates /tʃ/☐☐☐☐☐☐ dʒ/ ☐☐☐☐☐☐ in English and Urdu and have 0 difference and maximum similarity between both languages.

Affricates with one distance: Sounds That Are Different in Urdu and English

Along with 2 common affricate sound /tʃʰ/☐☐☐☐ /dʒʰ/ ☐☐☐☐☐☐ sounds /☐☐☐☐☐☐☐☐☐☐☐☐☐☐are different. Different sounds are given in the following table; **Table: Fricatives in English and Urdu with 1 distance**

S.No	Urdu	English	Levenshtein distance
1	/tʃʰ/		1
2	/dʒʰ/	☐	1
Total			2

The above table shows the sounds that are different and have 1 distance in them. These two affricate sounds ☐/tʃʰ/☐☐☐☐/dʒʰ/ ☐only exist in Urdu language and considered aspirated sounds. These sounds do not exist in English language.

Nasal sounds with 0 and 1 distance

In the Urdu language, five nasal sounds are present whereas in English only 3nasal sounds exist. These nasal sounds are given in the following table;

Table: Nasal sounds with 0 and 1 distance

S. No	Urdu	English	Levenshtein distance
1	/m/	/m/	0
2	/n/	/n/	0
3	/ŋ/	/ŋ/	0
4	/nʰ/		1
5	/mʰ/		1

Above table shows that 3 nasal sound /m//n//ŋ/ are present in both languages and have same manner and places of articulation. Therefore, these sounds have 0distance. This means they are 100% similar. The sounds /mh/ and /nh/only exist in Urdu language; therefore, they are different and have 1 distance as per Levenshtein algorithm.

Approximants with 0 distance (Distance 0 or 100% Similarity)

According to Roach, P (2009) 3 approximants exist in English i-e/j/ ☐☐/w/ ☐☐☐/r/☐☐☐☐☐☐☐in Urdu language approximants ☐☐/j/and /w/ are reported by CLE. However, some similarities and differences have been calculated by using the Levenshtein Algorithm. Common approximants are given in the following table

Table: Approximants in English and Urdu with zero distance

S.No	Urdu	English	Levenshtein distance
1	/j/	/j/	0
	☐☐☐	☐☐☐	0
Total			2

The above table shows that there are approximant that have 0 distance. This means that both languages share 2 common approximant.

Approximants with 1 distance: Sounds That Are Different in Urdu &English

There is one different approximant sound in English and Urdu. This sound is different in the terms of its manner of articulation. These sounds are presented in the table below;

Table: approximant in English and Urdu with 1 distance

S. No	Urdu	English	Levenshtein distance
1		/r/	1

The approximant presented in the above table has 1 difference. Sounds /w/ and /r/ are treated as approximants in English but in /r/ is treated as trill. Therefore, these sounds are different in terms of their manner of articulation and have 1 distance.

Lateral sounds with 0 and 1 distance

There are 2 lateral sounds are present in Urdu and 1 sound in English. These sounds are presented in the table below;

Table: Lateral sounds with 0 and 1 distance

S. No	Urdu	English	Levenshtein distance
1	/l/	/l/	0
2	/lh/		1

Above table shows that the sound /l/ is present in both languages and treated as lateral. This sound has 0 distance. /lh/ sound exists only in Urdu language and has 1 distance.

Trills and Flaps with 0 distance (Distance 0 or 100% Similarity)

 Urdu language has 2 trills and 2 flaps. These sounds do not exist in English language. This mean there is no common trill and flap sounds in English and Urdu. So, no trill and flap sound has 0 distance.

Trills and Flaps with 1 distance: Sounds That Are Different in Urdu &English

Trills and Flaps are sounds that only exist in the Urdu language. Trills /r/ and /rʰ/□□□□□□□□□□□/ɽ/ and /ɽʰ/□do not exist in the English language. These sounds are given in the following table;

Table: Trills and Flap in English and Urdu with 1 distance

S. No	Urdu	English	Levenshtein distance
Trills			
1	/r/		1
2	/rʰ/		1
Flap			
1	/ɽ/		1
2	/ɽʰ/		1
Total			4

As per Levenshtein algorithm there is four sound including 2 trills and 2 flaps have 1 distance. This means that both languages have no common Trill and Flap sounds. The sound /r/ exists in English where it is not treated as trill rather it is treated as approximant. Therefore, this sound does not have 100% similarity.

Similarity index between Urdu and English

Total similar consonant sounds   20

Total consonantal phonemic similarity   43.47%

Differences index between Urdu and English

Total different consonant sounds   26

Total consonantal phonemic difference 56.52%

Despite sharing 20 similar consonant sounds (43.47% of their total), English and Urdu diverge significantly in pronunciation. The remaining 26 consonant sounds (56.52%) are entirely absent in the other language, highlighting their phonemic dissimilarity. This analysis, expressed as a similarity index of 43.47% and a difference index of 56.52%, reinforces the conclusion that English and Urdu are distinct languages with limited phonemic overlap.
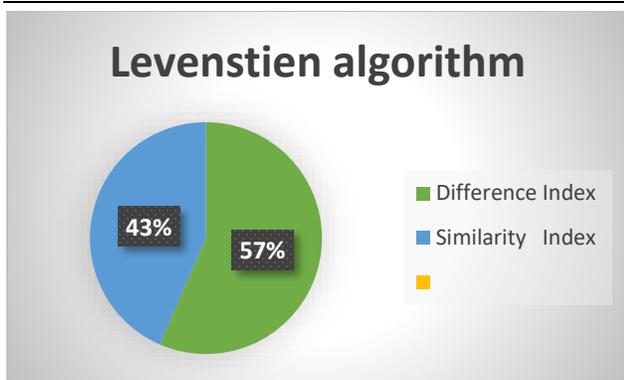
Figure 4. Index of difference between the consonants of English and Urdu

The above pie chart indicates the similarity and difference index between English and Urdu

Discussion

To find similarities and differences in English and Urdu language the analysis was done after obtaining the data from the inventories of both languages. English and Urdu share a notable chunk of their consonant sounds: /p/, /b/, /t/, /d/, /k/, /g/, /f/, /v/, /s/, /z/, /ʃ/, /ʒ/, /tʃ/, /dʒ/, /h/, and /j/. Notably, most of these consonants are pronounced similarly in both languages, sharing the same "manner" and "place of articulation." This means sounds like /p/ and /b/ are both plosives in both English and Urdu, and sounds like /f/ and /v/ are both fricatives. This overlap can be a helpful starting point for Urdu speakers learning English pronunciation. The sounds /m/,/n/,/ŋ/are found in English and Urdu as nasal. In Urdu, two/mh/ and /nh/ exist but these are not present in the English language. /l/□ sound is found lateral in both languages; however, Urdu has the sound /lʰ/, which does not exist in the English language. /j/ is

found to be an approximant in both languages. The /tʃ/, and/dʒ/□sounds are found affricates in both languages. /r/ sound exists in both languages but in English /r/ is treated as an approximant whereas in Urdu it is treated as trill. Sharing 16 consonant sounds, English and Urdu offer learners a head start in pronunciation. These common sounds are represented by the same symbols in both languages. However, Urdu has 17 additional consonant sounds absent in English, including: /pʰ/, /bʰ/, /ʈ/, /ʈʰ/, /ɖ/, /ɖʰ/, /tʰ/, /dʰ/, /kʰ/, /gʰ/, /tʃʰ/, /dʒʰ/, /ʔ/, /ɣ/, /q/, /mh/, /nʰ/, /lh/.While /Z/ exists in both languages, Urdu's /ɖ/ is a plosive sound compared to English's fricative /ð/, though represented by the same symbol. This means all 26 consonant sounds differ between the languages, with a distance of 1 calculated using the Levenshtein algorithm. The table distinguishes sounds with distances of 0 and 1.

Conclusion

While English and Urdu share 20 consonant sounds (roughly 43%), pronounced similarly, their overall phonemic similarity is quite low. This analysis, using the Levenshtein algorithm, reveals a similarity index of 43.47% and a difference index of 56.52%. This confirms that the two languages are distinct, with significant disparities in 26 consonants (out of 44 in Urdu and 24 in English). Although shared sounds offer a learning advantage for Urdu speakers acquiring English, the overall dissimilarity

emphasizes the independent nature of these languages. This finding aligns with the commonly accepted threshold of 85% similarity suggesting dialects, as proposed by Maldonado García & Borges de Souza (2014). Therefore, while shared elements exist, this research highlights the substantial differences between English and Urdu, offering valuable insights for language learning initiatives.

References

Algeo, J., & Butcher, C. A. (2013). *The origins and development of the English language*. Cengage Learnin.

Chohan, N. & Talib, N. (2020). Phonemic comparison of English and Arabic. Hamdard Islamicus · May 2020

Chohan, N & García, M. (2019). Phonemic comparison of English and Punjabi. Journal of English Linguistics · August 2019

Clark, J., & Yallop, C. (2011). An introduction to phonetics and phonology. Massachusetts: Blackwell Publishing.

Dalton-Puffer, C. (2011). Content and language integrated learning: From practice to principles? Annual Review of Applied Linguistics, 31, 182–204. https://doi.org/10.1017/S0267190511000092

Dufour, F. (2017). Exploring the possibilities for the emergence of a single and global native language.*Philosophy of Language E-Journal*, *10*(29). https://doi.org/10.2139/ssrn.3068406

Ethnologue. (2016). Retrieved from https://www.ethnologue.com/language/pnb

Ethnologue. (2019). Retrieved from https://www.ethnologue.com/language/pnb

Gregova, R. (2010). A Comparative Analysis of Consonant Clusters in English and in Slovak. Bulletin of the Transilvania University of Brasov, 3(52)

Ghai, W., & Singh, N. (2013). Phone Based Acoustic Modeling for Automatic Speech Recognition for the Punjabi Language. Journal of Speech Sciences, 3, 69–83.

Giegerich, H. J. (1992). English phonology: An introduction. Cambridge University Press. https://doi.org/10.1017/CBO9781139166126

National University of Computer and Emerging Sciences, Lahore, Pakistan.

Schepens, J., Dijkstra, T., Grootjen, F., & Heuven, W. J. B. (2013). Cross-language distributions of high frequency and phonetically similar cognates. PloS One, 8(5).

Gooskens, C., & Schneider, C. (2016). Testing mutual intelligibility between closely related languages in an oral society. Language Documentation & Conservation, 10, 278–305.

Hardcastle, W. J., & Beck, J. M. (2005). A Figure of Speech. New Jersy: Lawrence Erlbaum.

Heeringa, W. J. (2004). Measuring dialect pronunciation differences using Levenshtein distance. Citeseer. https://doi.org/10.1080/09296170802514138 Hogg, R. M., Burchfield, R. W., Blake, N. F., Romai

Hussain (1997). *"Phonetic Correlates of lexical stress in Urdu"*. Northwestern University, IL, USA.

Javed, F. (2013). Arabic and English phonetics: A comparative study. The Criterion: An International Journal in English, 4(4).

Maldonado García, M. I., & Borges De Souza, A. (2014). Lexical similarity level between English and Portuguese. Grassroots, 49(1), 203–218.

Myers-Scotton, C. (2005). Multiple Voices: An Introduction to Bilingualism. Oxford: Wiley-Blackwell.

Rahman, G. (2016). A Comparative Study of Pashto and English Consonants. Pashto, 45, 11–27

Roach, P. (2010). English phonetics and phonology: A practical course (4th ed.). Ernst KlettSprachen

Sanders, N. C., & Chin, S. B. (2009). Phonological Distance Measures*. Journal of Quantitative Linguistics, 16(1), 96–114.

Saleemet. al (2002). Urdu consonantal and vocalic sounds. *Center for Research in Urdu Language Processing(CRULP)*,

https://doi.org/10.1371/journal.pone.0063006

Sundara, M. (2005). Acoustic-phonetics of coronal stops: A cross-language study of Canadian English and Canadian French. The Journal of the Acoustical Society of America, 118(2), 1026–1037. https://doi.org/10.1121/1.1953270