

**PRODUCTION OF THE VOICELESS PHARYNGEAL /h/ AND VELAR /x/
FRICATIVES BY PASHTO-SPEAKING UNDERGRADUATES IN MARDAN: AN
EXPLORATORY STUDY**

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Abstract

This exploratory study examines the production of the voiceless pharyngeal fricative /h/ and the voiceless velar fricative /x/ by Pashto-speaking undergraduate students in Mardan, Pakistan. The contrast is linguistically important because /x/ is an established consonant in Pashto, whereas /h/ occurs primarily in Arabic-origin vocabulary and is more strongly associated with formal, religious, and careful pronunciation. The study involved 25 male undergraduates drawn from five institutions. Participants read selected words containing the target sounds in initial, medial, and final positions; their productions were audio-recorded and evaluated through structured observation. The surviving study documentation indicates recurrent difficulty maintaining the place-of-articulation contrast, including reciprocal substitution between the two sounds. Because the original tables contained inconsistent denominators of 25, 50, and 20, unverified percentages are not reproduced in this revised report. The findings are interpreted in relation to the marginal phonemic status of /h/, dialectal practice, limited explicit phonetic instruction, and uneven exposure to stable pronunciation models. The study recommends integrated perception-production training, articulatory explanation, visual and acoustic modelling, and repeated contextualised practice. The findings should be treated as preliminary until the original item-level data are independently verified.

Keywords: Pashto phonology; Yousafzai dialect; pharyngeal fricative; velar fricative; loan phoneme; pronunciation instruction

1. Introduction

Pronunciation research often focuses on contrasts that are absent from a learner's first-language inventory. A different but equally important problem arises when two sounds are represented in the orthography and are available in formal speech, yet differ in their degree of integration into everyday phonological practice. The Pashto contrast examined in this study illustrates that problem. The voiceless velar fricative /x/ is well established in Pashto, whereas the voiceless pharyngeal fricative /h/ is largely associated with Arabic-origin lexical items and careful pronunciation. The two sounds share voiceless frication and a posterior place of articulation, but they require distinct constrictions: /x/ is produced with the tongue dorsum approaching the velum, while /h/ is produced through constriction in the pharyngeal region (Ladefoged & Maddieson, 1996).

In Pashto-speaking communities, especially those using northeastern or Yousafzai varieties, Arabic-origin forms may be adapted to familiar Pashto categories in ordinary speech. Such adaptation can reduce the contrast between an established native or fully integrated sound and a marginal loan sound. Tegey and Robson (1996) describe Pashto as a language with substantial lexical borrowing from Arabic, Persian, Urdu, and other languages, and distinguish core phonological patterns from sounds concentrated in borrowed vocabulary. Comparative descriptions likewise identify /x/ as part of the Pashto consonantal system and /h/ as a restricted or borrowed segment (Iqbal & Rahman, 2016).

The original study underlying this article attempted to investigate undergraduate learners' pronunciation of /h/ and /x/ in Mardan. However, its initial formulation moved between three separate questions: replacement of /h/ by /x/, replacement of /x/ by /h/, and the

pronunciation of English /h/ and /k/. These phenomena are not equivalent. Neither /h/ nor /x/ is an English phoneme, and the relevant contrast is principally one of pharyngeal versus velar articulation within Pashto and Arabic-origin vocabulary. The present revision therefore narrows the investigation to the production and differentiation of /h/ and /x/ by Pashto-speaking undergraduates.

The study addresses two questions: (1) Do Pashto-speaking undergraduate students in Mardan maintain a consistent production contrast between /h/ and /x/ in elicited word reading? (2) What substitution patterns are documented when the contrast is not maintained? Because the available record does not contain reliable participant-by-item scores, the article treats the findings as exploratory and descriptive rather than as a definitive statistical account.

2. Literature Review

2.1 Pashto phonology and dialectal variation

Pashto is an Eastern Iranian language with substantial regional variation in consonant realisation. Descriptions of the language emphasise differences across southwestern, central, southeastern, and northeastern varieties, including variation in dorsal and retroflex consonants (Tegey & Robson, 1996). Mardan lies within the broader Yousafzai-speaking region, where speakers are typically exposed to Pashto alongside Urdu, English, and Arabic through education, media, and religious practice. This multilingual ecology affects both lexical borrowing and the social distribution of pronunciation variants.

The consonant /x/ is a voiceless velar fricative. It is formed by narrowing the oral passage between the back of the tongue and the soft palate, creating turbulent airflow. By contrast, /h/ is conventionally classified as a voiceless pharyngeal fricative, produced by constriction farther back in the vocal tract. Although both are voiceless posterior fricatives, they differ substantially in place of articulation and in the articulatory gestures required for accurate production. This partial similarity can facilitate category assimilation when one of the sounds has limited functional load or restricted use.

Table 1

Phonetic and phonological profile of the target consonants

Sound	IPA description	Primary constriction	Status in Pashto	Likely source of difficulty
/h/	Voiceless pharyngeal fricative	Pharyngeal region / tongue root	Marginal; concentrated in Arabic-origin and formal vocabulary	Limited everyday frequency; articulatory unfamiliarity; possible adaptation to a familiar posterior fricative
/x/	Voiceless velar fricative	Tongue dorsum and velum	Established Pashto consonant	Possible overextension into words conventionally requiring /h/

Note. The classification follows standard articulatory descriptions and Pashto reference works; the sociophonetic status of /h/ may vary by speaker, lexical item, and speech context.

2.2 Loan phonemes and formal pronunciation

Borrowed consonants may occupy an intermediate position between orthographic recognition and stable phonological production. Speakers can know that two letters or careful-speech forms are distinct without maintaining the distinction consistently in spontaneous speech. In Pashto, Arabic-origin consonants may be preserved in formal reading, religious recitation, or highly monitored speech while being adapted in casual usage. Nasir (2022) reports that Yousafzai Pashto speakers' realisation of Arabic-origin fricatives varies with

education, formality, and prior exposure, illustrating the broader tension between source-language pronunciation and local phonological integration.

This distinction is important for interpreting pronunciation accuracy. Substitution does not necessarily indicate a general inability to articulate a sound. It may instead reflect lexical frequency, context-sensitive style shifting, uncertainty about which items conventionally preserve the borrowed segment, or insufficient practice connecting orthography, perception, and articulation. A study of /h/ and /x/ must therefore separate phonetic production from spelling knowledge and from prescriptive judgments about Arabic pronunciation.

2.3 Cross-linguistic influence and speech-category learning

Contrastive analysis predicts that learners will rely on familiar categories when producing unfamiliar or marginal sounds (Lado, 1957; Odlin, 1989). Contemporary speech-learning accounts refine this prediction by emphasising perceived phonetic similarity. Under the revised Speech Learning Model, a new category is difficult to establish when a learner perceives a nonnative or marginal sound as sufficiently similar to an existing category (Flege & Bohn, 2021). The Perceptual Assimilation Model similarly predicts that discrimination is reduced when two sounds are assimilated to a single familiar category or to closely related variants of that category (Best & Tyler, 2007).

Applied to the present contrast, /h/ may be mapped onto /x/, /h/, or a breathy glottal realisation depending on the speaker's dialectal experience and exposure. Conversely, hypercorrection may produce /h/ in items requiring /x/ when speakers know that a formal distinction exists but have not acquired stable lexical and articulatory control. These models support instruction that combines auditory discrimination with guided production rather than relying on spelling or verbal explanation alone.

2.4 Research gap

Previous research on Pashto pronunciation has largely compared the Pashto and English consonant inventories or examined English consonants that are difficult for Pashto speakers (Iqbal & Rahman, 2016; Rehman et al., 2012). Less attention has been given to contrasts involving Arabic-origin consonants within Pashto-speaking educational contexts. The present study contributes a small, locally grounded account of how undergraduates in Mardan manage the /h/-/x/ distinction in an elicited reading task.

3. Methodology

3.1 Research design

The study used a quantitative-descriptive design supported by auditory observation. Its original intention was to calculate the proportion of accurate and substituted productions for the two target consonants. Because the surviving tables contain incompatible sample totals, the present reconstruction retains the design description but reports the results qualitatively.

3.2 Participants and setting

The sample comprised 25 male, Pashto-speaking undergraduate students from five educational institutions in Mardan. Five students were selected from each institution. The source document describes the selection as random, but it does not specify the sampling frame or randomisation procedure. The sample should therefore be interpreted as a small stratified institutional sample rather than as representative of all undergraduate students in Mardan. Participant ages, fields of study, dialect histories, proficiency profiles, and prior phonetics training were not reported.

3.3 Materials and procedure

Participants were asked to pronounce a researcher-prepared set of words containing /h/ and /x/ in initial, medial, and final positions. Their productions were audio-recorded and



observed by the researchers. The original correction record does not preserve the complete stimulus list, the number of tokens per position, the recording specifications, or the number and qualifications of raters. These omissions limit replicability and should be corrected in any future administration of the study.

3.4 Coding and analysis

Productions were intended to be coded as accurate or inaccurate and summarised through frequencies and percentages. A more rigorous coding scheme would distinguish at least four outcomes: target-like /h/, target-like /x/, substitution of one target by the other, and production of another segment such as [h] or [fi]. Independent coding by two trained raters and reporting of inter-rater agreement would improve reliability. In the current report, only substitution patterns explicitly documented in the available notes are retained.

Table 2

Documented study design

Component	Documented information
Design	Quantitative descriptive pronunciation study with auditory observation
Participants	25 male Pashto-speaking undergraduate students
Sites	Five institutions in Mardan; five participants per institution
Task	Reading selected words containing /h/ and /x/ in initial, medial, and final positions
Data collection	Audio recording and researcher observation
Planned analysis	Frequencies and percentages
Integrity constraint	Original tables used conflicting totals of 25, 50, and 20; percentages cannot be verified from the supplied document

4. Results

4.1 Maintenance of the /h/–/x/ contrast

The available study notes indicate that a substantial number of participants did not maintain a stable distinction between /h/ and /x/ throughout the elicitation task. The principal documented outcome was category confusion: participants sometimes replaced the pharyngeal consonant with the velar consonant and, in other cases, produced the pharyngeal consonant where the velar consonant was expected. This pattern shows that the difficulty was not limited to a single articulatory failure; it also involved uncertainty about the lexical distribution of the two sounds.

The source record does not support a reliable comparison of initial, medial, and final positions, nor does it establish which direction of substitution was more frequent. The original methodology identifies 25 participants, whereas one table totals 50 responses and another totals 20. Recalculating or proportionally adjusting those values would create unsupported data. Accordingly, no numerical percentages are presented here.

4.2 Descriptive error patterns

Table 3

Descriptive patterns retained from the study record

Documented pattern	Phonological interpretation	Evidential status
/h/ realised as /x/	Assimilation of a marginal pharyngeal sound to an established Pashto velar category	Explicitly identified in the correction record; frequency unavailable
/x/ realised as /h/	Possible hypercorrection or unstable lexical assignment of the formal contrast	Explicitly identified in the correction record; frequency unavailable
General difficulty distinguishing the sounds	Incomplete control of place of articulation and/or lexical distribution	Central conclusion of the source document

5. Discussion

The findings suggest that the /h/–/x/ contrast is unstable for at least some Pashto-speaking undergraduates in formal word reading. The most plausible phonological explanation is unequal category strength. The velar fricative /x/ is an established and frequent Pashto sound, whereas /h/ is restricted largely to Arabic-origin vocabulary and careful registers. When speakers encounter a low-frequency pharyngeal target, they may assimilate it to the nearest robust posterior fricative in their everyday system. This interpretation is consistent with both contrastive accounts of cross-linguistic influence and modern category-learning models (Best & Tyler, 2007; Flege & Bohn, 2021).

The reverse substitution, /x/ to /h/, requires a different explanation. It may reflect hypercorrection: once learners become aware that a word may contain a more formal or Arabic-associated sound, they may overapply that category. It may also indicate that instruction has emphasised letter names or prescriptive distinctions without providing sufficient perception practice and lexical reinforcement. The coexistence of both substitution directions therefore points to instability in both articulation and lexical categorisation.

Dialect and register are also relevant. A speaker may use one realisation in casual Pashto, another during Quranic recitation, and a third when reading a formal text. Without detailed language-background interviews and separate tasks for spontaneous speech, word reading, and religious recitation, it is impossible to determine whether an observed substitution represents lack of ability, normal dialectal adaptation, or context-sensitive style choice. Future research should treat these as separate possibilities rather than labelling every locally conventional realisation as an error.

The study's educational significance lies in showing that pronunciation instruction should not be reduced to repeated imitation. Learners need to perceive the contrast, understand the articulatory difference, and connect each sound to the correct lexical items. Celce-Murcia et al. (2010) and Derwing and Munro (2015) emphasise that effective pronunciation teaching integrates perception, production, communicative use, and feedback. That approach is particularly appropriate for a contrast whose use varies by formality and lexical origin.

6. Pedagogical Implications

A short instructional sequence can address the contrast systematically. First, teachers should demonstrate the difference in place of articulation using a side-view vocal-tract diagram and simple kinaesthetic cues: dorsal constriction near the velum for /x/ and a deeper pharyngeal constriction for /h/. Second, learners should complete identification and discrimination

activities before intensive production practice. Third, practice should move from isolated consonants to syllables, words, short phrases, and meaningful reading. Fourth, audio and video models should include locally respected Pashto speakers and, where relevant, careful Arabic models, while explicitly explaining that everyday Pashto and formal Arabic-influenced pronunciation may differ.

Feedback should be specific rather than evaluative. Instead of simply marking a production wrong, instructors can identify whether the constriction is too far forward, too weak, or assigned to the wrong lexical item. Recording learners before and after instruction can promote self-monitoring. Minimal or near-minimal word sets, waveform or spectrogram displays, and peer comparison may be useful, provided that the instructional goal is intelligible and context-appropriate pronunciation rather than imitation of an unattainable external norm.

7. Limitations and Directions for Future Research

The study has substantial limitations. The sample was small, all participants were male, and important demographic and linguistic variables were not reported. The elicitation list, number of tokens, recording conditions, rater training, coding criteria, and ethics procedures are absent from the surviving record. Most importantly, the original tables use inconsistent denominators, preventing trustworthy statistical reporting. These limitations mean that the study cannot estimate prevalence or support causal claims about mother-tongue interference, lack of training, or exposure.

A stronger replication should recruit a gender-balanced sample across institutions and record age, home dialect, multilingual background, Quranic or Arabic education, prior phonetics coursework, and frequency of formal Pashto use. The word list should be published in an appendix and balanced for word position, vowel context, lexical frequency, and source language. At least two trained raters should code each token, with inter-rater reliability reported. Acoustic measures capable of differentiating velar from pharyngeal constriction should supplement auditory judgments. A pre-test/post-test design could then evaluate whether targeted instruction improves both perception and production.

8. Conclusion

This exploratory study identifies instability in the production of /h/ and /x/ among a small group of Pashto-speaking male undergraduates in Mardan. The contrast is best understood not as an English-pronunciation problem but as a distinction between an established Pashto velar fricative and a marginal Arabic-origin pharyngeal fricative used most consistently in formal contexts. The documented reciprocal substitutions suggest both articulatory assimilation and uncertainty about lexical distribution. Focused perception-production training, explicit articulatory instruction, and contextualised practice may strengthen the distinction. Nevertheless, the original numerical findings must be reconstructed from verified participant-level data before the study can support statistical claims.

Declarations

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Data availability: Participant-level data and the complete elicitation list were not supplied with the correction document. Any submission should include a transparent data-availability statement consistent with the target journal's policy.



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