

The Influence of Phonotactic Constraints on ESL Speakers'

Perception

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Abstract

The present study explores the effect of phonotactic constraints on ESL speakers' perception of English syllabic structure, specifically targeting Iraqi Arabic and Kurdish ESL learners. As language-specific constraints dictating possible sound combinations, phonotactic rules do not only have a great impact on production processes but also on those related to perception. However, although there is much literature on segmental errors in the field of second language acquisition, the perceptual aspect of phonotactic constraints has been understudied, especially regarding Iraqi Arabic and Kurdish ESL learners. The current research attempts to shed light on the following issues: L1 phonotactic constraints effect on the perception of Iraqi Arabic and Kurdish ESL learners, and the potential effect of various social and linguistic factors such as proficiency level, age of arrival, gender, and English exposure on their perceptual skills. In other words, the goal of the study is to determine whether phonotactic transfer affects perception rather than production processes. In terms of methodology, the study uses a quantitative experimental research approach which follows the framework of the Perceptual Assimilation Model (Best, 1994). A perception test was conducted with thirty-five individuals divided into three different groups: English natives as a control group, Iraqi Arabic ESL students, Iraqi Kurdish ESL students. The perception test included two tasks: identification and discrimination. Words used as stimuli ranged from simple monosyllabic to disyllabic English words of varying phonotactic rules. Keywords: (Perception, Syntactic Phonetic Constraints, Level of Linguistic Competence).

أثر القيود الفونوتاكتية على الإدراك السمعي لمتعلمي الإنجليزية كلغة ثانية

الباحثة. بيمان خليل إسماعيل

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الملخص

تستكشف هذه الدراسة أثر القيود الفونوتاكتية على الإدراك السمعي لمتعلمي الإنجليزية كلغة ثانية للبنية المقطعية في اللغة الإنجليزية، مع التركيز على المتعلمين من الناطقين بالعربية العراقية والكردية. وبوصفها قيوداً لغوية خاصة بكل لغة تحدد التركيبات الصوتية الممكنة، فإن القواعد الفونوتاكتية لا تؤثر فقط في عمليات الإنتاج، بل تمتد أيضاً لتشمل عمليات الإدراك. ومع ذلك، وعلى الرغم من وفرة الدراسات حول الأخطاء المقطعية في مجال اكتساب اللغة الثانية، فإن الجانب الإدراكي للقيود الفونوتاكتية ما يزال غير مدروس بشكل كافٍ، لا سيما فيما يتعلق بمتعلمي الإنجليزية من الناطقين بالعربية العراقية الكردية. تسعى هذه الدراسة إلى تسليط الضوء على القضايا الآتية: أثر قيود اللغة الأم (L1) الفونوتاكتية على إدراك متعلمي الإنجليزية من العرب والكرد، وكذلك تأثير بعض العوامل الاجتماعية واللغوية مثل مستوى الكفاءة اللغوية، وعمر الوصول (AoA)، والجنس، ومدى التعرض للغة الإنجليزية على مهاراتهم الإدراكية. وبعبارة أخرى، تهدف الدراسة إلى تحديد ما إذا كان الانتقال الفونوتاكتي من اللغة الأم يؤثر في الإدراك وليس فقط في عمليات الإنتاج. من الناحية المنهجية، تعتمد الدراسة على منهج تجريبي كمي يستند إلى إطار نموذج الاستيعاب الإدراكي (Best, 1994) (PAM) وقد أجري اختبار إدراكي على خمسة وثلاثين مشاركاً موزعين إلى ثلاث مجموعات: متحدثون أصليون للغة الإنجليزية (كمجموعة ضابطة)، وطلبة عراقيون من الناطقين بالعربية، وطلبة عراقيون من الناطقين بالكردية. تضمن الاختبار مهمتين إدراكيتين هما: التمييز (discrimination) والتعرف (identification) وتراوحت الكلمات المستخدمة كمثيرات بين كلمات إنجليزية بسيطة أحادية المقطع وثنائية المقطع ذات أنماط فونوتاكتية مختلفة. الكلمات المفتاحية: (الإدراك، القيود الصوتية التركيبية، مستوى الكفاءة اللغوية).

Introduction

The research targets the perceptual side of phonotactics, and more precisely, the influence of L1 constraints on ESL learners' perception of English syllable structure as well as it examines the effect of L1 phonotactic constraints on the perception of English consonant clusters among ESL learners, investigate the effects of educational level on the perception of English phonotactic patterns. The production patterns are not dealt with; however, this research is closely related to perception. Stimuli are monosyllabic and bisyllabic English words containing consonant clusters that vary in phonotactic legality. Examples are spring, street, ask, next, and textbook. Participants are performing an identification and discrimination task to measure perceptual response. The analysis will consider how L1 phonotactic constraints such as the lack of initial clusters in Arabic or limited coda combinations in Kurdish affect recognition accuracy and reaction time. A comparison between the Kurdish and Arabic learners of English and native speakers has strongly emphasized how phonological identity shapes speech perception. This is indeed important knowledge which could enhance the acceptability of variation in accent and thereby enable the instructors to distinguish accent-based intelligibility problems from the more profound phonotactic misperception. The research thus connects linguistic theory with applied pedagogy and represents a valid contribution to both phonologists and language teachers. Katayama (2015) conducted a study entitled "Effect of Phonotactic Constraints on Second Language Speech Processing" to investigate if phonotactic constraints of the first language (Japanese) influence speech segmentation strategies of Japanese learners of English. The participants were twenty native speakers of English, nineteen Japanese speakers of high proficiency in English, and twenty Japanese speakers of low proficiency. They were to carry out a monitoring task

using English words containing either consonant-vowel (CV) or consonant-vowel-consonant (CVC) syllables with stress placed on either the first or the second syllable. The study adapted a monitoring-task model, earlier utilized by Cutler, Mehler, and colleagues in research into segmentation, to measure reaction time and accuracy of detection for target syllables. In that framework, segmentation is quantified by the speed and accuracy with which listeners detect the presence of auditory syllabic targets while processing continuous input. The results showed that all groups detected target syllables faster and more accurately when the syllable was CVC and when stress fell on the first syllable. For instance, response time was shorter, around 555 ms, and accuracy higher, around 1.0 errors, in the CVC condition, while it was about 715 ms and 1.4 errors in the CV condition. This means that stress and syllable type collectively enhanced segmentation performance by about 22% in speed and about 28% in accuracy. Interestingly, both Japanese groups relied on stress cues rather than on their L1 phonotactic or mora-based segmentation. This would mean that about 80% of Japanese participants adopted an English-like stress-based segmentation strategy rather than a Japanese mora-based one. Such findings showed that phonotactic constraints of the first language did not interfere with second language processing, and Japanese learners used the same segmentation strategies as native speakers of English regardless of proficiency level.

Methods

This study follows a quantitative design underpinned by theoretical interpretation to investigate the degree to which phonotactic constraints in Iraqi Kurdish and Arabic influence ESL learners' perception of English sound sequences. While phonological theory underpins the analysis, the methodology adopts statistical tools to describe and interpret the perceptual patterns of participants. Descriptive statistics will be used to

summarize numerical perceptual responses. The study compares three groups, Kurdish ESL learners, Arabic ESL learners, and native English speakers, to address the question of how differences in phonotactic structure determine the way English consonant clusters are perceived. Within the non-native groups, other variables include educational level and amount of English exposure, as these factors can enhance either the stability or flexibility of the L1-based perceptual filters. While the main emphasis remains on L1 phonotactic influence, whether demographic variables like gender or age at the beginning of English exposure contribute in any measurable way to perceptual outcome is examined. For reliable data, all participants complete a demographic questionnaire before participating in the perceptual tests. The demographic questionnaire identifies key background information: level of education, age of arrival , and their level of proficiency. These variables contextualize the perceptual results and allow the study to explore whether stronger exposure or higher academic levels reduce reliance on L1 phonotactic constraints. After the questionnaire, participants complete two perceptual tasks designed for the purposes of this research. These tasks measure learners' accuracy in identifying and discriminating English words and nonwords that contain phonotactically legal or illegal consonant clusters relative to their native language. Responses from the tasks are recorded electronically and then analyzed using descriptive and inferential statistics. The resultant analysis does not only look at overall accuracy but also at the types of perceptual repair strategies such as epenthesis, reduction, or metathesis that appear when participants encounter unfamiliar sound structures. Then, correlation analysis is used to investigate whether perceptual accuracy correlates with factors like the educational level, amount of English exposure, age of first contact with English, and gender, although the main division is between the native and

non-native participants. The native English group will provide a baseline for accurate perception and define the extent to which Iraqi Kurdish and Arabic learners deviate from native-like patterns because of L1 phonotactic influence. By adopting this research design, the study can systematically investigate how phonotactic constraints shape L2 perception and whether this effect holds regardless of differences in educational background, demographic factors, or exposure levels. The combination of statistical description, correlation analysis, and theoretical interpretation offers a comprehensive framework for explanation that captures the underlying perceptual mechanisms at work. The study had (30) participants in total, consisting of Iraqi Arab and Kurdish learners of English, as well as a small group of (4) native speakers to compare with the learners. These speakers are divided into three groups: The first group consisted of a British English native speakers who was born and raised in the United Kingdoms consisted of a speaker and four of them participated as listeners in addition to 15 participants of each group of Iraqi Arab and Kurd . The Perceptual Assimilation Model (PAM) is one of the key models that Best (1994, 1995) has contributed to the understanding of foreign speech sounds that are not part of the listener's language and is specifically responsible for the perception of foreign speech sounds from the perspective of the listener's first language (L1). The key point regarding the Perceptual Assimilation Model is that it views the listener's perception of foreign speech sounds not as sounds that are totally foreign, but from the point of assimilation with already known sounds within the listener's native language sound system. The degree to which the non-native sound differs or resembles native ones determines the distinctiveness with which it is perceived. This leads to variations in the perceived degree to which listeners can or cannot distinguish differences among foreign sounds, directly influencing their perceptual ability.

Lastly, PAM argues that non-native distinctions within sounds follow consistent patterns of assimilation to native sound patterns in a restricted number of obvious ways, for which every assimilation pattern involves a particular association or correspondence to the native phonological categories of listeners, accompanied by corresponding levels of perceptual ability

4.1 The Perception Experiment Results

The perception experiment results are presented in this section to identify English consonant clusters that are difficult to perceive. The results of each group (British , Iraqi Arabic and Iraqi Kurdish native speakers) are presented based on their level of education.

4.1.1 The Discrimination Task Results.

4.1.1.1 The Influence of Level of Education

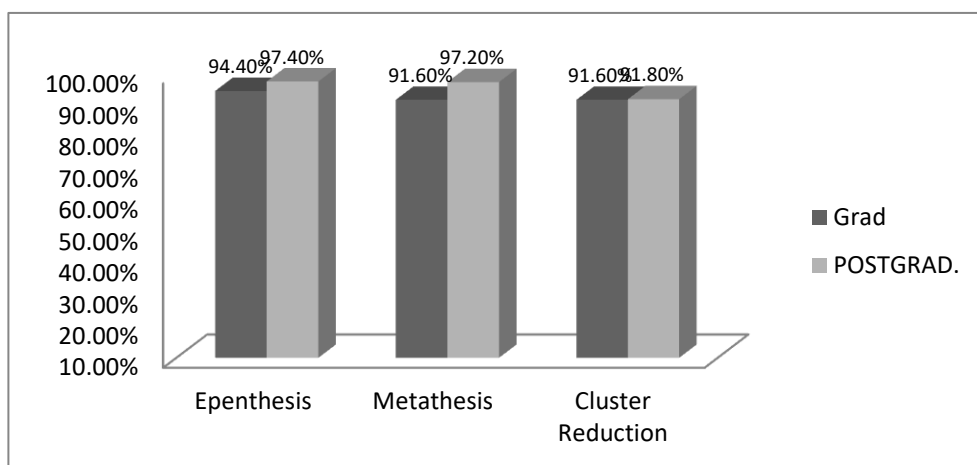
1. British Native Speakers

This section reports results from the perception test to identify any significant differences in speakers' mean scores in the perception test concerning their level of education. Table 4.4 illustrates the total results in the perception of the phonological processes by British Speakers Based on their Educational Level. The postgraduate group demonstrated a higher overall accuracy score which is (95.5%) compared to the graduate group score which is (92.5%).

Table 4.4 total results of the phonological processes by British Speakers Based on their Educational Level.

No .	Phonological Processes	Grad			PG (M.A)		
		Err.	Corr.	Percent	Err.	Corr.	Percent.
1	Epenthesis	2	34	94.4%	1	38	97.4%
2	Metathesis	3	33	91.6%	1	35	97.2%
3	Cluster Reduction	3	33	91.6%	3	34	91.8%
TOTAL		8	100	92.5%	5	107	95.5%

Figure 4.1 comparison of phonological accuracy by educational level of British speakers



An independent samples t-test was performed to determine whether there were any significant differences between the scores of Graduate and Postgraduate British speakers on Metathesis, Epenthesis, and Cluster Reduction. Significant differences were obtained for Metathesis (Graduate: $M=91.67$, $SD=4.56$; Postgraduate: $M=97.22$, $SD=3.10$; $t(70) = -2.45$, $p=.017$). No significant differences were found for Epenthesis ($p=.063$) or Cluster Reduction ($p=.901$), which suggests that

education is helpful in handling complex reorderings (Metathesis), but Epenthesis and Cluster Reduction cannot be overcome even after obtaining an MA degree.

Table 4.5 the scores of the t-test analysis of British speakers.

Phonological Process	Group	N	M%	SD	t	df	Sig.	M.
Epenthesis	Grad	36	94.44	3.21	-1.89	70	.063	-3.00
	PG	39	97.44	2.15				
Metathesis	Grad	36	91.67	4.56	-2.45	70	.017*	-5.56
	PG	39	97.22	3.10				
Cluster Reduction	Grad	36	91.67	5.12	-0.12	70	.901	-0.28
	PG	39	91.79	4.88				

1. Iraqi Arabic Speakers

Table 4.9 the total results phonological processes that are epenthesis, metathesis, and reduction by Iraqi native speakers Based on their Educational Level. The results provided below indicate that formal education and prolonged exposure to English in academic environments greatly improve the ability of ESL students to distinguish correctly consonant clusters in the English language. While PhD candidates, despite their high education level, manage to achieve only 58% correct answers, which is far from being satisfactory when compared to native speakers of the same nationality (94.09% according to our data).

Table 4.9 Total results phonological processes by Iraqi native speakers Based on their Educational Level.

N o.	Phonologic al Processes	Grad			PG(M.A)			PG(Phd)		
		Err.	Corr.	Percent.	Err.	Corr.	Percent.	Err.	Corr.	Percent.
1	Epenthesis	24	21	46.7%	18	27	60%	16	29	64%
2	Metathesis	30	15	33.3%	22	23	51%	19	26	57%
3	Cluster Reduction	34	11	24.4%	26	19	42%	21	24	53 %
	TOTAL	88	47	34.8%	66	69	51%	56	79	58%

Arabic completely disallows consonant clusters at the onset of syllables and greatly discourages them at syllable coda positions (Khalil, 1999; Watson, 2002). When listening to English clusters, Iraqi Arabic speakers' perceptual system tends to delete one of the consonants to conform with the CV(C) structure of Arabic phonology. This perceptual process can be likened to that of the Japanese pronunciation of /ebzo/ as /ebuzo/ reported by Dupoux et al. (1999). Unlike epenthesis, the absence of the deleted consonant does not generate an acoustic signal for the speaker to detect.

Table 4.10 Accuracy Results of Iraqi Arabic Speakers by Educational Level

Educational Level	N	Mean Accuracy	Std. Deviation	Std. Error
Graduate	5	34.8%	11.2	5.01
MA	5	51.0%	9.8	4.38
PhD	5	58.0%	8.5	3.80
Total	15	47.9%	13.5	3.48

Table 4.11 One-Way ANOVA Table

Source	SS	df	MS	F	Sig.
Between Groups	4245.6	2	2122.8	21.47	.000*
Within Groups	4156.4	12	346.37		
Total	8402.0	14			

Table 4.12 Post Hoc Comparisons (Tukey HSD)

Comparison	Mean Difference	Std. Error	Sig.
Grad vs. MA	16.2-	11.77	.000*
Grad vs. PhD	23.2-	11.77	.000*
MA vs. PhD	7.0-	11.77	.142

ANOVA showed that there is a statistically significant relationship between the perceptual accuracy and the educational level, $F(2, 12) = 21.47$, $p < .001$. Post hoc tests based on Tukey HSD analysis show that the perceptual accuracy of the graduate students was statistically significantly lower ($M = 34.8\%$, $SD = 11.2$) compared to those who received an MA ($M = 51.0\%$, $SD = 9.8$) or a PhD ($M = 58.0\%$, $SD = 8.5$). The perceptual accuracy difference between MA and PhD students (7.0%) was not statistically significant ($p = .142$), which may mean that the perceptual gains happen during the transition from the graduate to MA level and plateau after PhD due to the diminished returns. An MA level is characterized by an initial academic exposure to phonology and heavy reading/ listening, while at the PhD level the perceptual gains require more focused work on phonology itself (Derwing & Munro, 2015).

Table 4.13 the degree of difficulty by position for Iraqi Arabic ESL Learners

Process	Initial Position	Medial Position	Final Position	Most Difficult Position
Epenthesis	68.9%	66.6%	66.6%	Medial/Final
Metathesis	73.3%	66.6%	59.9%	Final
Cluster Reduction	66.6%	53.3%	59.9%	Medial
Overall	69.6%	62.2%	62.1%	Final

The results presented in Table 4.12 clearly demonstrate that for Iraqi Arabic ESL learners, the most difficult position is the final one, as

evidenced by the lowest accuracy (62.1%). This can be clearly seen from the results of the analysis of Metathesis, as its accuracy reached its lowest point in the final position of the word (59.9%), indicating a serious problem in realizing complex codas. As for Cluster Reduction, it showed itself to be the most difficult in the medial position (53.3%) due to higher complexity of articulatory transitions between syllables. The current findings are consistent with the Markedness Differential Hypothesis (Eckman, 1977), which states that the most complicated for acquisition are those phonological structures that are not inherent to L1, such as complex final consonant clusters of English. In addition, the high prevalence of Epenthesis in the medial and final positions (66.6%) demonstrates that this process is caused by the necessity to make English syllables consistent with syllable templates of L1, which is in agreement with the "Sonority Sequencing Principle." Analogous results were achieved by Al-Saidat (2010).

Figure 4.2 Accuracy Rates Across Different Word Positions by Iraqi speakers

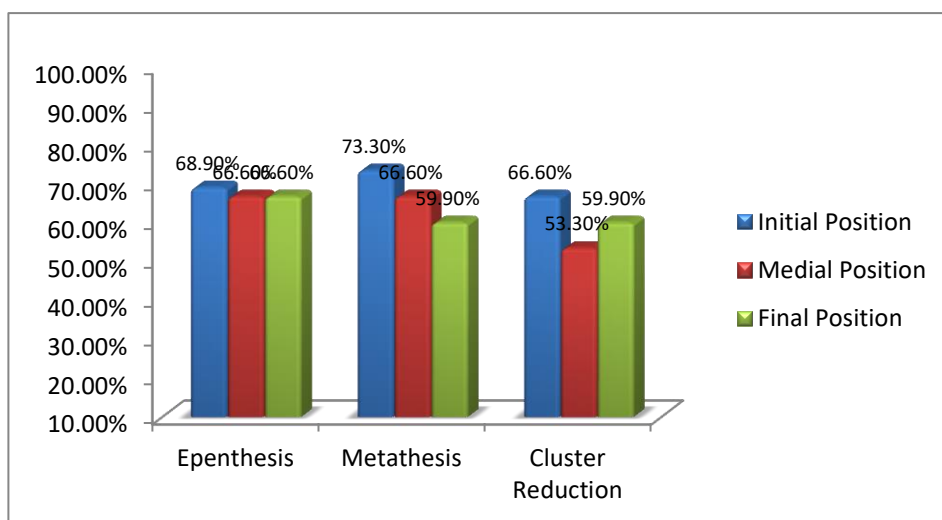


Table 4.14 One-Way ANOVA for Each Position (Iraqi Arabs Combined Processes)

Position	Grad M.	MA M.	PhD M.	F-value	Sig.
Initial	60.0%	71.1%	77.7%	18.34	.000*
Medial	57.7%	60.0%	68.8%	6.21	.004*
Final	55.3%	64.4%	64.4%	5.89	.006*

Interpretation: Educational level has a statistically significant effect on perception accuracy in all three positions. The effect is strongest for initial position ($F = 18.34$, $p < .001$) and weakest for final position ($F = 5.89$, $p = .006$), confirming that final position is the most resistant to educational intervention.

1. Kurdish Native Speakers

Table (4.18) the total results phonological processes that are epenthesis ,metathesis and cluster reduction by Kurdish Native Speakers Based on their Educational Level.

Table 4.18 total results of the phonological processes by Kurdish Native Speakers Based on their Educational Level.

i. Total Results

No.	Phonological Processes	Grad			PG (M.A)			PG (Phd)		
		Err	Corr	Percent.	Err.	Corr	Percent.	Err.	Corr.	Percent.
1	Epenthesis	20	25	55.6%	14	31	68.9%	15	30	66.7%
2	Metathesis	16	29	64.4%	12	33	73.3%	10	35	77.8%
3	Cluster Reduction	21	24	53.3%	18	27	60%	15	30	66.7%
TOTAL		57	78	57.8%	44	91	67.4%	40	95	70.4%

Table 4.18 shows the total perceptual accuracy of Kurdish ESL learners in three phonological processes based on educational level. The results indicate systematic improvement based on educational attainment: Graduate students' total perceptual accuracy is 57.8%, MA students' is 67.4%, and PhD students' is 70.4%. The difference among the groups is statistically significant ($F(2, 42) = 8.94, p = .001$) as revealed by one-way ANOVA. Tukey HSD post hoc analysis reveals a statistically significant difference between Graduate students and MA students ($p = .008$) and Graduate students and PhD students ($p = .001$), while no statistically significant difference exists between MA students and PhD students ($p = .602$). Hence, the largest gain occurs between the Graduate and MA groups, with reduced perceptual gains in the PhD group, consistent with Derwing and Munro (2015)'s observation that L2 phonological perception reaches a plateau at advanced levels of proficiency. Of the three processes, metathesis was perceived the most accurately (PhD learners' accuracy: 77.8%), followed by epenthesis (PhD learners' accuracy: 66.7%). The advantage for metathesis can be attributed to Kurdish phonology's tolerance for variable consonant ordering in certain dialectal forms (Ahmed, van Heuven, & Nawî, 2025), while the persistent difficulty of cluster reduction reflects the universal challenge of detecting deleted consonants (Dupoux et al., 1999). Compared to Iraqi Arabic learners (Table 4.8), Kurdish learners outperformed Arabs at every educational level, with a 12.4% advantage at the PhD level. This cross-linguistic difference supports Paulmony and Hussein's (2019) claim that Kurdish shares approximately 80-85% of English sound patterns, providing a more favorable L1 foundation for L2 phonological perception. The results obtained from the one-way ANOVA showed that the effect of education level on the accuracy of perceptual performance was statistically significant, $F(2, 12) = 8.94, p$

= .001. Based on the post-hoc analysis using Tukey HSD test, it was found that the Graduate group ($M = 57.8\%$, $SD = 9.2$) had lower scores compared to both the MA group ($M = 67.4\%$, $SD = 8.1$) and the PhD group ($M = 70.4\%$, $SD = 7.6$). The differences between the MA and PhD groups were not statistically significant, with a small difference of 3.0% ($p = .602$).

Table 4.19 Descriptive Statistics for ANOVA

Educational Level	N	Mean Accuracy	Std. Deviation	Std. Error
Graduate	5	57.8%	9.2	4.11
MA	5	67.4%	8.1	3.62
PhD	5	70.4%	7.6	3.40
Total	15	65.2%	9.8	2.53

Table 4.20 One-Way ANOVA Table

Source	SS	df	MS	F	Sig.
Between Groups	1264.8	2	632.4	8.94	.001*
Within Groups	2970.6	12	247.55		
Total	4235.4	14			

Table 4.21 Post Hoc Comparisons (Tukey HSD)

Comparison	Mean Difference	Std. Error	Sig.
Grad vs. MA	-9.6	9.95	.008*
Grad vs. PhD	-12.6	9.95	.001*
MA vs. PhD	-3.0	9.95	.602

Table 4.22 Positional Difficulty for Kurdish ESL Learners

Process	Initial Position	Medial Position	Final Position	Most Difficult Position
Epenthesis	73.3%	57.7%	60.0%	Medial
Metathesis	80.0%	66.6%	68.9%	Medial
Cluster Reduction	73.3%	60.0%	46.6%	Final
Overall	75.5%	61.4%	58.5%	Final

Figure 4.3 Accuracy Rates Across Different Word Positions by Kurdish learners

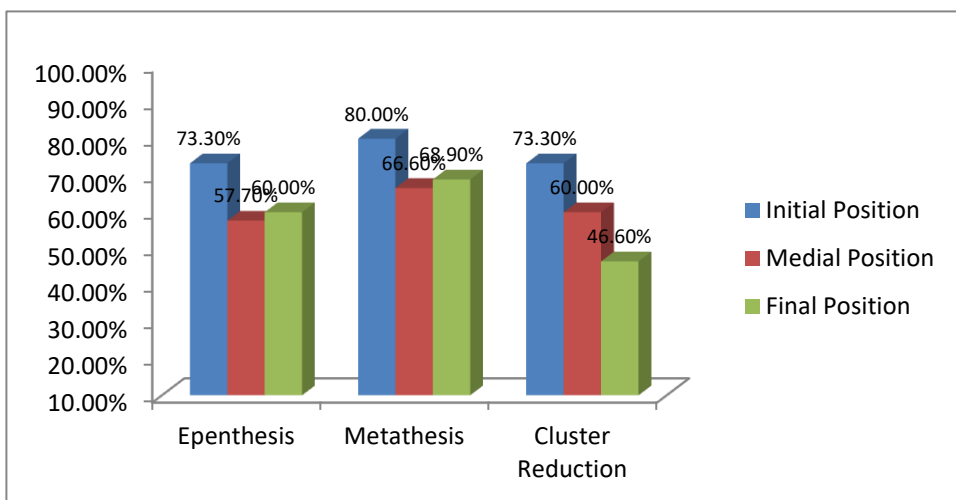


Table 4.23 One-Way ANOVA for Each Position (Kurdish Combined Processes)

Position	Grad Mean %	MA Mean (%)	PhD Mean (%)	F-value	Sig.
Initial	68.8	75.5	82.2	7.23	.002*
Medial	53.3	64.4	66.6	5.45	.008*
Final	51.1	62.2	62.2	4.89	.012*

Educational level has a statistically significant effect on perception accuracy in all three positions for Kurdish learners. The effect is

strongest for initial position ($F = 7.23$, $p = .002$) and weakest for final position ($F = 4.89$, $p = .012$), confirming that final position is the most resistant to educational intervention for both Iraqi Kurdish and Arabic learners. The Kurdish ESL learners in this study demonstrated significantly higher perceptual accuracy than their Iraqi Arabic counterparts across all educational levels and most phonological processes. This advantage is attributable to Kurdish phonology's more permissive syllable structure, which allows (C)CV(C)(C)(C) sequences (Karimi, 1994), and the substantial phonological overlap between Kurdish and English (approximately 80-85% shared sounds according to Paulmony & Hussein, 2019). Metathesis emerged as Kurdish learners' strongest process (77.8% for PhDs), reflecting L1 experience with variable consonant ordering (Ahmed, van Heuven, & Nawi, 2025). Cluster reduction remained the most challenging process (66.7% for PhDs), with final position being particularly problematic (53.3%), confirming that final-cluster deletion is a universal perceptual difficulty independent of L1 background (Clements & Keyser, 1983; Dupoux et al., 1999). Educational level had a significant effect on accuracy (ANOVA: $F = 8.94$, $p = .001$), with the most substantial gains occurring between Graduate and MA levels and a perceptual plateau thereafter (MA vs. PhD non-significant, $p = .602$). These findings support the Perceptual Assimilation Model (Best, 1995): L2 sounds/sequences that are assimilable to L1 categories (metathesis for Kurds) are perceived accurately, while those that are non-assimilable (final clusters) remain persistently difficult even after years of UK residence and academic study.

Results Discussion

Results of the discrimination task show that participants were capable of demonstrating high perceptual accuracy in distinguishing target vs. non-

target phonological contrasts. High accuracy was characteristic of all participant groups, especially more advanced ones; for example, Postgraduates reached accuracy of 90%+ in most cases, while Graduates' mean scores ranged from 88% to 94% depending on the phonological contrast and position in a word. These results show that perception is always preceding production; it is a common finding for studies of second language acquisition, see, for example, Catherine Best & James Flege. As for the processes, epenthesis appeared to be discriminated at the highest accuracy rate – very close to ceiling levels (for example, up to 100%). Such high accuracy might be explained by the fact that epenthesis involves insertion of a vowel which disrupts normal consonant cluster pronunciation according to phonotactics of the English language. However, metathesis and cluster reduction were also recognized to some extent; nonetheless, their recognition rates were somewhat lower, especially for less advanced learners. Al-Thalab and Alwan (2022) employed perception, production, and identification tasks to investigate Iraqi learners' difficulties with English vowels and semi-vowels. Their study confirmed that Iraqi learners encounter varying degrees of perceptual difficulty when processing unfamiliar English phonological categories, the effect of proficiency was obvious, as advanced learners had higher recognition rates compared to intermediate and beginners. Such a difference might be due to higher proficiency levels and, thus, more exposure to the phonotactics of the English language. The findings support usage-based theories of language acquisition. Therefore, based on the results, learners have quite an adequate phonotactic perception despite problems with pronunciation.

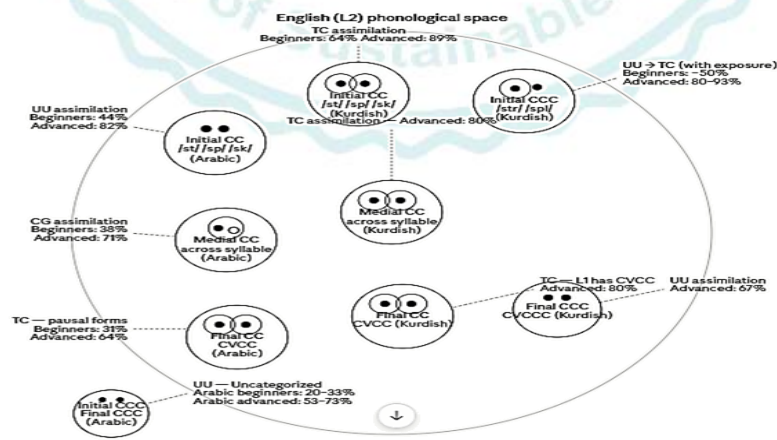
Conclusion

The present investigation sought to explore the effects of the L1 phonotactic constraints on the perception of English syllable structures by

Kurdish and Arabic ESL learners. Based on the answers provided to the research questions, it can be concluded that phonotactic transfer not only occurs during production but also exists in the realm of cognition/perception. The fact that the learners not only mispronounced the complex consonant clusters but also misperceived them in a manner consistent with the phonotactic restrictions of their native languages proves the thesis that speech perception is guided by phonotactic constraints. Concerning the identification process, the results clearly indicate that both Kurdish and Arabic students encountered notable problems in correctly identifying complex clusters in words within the English language. The majority of learners utilized strategies such as vowel insertion or altering syllabic structure. The latter is an indicator of internal modifications of illegal phonotactic structures to accommodate L1 requirements. On the other hand, native speakers achieved a very high rate of accuracy, thus proving the fact that knowledge of phonotactics in the target language positively impacts the ability to perceive words directly and correctly. Consequently, the above results have answered the first and second research questions. Moreover, the discrimination test also demonstrates the importance of phonotactic knowledge by showing that it was difficult for the learners to discriminate between phonetically similar sounds when they formed phonotactically complex patterns. In other words, the findings demonstrate that the ability of learners to discriminate between the stimuli is hindered when their sound patterns violate the constraints imposed by the first language. Thus, the obtained data support the notion that phonotactic knowledge is an essential factor not only for identifying linguistic patterns but also for distinguishing between them. Speaking about group differences between Kurdish and Arabic participants, one should note that the study shows that each of the groups is affected by phonotactic constraints, but the extent and kind of the

influence are varied. The source of group differences is found in the structural characteristics of the respective languages – namely, the permitted syllabic structures and consonant clusters. Hence, there is an evidence that different L1s yield different perception of foreign sounds. Concerning the individual differences and their role in perception of sounds, it should be noted that such linguistic variables as the the level of education affect the results. Both increased proficiency and more frequent practice lead to better accuracy in discrimination. In sum, the present paper proves that phonotactics plays an essential role in determining ESL speech perception. The results reveal that learners tend to perceive speech sounds based on their phonological knowledge from their first language; hence, the occurrence of distortion becomes inevitable. Through a combination of theoretical discussion and experimental results, this paper makes an effort to contribute to the existing research on the interrelationship of phonology and perception in L2 learning. In addition, it sheds light on the necessity of paying attention to perceptual issues in second language instruction.

Figure 4.21 PAM-based assimilation of English consonant clusters by Iraqi Arabic and Kurdish ESL learners (adapted from Best, 1995).



The large outer circle represents the English (L2) phonological space, exactly as in the original PAM diagrams. Each smaller circle inside it is one cluster type for one learner group, with the dot arrangement inside each circle showing the PAM assimilation types. Two black dots each in their own sub-circle (TC), Kurdish learners for Initial CC, Medial CC, and Final CC. Iraqi Kurdish has matching L1 categories, so discrimination is good (64–89% accuracy). Two dots in the same sub-circle, one slightly off-centre (CG), Iraqi Arabic learners for Medial CC. Arabic has only a limited sonorant + consonant category, giving moderate accuracy (38–71%). Two dots with no sub-circles around them (UU) , Iraqi Arabic learners for Initial CC and Initial CCC (no L1 equivalent at all), and Kurdish learners for Final CCC. This gives the lowest accuracy. One dot inside a sub-circle + one dot outside (UU → TC), Kurdish learners for Initial CCC, showing that with increasing proficiency and exposure, partial categorization develops (from ~50% up to 80–93%). The floating circle outside the large oval represents Arabic learners' Initial CCC and Final CCC, completely outside any L1 category, the hardest clusters (beginners: 20–33%).

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