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A CVX Syllable Structure-Theoretic Study of Initial Consonant Clusters in Basri Iraqi Arabic

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Abstract

This study examines initial consonant clusters in Basri Iraqi Arabic (BIA) within the CVX syllable structure framework. Although BIA appears to allow word-initial CC sequences on the surface, the analysis shows that these sequences do not form true branching onsets. Instead, they are accounted for by the CVX template through two main mechanisms: complex sounds formed via gestural overlap and morphological concatenation governed by CVX-compatible rules.

The data, drawn from natural Basri speech, demonstrate that all apparent initial clusters conform to the CVX theory constraints. When phonological licensing is insufficient, clusters are explained through morphological processes such as prefixation, the Affix Rule, the Potential Vowel Rule, and Anti-Allomorphy. The findings confirm that CVX theory provides an adequate and restrictive account of initial CCs in BIA and supports its broader cross-linguistic validity.

Keywords: (silent assemblies, primary silent assemblies).

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دراسة بنيوية مقطعية وفق نظرية CVX للتجمعات الصامتية الابتدائية في اللهجة العراقية البصرية

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الملخص

تتناول هذه الدراسة التجمعات الصامتية **(CC)** في بداية الكلمة في اللهجة العراقية البصرية ضمن إطار بنية المقطع وفق نظرية **CVX** . وعلى الرغم من أن اللهجة العراقية البصرية تبدو، على المستوى السطحي وكأنها تسمح بتتابعات صامتية ابتدائية من نوع**(CC)** ، إلا أن التحليل يُظهر أن هذه التتابعات لا تُشكّل بدايات مقطعية متفرعة حقيقية. وبدلاً من ذلك، يتم تفسيرها من خلال قالب **CVX** عبر آليتين رئيسيتين: الأصوات المركبة **(Complex Sounds)** الناتجة عن تداخل الحركات النطقية، واللصق الصرفي **(Morphological Concatenation)** الذي تحكمه قواعد متوافقة مع **CVX** .

وتُظهر البيانات المستمدة من الكلام البصري الطبيعي أن جميع التجمعات الابتدائية الظاهرية تتوافق مع قيود نظرية **CVX** .وعندما يكون الترخيص الصوتي **(Phonological Licensing)** غير كافٍ، يتم تفسير هذه التجمعات من خلال عمليات صرفية مثل قاعدة البادئة **(prefixation)** ، وقاعدة اللاحقة **(Affix Rule)**، وقاعدة الحركة المحتملة **(Potential Vowel Rule)** ، ومبدأ مضاد التغاير الصرفي **(Anti– Allomorphy)** .

وتؤكد النتائج أن نظرية **CVX** تقدم تفسيراً كافياً ومقيداً للتجمعات الصامتية الابتدائية في اللهجة العراقية البصرية، كما تدعم صلاحيتها الأوسع عبر اللغات.

الكلمات المفتاحية:(التجمعات الصامتية، التجمعات الصامتية الابتدائية).

1. Introduction

Consonant clusters (CCs) refer to sequences of two or more consonants occurring within a single phonological domain without the intervention of a vowel. These clusters constitute an important aspect of syllable structure, as their distribution and acceptability are governed by language-specific phonotactic constraints.

In Arabic dialects, and particularly in BIA, CCs exceeding three segments do not occur. In BIA, two-CCs are attested in initial, medial, and final positions.

The study of CCs provides crucial insights into the interaction between segmental features, syllable structure, and morphological processes.

This study is limited to one type of CCs, which is initial, and aims to address the following questions:

- Can the CVX theory adequately account for the occurrence of initial CCs in BIA?
- What rules mostly govern initial CCs in BIA?

2 CVX Theory

The CVX theory which originally was proposed by Duanmu (1990, 1994, 2008, 2011), has emerged as a compelling model that sets explicit limits on syllable structure. The theory proposes that the maximal size of a syllable is limited to the structure CVX, where C represents an onset consonant, V a nucleus vowel, and X a variable slot. This final slot (X) may be occupied either by a vowel element—yielding diphthongs or long vowels—or by a consonant (yielding closed syllables) (Duanmu, 2008; Duanmu, 2011). By restricting syllables to no more than one onset, one nucleus, and one coda (or a moraic extension), the model sharply contrasts

with more permissive accounts that allow syllables such as CCCVCCC (Clements & Keyser, 1983; Selkirk, 1982).

2.1 The CVX Theory Principles

The CVX theory is founded on a set of restrictive principles that define the permissible structure of syllables across languages. Duanmu (1990, 1994, 2008, 2011) consistently emphasizes that despite the surface diversity of syllable patterns, a small set of universal principles underlies all phonological systems. These principles can be summarized as follows:

- CVX as the Universal Syllable Template

CVX theory proposes that the maximum syllable structure is CVX, where C is a single onset consonant, V is the nucleus, and X hosts either a vowel or a consonant. Syllables do not exceed this template phonologically.

- No Branching Onsets

The onset position is universally non-branching. Apparent onset clusters are not phonological units but arise from morphology, epenthesis, or phonetic overlap.

- Bimoraic Limit

Syllables are limited to two moras. Structures that appear heavier than bimoraic are reanalyzed as non-phonological or derived.

- Apparent Complexity as Non-Phonological

Complex syllable shapes result from morphological concatenation or phonetic compression rather than underlying syllable structure.

- Restrictiveness of Syllable Structure

Cross-linguistic variation is constrained by the CVX template, eliminating the need for complex syllable representations.

These principles form the foundation of the CVX theory and serve as the analytical lens through which Duanmu interprets syllable structures across languages.

2.2 The CVX Theory Framework

By contrast, syllables that appear to exceed CVX—such as CVVC or CVCC—are

reanalyzed as sequences of two syllables, as cases of morphological concatenation, or as the result of phonetic overlap (Duanmu, 2008). Duanmu addresses the challenge of apparently complex syllables like CCVVC (e.g.,
smail ―smile‖), CVCCC (teksts ―texts‖), and CCCVCCC(sprints ―sprints‖) by applying key strategies:
Duanmu's CVX theory accounts for apparent syllable complexity through three closely related mechanisms: the Affix Rule, the Potential Vowel Rule with Anti-Allomorphy, and Gestural Overlap. Together, these mechanisms explain why surface forms may appear to violate the CVX template while underlying syllable structure remains simple.

The Affix Rule holds that affixal or affix-like consonants may be phonetically realized even when they cannot be incorporated into the syllable proper. Many English word-final coronals (e.g., /t, d, s, z, θ/) function as suffixes or perceived suffixes and therefore surface outside the core CVC syllable. As a result, words such as texts or tenths only appear to contain final CCs; once suffixal
material is stripped away, their syllable cores conform to the CVX template. Phonotactic acceptability thus correlates with morphological or perceived affixhood rather than with syllable size.

The Potential Vowel Rule, reinforced by Anti-Allomorphy, explains how extra consonants at word edges are licensed by morphology. Anti-Allomorphy requires a morpheme to maintain a consistent shape across environments. Accordingly, a word such as help is analyzed as [hel] plus an extrasyllabic /p/ in isolation, while the same /p/ becomes the onset of the following syllable in helping. This analysis preserves the CVX template while ensuring morphological uniformity across related forms.

Finally, **Gestural Overlap** accounts for apparent CCs by treating them as single complex sounds occupying one timing slot. When two sounds involve different articulators and do not violate the No Contour Principle, their gestures may overlap and be realized simultaneously. For example, /p/ (labial) and /l/ (coronal) can merge into a single complex segment, whereas sequences requiring

conflicting gestures on the same articulator cannot. This articulatory explanation further supports the claim that surface clusters do not necessarily correspond to multiple phonological timing units.

In sum, CVX theory explains surface complexity through morphological licensing and articulatory timing rather than through expanded syllable structure, maintaining a highly restrictive and universal syllable template.

3 Consonant Clusters

CCs are generally defined as sequences of consonants occurring at syllable margins. Catford (1988) characterizes clusters as consonant sequences that belong to the same syllable, distinguishing true clusters such as /pl/ in plant from consonant sequences that cross syllable boundaries, as /p-l/ in stop-light. Similarly, Crystal (1991) describes CCs as adjacent consonants that occur in restricted patterns at syllable onsets or codas. He further notes that the term is sometimes applied to orthographic sequences, though written clusters do not always correspond to phonetic ones, as illustrated by mismatches between spelling and pronunciation in words such as fox and sick.

Other scholars adopt comparable views. Richards (1993) defines a CC as a grouping of two or more consonants without an intervening vowel, whereas Rogerson

(2011) identifies it more specifically as a sequence of consonants that occurs at the beginning or end of a syllable.

Erwin (1963) observes that in Iraqi Arabic,

CCs exceeding three segments do not occur.

4 Basri Iraqi Arabic

BIA is the variety of Southern Mesopotamian Arabic spoken in the city of Basrah and nearby districts along the Shatt al-Arab in southern Iraq. It shares many phonological and morphological features with other Southern Mesopotamian dialects but also exhibits distinctive traits influenced by its geographical location,

historical trade connections, and contact with neighboring dialects, including Gulf Arabic (Mahdi, 1985).

BIA, like other dialects, has its own distinct phonetic and phonological systems, which include a specific set of consonants and vowels. The phonology of BIA consists of 40 phonemes: 8 monophthongal vowels, including 3 short vowels /i, u, a/ and 5 long vowels /iː, eː, aː, oː, uː/, as well as 32 consonants. The consonants in SIA are /p, b, t, ṭ, d, ḍ, k, g, q, ʔ, f, θ, ð, ð., s, ṣ, z, ʃ, x, ġ, ḥ, ʕ, h, tʃ, ʤ, m, n, l, ḷ, r, w, y/ (as cited in Abdul Sattar).

In terms of syllable structure, BIA exhibits ten syllabic patterns, including open, closed, and double- closed syllables: /cv, cvv, ccvv, cvc, ccvc, cvcc, cvvc, cvvcc, ccvvc, ccvcc/. Along with this, there is an eleventh syllable pattern in SIA, which is /ccv/. The maximum number of consonants permitted in both the onset and coda positions in SIA is two, as illustrated by the formula C0-2 V C0-2.

5 Previous Studies

Previous research on Duanmu's CVX theory has tested its applicability across languages with diverse phonotactic systems, yielding mixed but informative results. Gregová (2011) showed that English initial clusters largely conform to the CVX single-slot analysis, whereas Slovak exhibits a wider range of onset clusters that cannot always be accommodated within a single- slot framework, suggesting the possible need for a more complex onset representation. Karim (2012) provided strong support for CVX in his analysis of Burushaski, demonstrating that onset and medial clusters conform to the CVX template through complex sound formation and morphological mechanisms such as the potential vowel rule, while also confirming the predominance of coronal word-final consonants. However, Burushaski challenged CVX in terms of syllable weight, as CV syllables function as heavy in stress assignment. Khan (2011) showed

that Pahari allows limited two-consonant onsets governed by strict sonority-based constraints,

illustrating that languages often considered clusterless may permit systematically restricted clusters. Duanmu (2008) further

emphasized the typological predictions of CVX, distinguishing languages with simple syllable inventories that directly reflect the CVX template from languages with apparent surface complexity, where clusters arise through resyllabification, appendices, or morphological layering rather than true violations of CVX.

6 Procedures of the Study

The present study is carried out according to the following analytical procedures:

- Data Collection

Linguistic data are collected from naturally occurring Basri Iraqi Arabic through personal observation, native-speaker intuition, and available documented sources. All selected items are verified as stable lexical forms rather than performance errors or idiosyncratic pronunciations.

- Phonetic Transcription and Syllabification

The collected words are transcribed using the International Phonetic Alphabet (IPA) and syllabified according to established phonological principles, with careful attention to syllable boundaries, stress placement, and segmental sequencing.

- Identification of CCs

Consonant sequences in initial, medial, and final positions are identified and classified. Apparent CCs are distinguished from sequences that arise across syllable boundaries or as a result of morphological concatenation.

- Application of the CVX Template

Each syllable is analyzed in reference to the CVX syllable template, which restricts syllable structure to a single onset (C), a vowel nucleus (V), and one optional slot (X). Structures that appear to exceed CVX are examined to determine whether they represent true phonological complexity or surface-level effects.

- Complex Sound Analysis

Apparent onset or coda clusters are evaluated to determine whether they can be analyzed as complex sounds occupying a single timing slot, based on articulator-based feature theory and the principle of gestural overlap.

- Morphological Interpretation

Consonant sequences that cannot be accounted for phonologically are analyzed morphologically through the application of the Affix Rule, the Potential Vowel Rule, and Anti- Allomorphy, allowing extra consonants to surface while preserving morphemic stability and conformity with the CVX framework.

- Interpreting the findings within the framework of OT and addressing the questions of the study based on the analysis of the data.
- Drawing conclusions based on the analysis and providing suggestions for future research.

7. Data Analysis

The data are analyzed within the CVX syllable structure framework, which limits syllables to a single onset (C), a vowel nucleus (V), and one optional slot (X). Basri Iraqi Arabic words are grouped into natural classes based on the place of articulation of consonant sequences (e.g.

Labial–Coronal, Coronal–Dorsal, Pharyngeal–Coronal). Apparent CCs are examined to determine whether they can be analyzed as complex sounds through gestural overlap or must be reinterpreted morphologically using CVX mechanisms such as the Affix Rule, the Potential Vowel Rule, and Anti-Allomorphy. The following data represent the words selected for analysis. The instances of the initial consonant clusters are provided in this table:

Table 1: Instances of Initial Consonant Clusters in the Selected

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Data

No.	Cluster	Word (Arabic)	IPA	Gloss
1	/bn-/	بنية	/bnajja/	Daughter , girl
2	/bl-/	بلوزة	/bluːza/	Blouse
3	/br-/	بروش	/bruːʃ/	Brooch
4	/bʃ-/	بشارة	/bʃaːra/	good news
5	/bt-/	ابتسامة	/btisaːma/	Smile
6	/θg-/	ثكيل	/θgiːl/	Heavy (Pl.)
7	/θw-/	ثواب	/θwaːb/	divine reward
8	/ħr-/	حرام	/ħraːm/	Prayer garment
9	/ħs-/	حسين	/ħseːn/	A name
10	/ħʧ-/	حچاية	/ħʧaːja/	Word
11	/ħm-/	حمار	/ħmaːr/	Donkey
12	/χw-/	خوارة	/χwaːra/	Going out a lot
13	/btˤ-/	بطوط	/btˤuːtˤ/	Duck (Pl.)
14	/bʃ-/	بشوش	/bʃuːʃ/	Female duck (Pl.)
15	/ħðˤ-/	حظوظ	/ħðˤuːðˤ/	Luck (Pl.)
16	/χd-/	خدود	/χduːd/	Cheeks
17	/dʃ-/	دشاديش	/dʃaːdiːʃ/	cloth/name
18	/dm-/	دموع	/dmuːʕ/	Tears
19	/ðj-/	ذيابة	/ðjaːba/	Wolves
20	/ðn-/	ذنوب	/ðnuːb/	Sins
21	/rm-/	رموش	/rmuːʃ/	Eyelashes
22	/sn-/	سنين	/sniːn/	Years
23	/ʃm-/	شموع	/ʃmuːʕ/	Candles
24	/ʧw-/	چواكيچ	/ʧwaːkiːʧ/	Hammers
25	/tˤj-/	طيور	/tˤjuːr/	Birds
26	/ðˤn-/	ظنون	/ðˤnuːn/	Suspicions
27	/ðˤr-/	ظروف	/ðˤruːf/	Circumstances
28	/ʕz-/	عزاز	/ʕzaːz/	Dear (Pl.)
29	/ʕj-/	عيون	/ʕjuːn/	Eyes
30	/ɣj-/	غيوم	/ɣjuːm/	Clouds
31	/fj-/	فيالة	/fjaːla/	Elephants
32	/qw-/	قواري	/qwaːriː/	Teapots
33	/mk-/	مكانيس	/mkaːniːs/	Brooms
34	/sm-/	سمعت	/smaʕit/	I heard
35	/rk-/	ركضت	/rkadˤit/	I ran
36	/ʃr-/	شربت	/ʃrabit/	I drank
37	/sˤʕ-/	صعدت	/sˤʕadit/	I went up
38	/nz-/	نزلت	/nzalit/	I went down

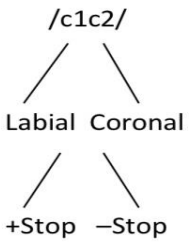
39	/tˤl-/	طلعت	/tˤlaʕit/	I went out
40	/tʕ-/	تعبت	/tʕabit/	I got tired
41	/tˤb-/	طبخت	/tˤbaχit/	I cooked
42	/rʤ-/	رجعت	/rʤaʕit/	I returned
43	/nb-/	نباك	/nba:g/	It was stolen
44	/mb-/	مبارك	/mba:rak/	Blessed
45	/mʕ-/	معاند	/mʕa:nid/	Stubborn
46	/mb-/	مبهذل	/mbahðal/	Untidy
47	/md-/	مدلل	/mdallal/	Spoiled
48	/md-/	مدلع	/mdallaʕ/	Pampered
49	/mɣ-/	مغلف	/mɣallaf/	Wrapped
50	/mɣ-/	مغطى	/mɣatˤtˤa/	Covered
51	/mɣ-/	مغمض	/mɣammudˤ/	Eyes closed
52	/mg-/	مكصص	/mgasˤsˤasˤ/	cut/trimmed

Single Slot Analysis

To avoid repetition, the following analysis applies to all the instances mentioned above, as the analysis is similar across all cases.

These words are analyzed in this way:

/bnajja/, /blu:za/, /bru:ʃ/, /bʃa:ra/ and /btisa:ma/

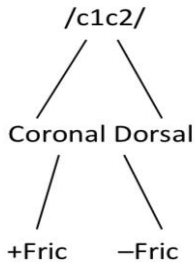


• DISTINCT*Articulator+: Yes

• NCP: Satisfied — distinct place features permit a single complex segment.

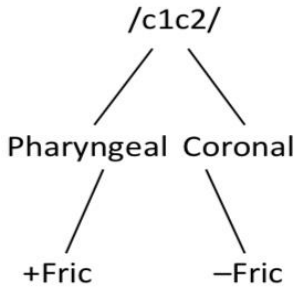
• CVX decision: Single C-slot (complex sound).

/θgi:l/ and /θwa:b/



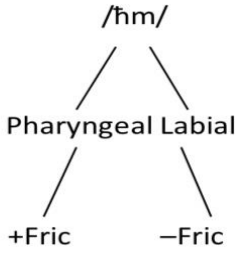
• DISTINCT*Articulator+: Yes
• NCP: Satisfied — distinct place features permit a single complex segment.
• CVX decision: Single C-slot (complex sound).

/ħra:m/, /ħse:n/ and /ħʧa:ja/



• DISTINCT*Articulator]: Yes
• NCP: Satisfied — distinct place features permit a single complex segment.
• CVX decision: Single C-slot (complex sound).

/ħma:r/



- DISTINCT*Articulator+: Yes
- NCP: Satisfied — distinct place features permit a single complex segment.
- CVX decision: Single C-slot (complex sound).

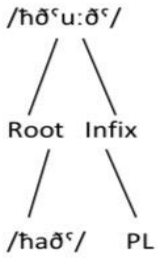
/xwa:ra/

- DISTINCT*Articulator+: Yes
- NCP: Satisfied — distinct place features permit a single complex segment.
- CVX decision: Single C-slot (complex sound).

Morphologica
l Derivation
Analysis
Plurality-
Induced

Clusters

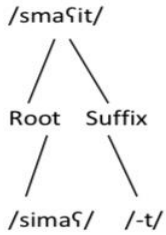
/btˤuːtˤ/, /bʃuːʃ/, /ħðˤuːðˤ/, /χduːd/, /dʃaːdiːʃ/, /dmuːʕ/, /ðjaːba/, /ðnuːb/, /rmuːʃ/, /sniːn/, /ʃmuːʕ/, /ʧwaːkiːʧ/, /tˤjuːr/, /ðˤnuːn/, /ðˤruːf/, /ʕzaːz/, /ʕjuːn/, /ɣjuːm/, /fjaːla/, /qwaːriː/, /mkaːniːs/



Root + PL(infix) → *CCVX+σ

Suffixation Constraint (/t-/) Induced Clusters

/smaʕit/, /rkadˤit/, /ʃrabit/, /sˤʕadit/, /nzalit/, /tˤlaʕit/, /tʕabit/, /tˤbaχit/, /rdʒaʕit/



Root + /-t/ → *CCVX+σ

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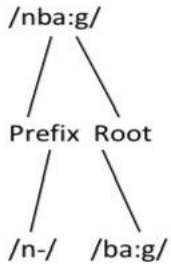
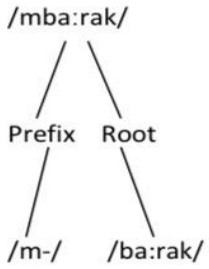
Participial Prefix /n-/ Induced Clusters



/n-/ + Root → *CCVX+σ

Derivational Prefix (/m-/) Induced Clusters

/mba:rak/, /mʕa:nid/, /mbahðal/, /mdallal/, /mdallaʕ/, /mɣallaf/, /mɣatˁtˁa/, /mɣammudˁ/, /mgasˁsˁasˁ/



/m-/ + Root → *CCVX+σ

In each case, the cluster is not underlyingly part of the root, but rather arises through morphology. Thus, the apparent complexity is morphologically conditioned, not lexical. Although these forms yield surface [CC] onsets, they remain consistent with the CVX syllable

model, since the structure conforms to permissible morphological concatenation in BIA rather than violating syllable well-formedness.

8 Discussion and Conclusion

This study investigated the occurrence of initial CC in BIA within the framework of CVX theory. The findings of this study provide clear and systematic answers to the research questions. First, the analysis demonstrates that CVX theory can adequately account for the occurrence of initial CC in BIA. Although BIA appears on the surface to allow initial CC sequences, these clusters do not violate the CVX template at the phonological level. Instead, they are consistently reanalyzed as single-slot structures, either as complex segments formed through gestural overlap or as morphologically derived sequences resulting from prefixation, affixation, or resyllabification. In all cases, the maximal CVX syllable structure (C–V–X) remains intact, confirming the explanatory power of CVX theory in capturing both surface complexity and underlying simplicity in BIA syllable structure.

Second, the study shows that initial CC in BIA are governed primarily by articulatory, phonological, and morphological constraints rather than unrestricted phonotactic freedom. Phonologically, consonants may co-occur only if their articulatory gestures are compatible enough to allow integration within a single timing slot. Morphologically, many apparent clusters arise through prefixation processes, particularly with prefixes such as /n-/, or /m-/, whose attachment to vowel-initial or CVX-compliant roots produces surface sequences that resemble clusters. These sequences are licensed under CVX through the Affix Rule, which preserves morphological integrity while preventing the emergence of true branching onsets.

The analysis demonstrates that many of the apparent initial CC in BIA can be systematically accounted for through a single-slot analysis within the CVX framework. Rather than representing sequences of two independent timing units, these clusters are reinterpreted as occupying a single skeletal position, in which multiple consonantal gestures are integrated into one phonological slot.

This interpretation is further supported by the concept of Gestural Overlap, which explains apparent consonant clusters by treating them

as temporally overlapping articulatory events rather than discrete sequential segments. In this view, when two consonants involve different articulators and do not violate the No Contour Principle, their gestures may be coarticulated and realized simultaneously within a single timing unit.

This articulatory account strengthens the CVX analysis by showing that surface consonant clusters do not necessarily correspond to multiple skeletal positions. Instead, they may be the phonetic outcome of complex segments or gesturally coordinated articulations within a single phonological slot. Consequently, what appears to be CC sequences at the surface level is better understood as single-slot structures with internal gestural complexity rather than true branching onsets.

In sum, initial CC in BIA are not exceptions to syllable well-formedness, but rather the outcome of systematic phonological and morphological licensing mechanisms combined with single-slot gestural organization. The study thus confirms that CVX theory not only accounts for the existence of initial CC in BIA but also explains the principled restrictions governing their distribution, reinforcing the theory's claim of a universal and highly restrictive syllable template. Such research would offer a more comprehensive understanding of the phonological system of BIA and contribute further to the field of phonological theory.

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