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THE ACQUISITION OF WORD INITIAL CONSONANT CLUSTERS IN JATT ARABIC

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ACKNOWLEDGMENT

When I finished my BA in Communication Disorders, I knew I needed to enrich my knowledge of language development, especially in Arabic, the subject that I have to deal with every day as a speech pathologist. I thus decided to study linguistics. My journey was challenging, especially with the pandemic, but also it was very beneficial.

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ABSTRACT

There are two approaches to the resources of language acquisition: The first one claims that language acquisition is experience-dependent (Tomassello 2003), so language acquisition and linguistic skills in general are interwoven with other cognitive abilities. The second approach claims that besides the experience-dependent process there are experience-independent universal constraints that affect acquisition (Chomsky 1959, 1968).

To address this issue, we investigated the acquisition of initial complex onsets in Palestinian Arabic – a specific dialect spoken in Jatt, a village in the triangle area in Israel. In contrast to Modern Standard Arabic, Jatt Arabic allows initial consonant clusters that vary in their sonority profile, and many of these clusters violate constraint on syllable structure (e.g. the cluster in *lbu:b* 'seeds' violates the Sonority Sequencing Principle).

Word initial clusters are acquired relatively late, and in the course of their development, children use different strategies to amend structures that they have not yet acquired: C-deletion (known as truncation), epenthesis, coalescence, gemination, and metathesis (McLoed, Doorn & Reed 2001, Ben-David 2001, Danna 2009). In addition to these strategies, prothesis was found to be a common strategy in the acquisition of Arabic (Daana 2009). Prothesis is a language specific strategy, used by children that acquire a language that employs prothesis in its phonology. Using prothesis agrees with Kiparsy (2003) claim that Palestinian Arabic, and so Jatt Arabic, is a VC dialect that inserts the epenthetic vowel to the left of the unsyllabified consonants. Crucially, children acquiring other languages do not use prothesis as a strategy of cluster simplification (Ben-David 2001, Ben-David & Bat-El 2016, McLoed, Doorn & Reed 2003, Alqattan 2015), and prothesis is likely enough an experience-dependent strategy.

Assuming the that children obtain, and referring to the two approaches above, the experience-dependent approach predict that children will tend to use prothesis more than other strategies to simplify initial clusters, and in parallel, the experience-independent approach predicts that universal principles will play a role in initial consonant cluster acquisition, so words that respect universal principles will be acquired earlier than words that violate universal principles, and they will play a role, also, in choosing the simplification strategy by children.

In this study we tested 46 typically-developing-monolingual children, mostly from Jatt, and few from Baqa (a nearby town with many mothers who originally from Jatt). The children were divided into six age groups: 2;00-2;05, 2;06-3;00, 3;01-3;06, 3;07-4;00, 4;01-4;06, 4;07-5;00. The data obtained via picture naming and sentence completion task. The words in the task are composed of 3 sonority profile groups: Sonority rise profile, sonority plateau profile, and sonority fall profile. The frequency of the words was obtained via a small corpus of Child Directed Speech (CDS).

In this study we examined three universal constraints that related to initial consonant clusters and the strategies using for cluster simplification: Sonority Sequencing Principle (SSP; Steriade 1982, Selkirk 1984, Clements 1990), Sonority Dispersion Principle (SDP; Clements 1990, 1992), and Syllable Contact Law (SCL; Murray & Vennemann 1983, Vennemann 1988).

Our results suggest that both universal constraints and language specific effect play a role in the acquisition of initial consonant clusters in Jatt Arabic, where language specific effect also include the frequency of clusters in CDS.

The findings reveal that children acquiring Jatt Arabic use three main strategies to amend initial consonant clusters: C deletion, Epenthesis, and Prothesis. Although C-deletion is a common strategy to simplify clusters cross languages (Ben-David 2001, for Hebrew; Łkaszewicz 2007, for Polish), in our study it was much less common than prothesis in all age groups but the youngest one. This finding supports the claim that universal effect plays a role in language development, and this effect is apparent, in particular, in early stages of acquisition (Adam and Bat-El 2009). Furthermore, the findings indicate that universal effects are reflected in the percentages of the children's faithful productions: On one hand, the better the sonority profile the greater the faithful productions of the cluster. On the other hand, Epenthesis decreased with the goodness of the sonority profile, and this can indicate that SCL play a role in choosing the simplification strategy. So, to conclude, both universal constraints and specific language effects play a role in the initial consonant clusters acquisition in Jatt Arabic.

1. Introduction

According to the nativist view, language learners share a common, dynamic acquisition mechanism as well as properties (Chomsky 1959). In order to shed a light on this hypothesis, several questions are raised. First, are first language learners aware of universal principles in phonological structures? Second, is language acquisition, also, experience-dependent and can be affected by language specific properties? The idea that universal restriction may appear in the early acquisition of phonology may oppose with the knowledge that frequency plays a role in the phonological process in general (Demuth 2007, Lieven 2010) and with the knowledge that the articulatory difficulties may affect the phonological acquisition.

In most languages, frequency and universal principles make the same predictions with regard to particular phenomena, and it is thus difficult to tease apart the effect of these two factors. However, some studies show the contrast between the frequency in the language and universal principles. Jarosz (2017) shows that universal principles can beat frequency in language acquisition. She shows that despite the existence of high-frequency clusters with sonority plateau in Polish, children-acquiring Polish preferred clusters with sonority rise in their first productions. Similarly, Adam & Bat-El (2009) show that frequency does not always predict the order of acquisition; stress in Hebrew is mostly final, and this leads to suggest that final stress will be acquired at early stages of acquisition, but Hebrew-acquiring children prefer non-final stress in the early stage of acquisition.

On the other hand, languages have specific features that children must acquire in their acquisition process. So, assuming the possible effect of universal principles on early language acquisition, the question remains: how one can tease apart these two potential effects.

Palestinian Arabic is a good empirical source which can provide answer these questions due to the large variety of consonant sequences that can stand in word initial onset position. There are very few studies on word initial clusters in Colloquial Arabic, and none on their acquisition.

The current study investigates the acquisition of word initial consonant clusters in Jatt Arabic (JA), a Palestinian dialect spoken the central of Israel. The purpose of the study is to understand the simplification strategies that children utilize until they acquire the consonant clusters and to establish why they prefer to use a specific strategy and not another. An additional purpose is to trace the acquisition process of the initial consonant clusters when taking in consideration the effect of the frequency of the clusters in the language and their sonority profile.

In the first stages of acquisition, a child language is less marked than adult language. This is because children's utterances fit the universal forms more than the specific forms that exist in

the language. As they acquire more specific structures in the language, they become more faithful to the target language (Smolensky 1996a). Assuming Smolensky's claim, I predict that children acquiring Arabic will simplify the initial consonant clusters by C-deletion, like children acquiring other languages. Moreover, Carlisle's (1991b) study for Spanish and Jarosz's (2017) for Polish found that the better the sonority profile of the cluster is the earlier it will be acquired. It is thus proposed that the children's performance will improve with age, but in words with 'good' sonority profile their performance will improve faster than words with 'less good' sonority profile. However, the frequency of the words plays a role in language acquisition (Diessel 2007), and children tend to be sensitive to the frequency of patterns in the ambient language when building their phonological knowledge (Amayreh & Dyson 2000). This can lead to suggest that initial consonant clusters in words with high frequency may be acquired first regardless of whether they have complex templates in terms of sonority or not. Similar to Jarosz's (2017) findings, words with sonority rise profile may be acquired first even if they are less frequent compared to other words.

As a result, this study attempts to address the following questions concerning the effect of universal constraints on language acquisition:

(1) Questions addressed in the study

a. Universal principles

i. Do universal principles (SSP, SDP, and SCL) play a role in the acquisition of initial consonant clusters?

ii. What is the role of cluster frequency in the acquisition of initial consonant clusters (if any)?

b. Language-specific effects

iii. How do universal principles interact with language specific effects?

c. Simplification strategies

iv. What are the strategies children use to simplify complex onsets?

v. Is there a correlation between some strategies and development?

This study examines the effect of both sonority profile of the initial consonant clusters and the frequency of the clusters and the words on the acquisition of these consonant clusters. The children's output was analyzed by dividing their utterances to three levels of sonority in six age groups. The simplification strategies were traced in each word.

The children studied here showed a high percentage of faithful outputs in words with sonority rise profile when compared to sonority plateau profile and sonority fall profile. The findings

show, also, a low frequency of initial clusters in the language according to CDS, However, the words with rise sonority profile are more frequent than the words with fall sonority profile. It may be established that both SSP and frequency affect the acquisition of the consonant clusters. For simplification strategies, the finding showed a language specific effect: children tend to simplify consonant clusters with prothesis more than other strategies (e.g. C-deletion which noticed to be more common in other languages like Hebrew (Bloch 2011, Ben- David 2001) and other languages.

2. Theoretical background: *Universal principles and their role in acquisition*

Most studies on language acquisition agree that children are affected by the input that they receive from the environment to develop their skills during the acquisition process. This leads us to assume that language acquisition depends on the child's experience in the specific tongue. However, some studies show that there are stages in the process of language acquisition where children also use universal principles. This claim is under dispute, and it is thus important to investigate whether language acquisition is subject to universal constraints that we can figure in language acquisition process.

To investigate this issue, a study was conducted on the acquisition of word initial clusters in a dialect of Palestinian Arabic, starting with an early developmental stage. This dialect, like many spoken dialects, has plenty of word initial consonant clusters (e.g. *sˁja:ħ*' shouting'), where many of them violate universal constraints. This can be helpful to determine whether the universal constraints play a role in the acquisition regardless of their massive violation in the ambient language, and what is the role of language specific properties in the process of language acquisition.

Here, two constraints are addressed that are relevant to the acquisition of consonant clusters, both of which refer to sonority. We assume the following sonority scale (Steriade 1982) – from high to low sonority: Glides > Liquids > Nasals > Fricatives > Stops.

(2) The relevant universal principles

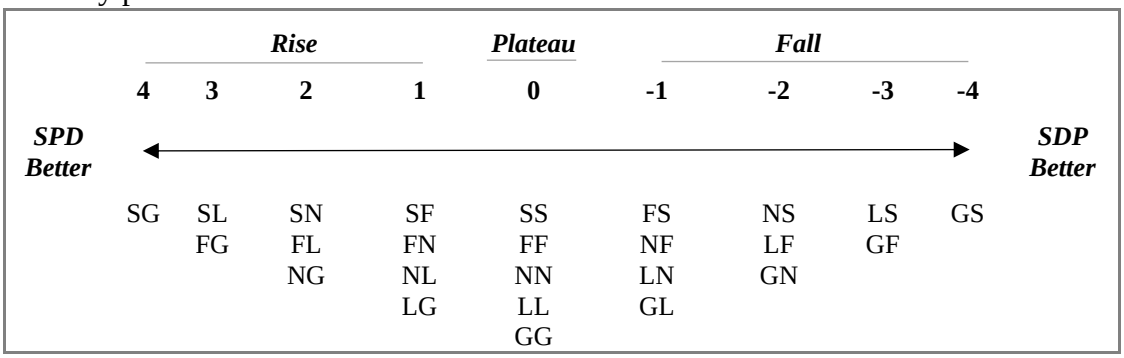
a. **Sonority Sequencing Principle (SSP)**: Sonority does not rise from the nucleus towards the edge of the syllable (Steriade 1982, Selkirk 1984, Clements 1990).

b. **Sonority Dispersion Principle (SDP):** The greater the sonority distance between adjacent consonants, the better (Clement 1990, 1992).

In terms of the SSP, the word ***tr****a:b* 'soil', ***tm****u:t* 'to die FM.', and ***tˁb****u:l* 'drums' are equally good, and better than ***rtˁ****u:bi* 'wetness' since the sonority of the consonants in the clusters of the first three words does not rise toward the left edge of the syllable, while in the fourth one the sonority rises. So the words can be ranked this way: *tra:b, tmu:t, tˁbu:l > rtˁu:bi.* The SDP provides more details with regard to this ranking: the largest sonority distance in these words is in *tra:b,* and the next one is the distance in *tmu:t,* while in the word *tˁbu:l* there is no sonority distance. Thus, the ranking according the two principles together is *tra:b > tmu:t > tˁbu:l > rtˁu:bi*.

As in most studies, we will assume the SSP includes the SDP, such that the SSP is gradual. Below is the sonority sequences and their distances (in numbers), which we divide into three sonority profiles – rise, plateau, and fall. In onset position, sonority rise is the better profile, while sonority fall is the worse; plateau is in between.

(3) Sonority profiles: Rise > Plateau > Fall



Legend: G – Glide, L – Liquid, N – Nasal, F – fricative, S – Stop.

Given the hypothesis that universal constraints play a role in language acquisition, the prediction is that initial consonant clusters with better sonority profile will be acquired earlier than those who violate these constraints.

However, two additional factors may play a role in this process. First, the acquisition of consonants, namely those that have not yet been acquired as singleton, or were acquired relatively late, will not be produced in a cluster. For example, although the cluster *dr* is better than *dm* (SL vs SN respectively; see (2)) in terms of the SDP, it is possible that *dr* will be acquired after *dm* because r is acquired after m. The second factor is the frequency of the clusters in the language; researchers found that frequency has an impact on the emergence of linguistic structure and that some well-known cross-linguistic tendencies arise from frequency effects (Diessel 2007). It is, therefore, possible that frequent clusters with a poor sonority profile will be acquired relatively early. In this study we take into consideration the three factors: sonority profile, the acquisition of singletons, and frequency in Child Directed Speech (CDS).

According to various studies in initial cluster acquisition, at the first stages of acquisition children tend to delete the entire consonant cluster, then they elicit the word with a simplification of the consonant cluster, at the next stage they produce the target word faithfully. Cluster reduction considered as the most common simplification strategy among children (Fikkert 1994, Bernhardt & Stemberger 1998, Ben- David 2001, Mashaqba, Al-Shdifat, Huneety & Abu Alhala 2019), vowel epenthesis, coalescence and metathesis considered as infrequent simplification strategies across languages. However, other studies that deal with consonant cluster acquisition in other Levantine dialects, such as Daana (2009), indicates that prothesis is the most common simplification strategy among acquiring- Arabic children. This

strategy is a very rare strategy in other languages, and this led us to conclude that prothesis is a language-specific strategy since this strategy exists only in languages that do not prohibit it in their phonological grammar.

3. Language background

Arabic is diglossic and stratified into two different linguistic registers – standard and colloquial. Modern Standard Arabic (MSA) is the language taught in schools and spoken in some TV programs, including the news; however, it is nobody's mother language. Colloquial Arabic (CA) is divided into dialects, with over thirty different varieties (Shah 2008), and over 200 million people speakers. Every Arab nation has multiple dialects that vary in some phonological features (Alghmaiz 2013).

In this study we focus on Palestinian Arabic (PA), a member of the Levantine group, along with dialects spoken in Lebanon, Syria, and Jordan (Rosenhouse 2000, Diab and Habash 2007, Abu Guba 2018). The Arabic dialects spoken in Israel/Palestine are divided into three main groups: Northern, Central and Bedouin (Havelova 2000). Further division is made according to non-geographical parameters such as urban and rural, sedentary and semi-nomadic, Muslim, Christian and Druze, and male and female (Kaye & Rosenhouse 1997, Rosenhouse 1998-1999).

The data in this study are drawn from the dialect spoken in Jatt, a village located at the triangle region in the central of Israel. Approximately 13,000 people reside in Jatt, whose dialect is classified as rural, Muslim, and sedentary.

3.1. Phonological variation and change

Colloquial dialects of Arabic differ from MSA in several phonological properties (in addition to morphological and syntactic/semantic properties). MSA has three vowels – a, u and i, which can be short or long, while many spoken dialects have two additional mid vowels /e/ and /o/, which can also be short or long. The long mid vowels e: and o: replaced the MSA diphthongs aj and aw respectively (Shahin 2003, Mustafawi 2019; e.g. *kawn* → *ko:n* 'universe', *lawn* → *lo:n* 'color' , *ʕajn* → *ʕe:n* 'eye', *waladajn* → *walade:n* 'two boys').[1]

Consonant change is one of the salient phonological differences between MSA and colloquial dialects, as shown below:

[1] These two diphthongs are often preserved in personal names in many Arabic dialects including JA (e.g. *ludʒ͡ajn*, *kawϑar*).

(4) Consonant change: From MSA to colloquial dialects

MSA	***Jatt Arab***	***Nazarene Arab.***	***Cairene Arab.***	***Kuwaiti Arab.***
d͡ʒ	d͡ʒ	ʒ	g	j
ð	ð	d	d / z	ð
θ	θ	t	t / s	θ
q	q/ k	ʔ	ʔ	g
k	k/ t͡ʃ	k/ ķ	k	t͡ʃ

Some consonantal changes are involved in a chain shift, as in the case of q > k > t͡ʃ. In rural dialects like JA, the dialect studied here, MSA k is replaced with t͡ʃ (e.g. *kúrsi* → *t͡ʃúrsi* 'chair', kálib → *t͡ʃálib* 'dog'); however, due to the low prestige of the replacement, some speakers avoid it. While MSA k is replaced by [t͡ʃ], k resurface as a replacement of MSA q (e.g. *qáhwi* → *káhwi* 'coffee'), though in a few words, especially in those with emphatic consonants, /q/ is retained (e.g. *qáras*ˁ 'he stings', *qútˁub* 'pole') probably due to emphasis spread (Davis 1995, Huneety and Mashaqba 2016). In addition to the variation just mentioned, the replacement is lexical as there are words that maintain their q with no obvious reason (e.g. *qámar* 'moon') and others that maintain their k (e.g. *kábil* 'before').

One of the most prominent phonological properties that varies among dialects is consonant clusters, in particular in word initial and word final position (see Kiparsky 2003 for typology and analysis). While MSA allows word final clusters, in many cases, JA and all Levantine dialects (Syrian, Lebanese and Jordanian) resolve these clusters with vowel epenthesis (e.g. ʃahr → *ʃaha**r*** 'month', ʔistaʕmalt → *ʔistaʕmal**i**t* 'I used'). So, in these dialects some clusters are preserved, and some are resolved. Examples are given in (5).

(5) Preserved and unpreserved final clusters in Levantine Arabic

MSA	***Levantine dialect***		
nafs	nafs	'self'	Nortern Jordanian Arabic (El-Badarin & Bani-Yasin 1993)
qasˁtˁ	qasˁtˁ	'installment'	Jatt Arabic
ħilm	ħil**i**m	'dream'	Ammani Arabic (Al-Sughayer 1990)
ʔibn	ʔib**i**n	'son'	Lebanese Arabic (Gouskova & Hall 2009)

Conversely, while MSA does not allow word initial clusters, JA, all Levantine dialects, and some of the gulf region dialects have a rich inventory of word initial consonant clusters. These clusters are of a major interest to linguistic theory, and serve as the focus of our study, since some of them (e.g. *lba:n* 'gum', *mkawwis* 'curved M.') violate the SSP (see §2).

Based on the differences between MSA and CA, Saiegh-Haddad & Spolsky (2014) divided the lexicon of PA into three groups:

a. Identical words: words that maintain their surface phonological form in CA and MSA (e.g. *ʃá:riʕ* ‘street’, *ʔísˁbaʕ* ‘finger’, *sá:ʕa* ‘clock’);

b. Cognate words: words with slightly different phonological form (e.g. consonant, vowel) (e.g. MSA *kanaba* vs. PA *kanaba:j* ‘sofa’, MSA *qásˁr* vs. PA *qásˁir* ‘palace’; MSA *madˁbú:tˁ* vs. PA *mazbú:tˁ* ‘correct’); and

c. Unique words: entirely different lexical forms (e.g. MSA *ħaqi:ba* vs. PA *ʃante* ‘bag’; MSA *kúra* vs. PA *tˁá:be* ‘ball’; MSA *míħfaðˁa* vs. PA *d͡ʒuzdá:n* ‘wallet’).

Lexical items in Arabic Child Directed Speech are distributed as follows: Identical Words 21.2% of the total number of word types, cognates 40.6%, and unique words 30.9% (Saiegh-Haddad & Spolsky 2014).

3.2. The phonology of Jatt Arabic

In this section we provide some information regarding the phonology of JA, which is similar to that of other Palestinian dialects (Taibih Arabic; Massarwa 2007, Abd El kadir 2018, Kfar Kanna Arabic; Abu-Dahud 2016), Jordanian Arabic (Amayreh & Dyson 1998, AbuAbbas 2003, Daana 2009, Mashaqba et al. 2019), and Lebanese Arabic (Hamdi et. al. 2005).

3.2.1. Segmental inventories

There are 28 consonants in JA, most of which also exist in MSA, though with a few changes as noted above.

(6) Consonant inventory in Jatt Arabic[2]

	Labial	***Labiodental***	***Interdental***	***Alveolar***	***Post-alveolar***	***Palatal***	***Velar***	***Uvular***	***Pharyngeal***	***Glottal***
Plosive	b			t d			k	q		ʔ
				tˁ dˁ						
Affricate				d͡ʒ[3]						
Fricative		f	θ ð	s z	ʃ		x ɣ	χ	ħ ʕ	h
			ðˁ	sˁ						
Nasal	m			n						
Lateral				l						
Trill				r						
Glide						j	w			

[2] The children participating in this study and their parents preserve [k]. Therefore, /t͡ʃ/ is not included in the inventory.

[3] In the sonority scale, d͡ʒ considered as stop.

All emphatic consonants are in use in JA. An emphatic consonant can cause an emphasis spread of the whole syllable, so the emphatic effect can be regressive or progressive (Davis 1995, Watson 1999). Unemphatic suffix can be emphasized, also, when it added to an emphatic stem. In most cases in JA, dˤ replaced with ðˤ (e.g. *ra:dˤi:* → *ra:ðˤi:* 'satisfied MS.SG') or with ẓ (*madˤbu:tˤ* → *maẓbu:tˤ* 'correct'). This can lead to a cognate word that differ in this segment specifically (see §3.1).

The vocalic system of JA consists of 5 vowels, phonemically contrasting in length, thus altogether 10 contrastive vowels.

(7) Vowel inventory in Jatt Arabic

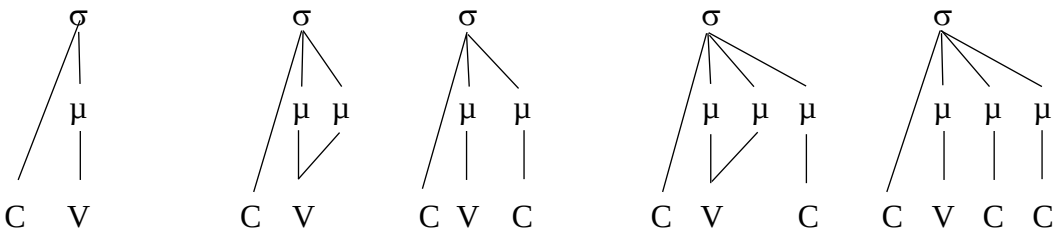
Short vowels	***Long vowels***
i u	i: u:
e o	e: o:
a	a:

3.2.2. Syllables and moras

Syllables in JA, as in many other dialects Arabic, have three weight levels – light, heavy, and super-heavy (Holes 1995, Watson 2011). Light syllables are open syllables (CV), heavy syllables are open or closed (CVV or CVC), and super-heavy syllables are closed with simple or complex coda (CVVC or CVCC). Assuming the moraic theory of syllable structure (Hayes 1995), a light syllable (8)a has one mora, and since onset and vowel nucleus are obligatory in Arabic, the light syllable is CV; a heavy syllable (8)b has two moras – a vowel and simple coda or long vowel; and a super-heavy syllable (8)c has three moras – either a long vowel with a simple coda or a short vowel with a cluster in the coda.

(8) Syllable structure in Arabic

a. Light *b. Heavy* *c. Super-heavy*



In dialects like those represented in (8), the final mora in heavy and super-heavy syllables is considered extrametrical (Hayes 1981, 1995; McCarthy & prince 1990b), so CVC syllable

behaves like a CV syllable and final CVCC behaves like CVC. And this can explain why CVCC / CVVC syllables attract stress, while CVC syllables do not (Watson 2002).[4]

(9) Syllable types in JA

	Syllables with simple onset			***Syllables with complex onset***		
Light	CV	**ká**.tab	'book'	CCV	**stá**.lam	'he received'
Heavy	CV:	**qá:**.bal	'he met'	CCV:	**ktá:**.bi	'my book'
	CVC	**mád**.ra.si	'school'	CCVC	**tʕál**.lim	'she will teach'
Super-	CV:C	nad͡ʒ.**d͡ʒá:r**	'carpenter'	CCVCC	**n-d͡ʒann**[5]	'he got crazy'
heavy	CVCC	**qérd**.na	'our monkey'	CCV:C	**blá:d**.na	'our countries'

The distribution of consonant clusters is restricted (Herzallah 1990). CCV:C syllables are restricted to word initial position, while CCVCC syllables are restricted to monosyllabic verbs, while CVCC syllables are restricted mostly to word final position, though they may appear word medially under certain conditions.

3.2.2.1. Onsets

Onsets are obligatory in all Arabic dialects, and in many spoken dialects, unlike in MSA, word initial consonant clusters are permitted (Al-sughayer 1990; El-Badarin and Bani Yasin 1993; Abu-Guba 2018; Abu Salim 1982; McCarthy 1981, 1982). In word medial position, an onset cluster is prohibited, as evident by the epenthetic vowel inserted in word medial position (e.g. *ʕal-kursi* 'on the chair' vs. *ʕal-**i**kta:b* 'on the book'). Being relatively marked universally, word initial consonant clusters are not very common; for instance, in Lebanese Arabic, only 8.3% of the words (in a corpus of 750 words) have word initial clusters (Hamdi et al. 2005).

(10) Complex onsets in Lebanese Arabic (Hamdi et al. 2005)

CCVC	4.0%	mʕáq.qad	'composed'
CCV	3.0%	nd͡ʒá.bar	'he was forced'
CCV:C	1.0%	sˤfu:f	'classes'
CCV:	0.3%	klá:.bu	'his dogs'

[4] The structural interpretation of extrametricality varies among researchers. Some assume that final codas in super-heavy syllables do not have a mora (Bokhari 2020), while others link the final mora to a node above the syllable (Hayes 1981, 1995; McCarthy and prince 1990b, Kiparsky 2003). Either way, this issue is not relevant to the present study which focuses on word initial rather than final position.

[5] In JA, this structure for verbs is only with geminates in the coda position (i.e., $C_1C_2VC_3C_3$).

The source of word initial clusters is often a process of vowel deletion in an open unstressed syllable (Kiparsky 2003), usually in the form of a high vowel (e.g. *ħ**i**sˤa:n* → *ħsˤa:n* 'horse', *q**u**lu:b* → *qlu:b* 'hearts'), but in some dialects also a low vowel (e.g. *m**a**ri:dˤ* → *mri:dˤ*). However, the most common epenthetic vowel in Palestinian Arabic, and so in JA, is e (Herzallah 1990). This process is also the source of cognates words, i.e. words in CA that differ from their correspondents in MSA in one segment only (see §3.1). However, we can see initial consonant clusters also in unique words, i.e. words that differ from MSA totally (e.g. *ħra:m* 'blanket'; MSA *batˤtˤa:nijja*).

Many of the word initial clusters in JA violate the SSP (see §2). This is most notable in clusters that straddle morpheme boundaries, given the sonorant prefixes/ prefixes *m-*, *n-*, *j-* which lead to clusters with sonority fall (e.g. *m-bájjin* 'clear MS.SG', *n-bátˤtˤil* 'will cancel 1PL', *j-d͡ʒáhhiz* 'will prepare 3PL').

3.2.2.2. Codas

JA allows singletons in coda position word medially and word finally (e.g. *ma**d**.ra.si* 'school', *qa.mi:**s**ˤ.ha* 'her shirt', *mán.ðˤa**r*** 'view'). Consonant clusters in codas are limited to derived environment, when a word ending with a consonant cluster is followed by a consonant-initial suffix/clitic, such as *-na* 'for us / our', *-ha* 'for her/ her', and *-li* 'for me / mine' (e.g. *qá**lb**-na* 'our heart', *qú**lt**-li* 'you said to me'). While consonant clusters are preserved in derived medial position, they are usually simplified via epenthesis in word final position (e.g. ʔisˤtˤabl → *ʔísˤ.tˤa.b**i**l* 'stable', ʔuxt → *ʔú.x**i**t* 'sister'). This process gives rise to cognate words (see §3.1) when comparing MSA and JA (e.g. MSA kasr → *kasir* 'fraction').

However, not all words undergo simplification. In some cases, the consonant clusters in the coda are preserved, in particular when the SSP is respected (e.g. *ʕunf* 'violence'). Further research is required to reveal whether cluster preservation word final codas is lexical, given the minimal pairs *mad͡ʒd* 'personal name' – *mad͡ʒid* 'glory' and *fardˤ* 'duty' – *faradˤ* 'he commands', *faridˤ* 'suggestion'.

JA shares with MSA the preservation of final geminates (e.g. *sa:mm* 'poisonous'; **samim*). This phenomenon, termed geminate inalterability (Hayes 1986), is attributed to the non-linear structure of geminates whereby a segment is linked to two prosodic positions and thus cannot be split by epenthesis (McCarthy 1986).

Word medial codas can also host the first part of a geminate (e.g. *ʕasˤsˤa:ra* ‘squeezer’). All consonants in Arabic can be geminated (Al-Tamimi, Abu- Abbas and Tarawneh 2010). Some geminates are lexical (e.g. *sábbak* ‘preceded MS.SG’, sám.ma ‘he named’), appearing as such in the underlying representation. Others are derived, as in the case of the definite article *l-* which assimilates to a following coronal (e.g. *ʔel- θáʕ.lab → ʔeθ.θáʕ.lab*, *ʔel dak.tó:r → ʔed.dak.tó:r* ‘the doctor’).

3.3. Stress

As in many dialects of Arabic, including MSA, stress in JA is weight-sensitive (Hayes 1995, Watson 2011). Stress is assigned to the rightmost super-heavy syllable – CVCC or CV:C (11)a; in the absence of a final super-heavy syllable, stress falls on the penultimate syllable if it is heavy – CVC or CV: (11)b; otherwise, stress falls on the antepenultimate syllable (Abu Abbas 2003). This mean that stress lands on one of the three final syllables (known as the trisyllabic window) even if the pre-antepenultimate syllable is heavy.

(11) Stress in JA

a.	*Final*	nad͡ʒ.**d͡ʒá:r**	‘carpenter’
		fusˤ.**tˤá:n**	'dress'
		ba.qa. **rá:t**	'cows'
b.	*Penultimate*	tˤaj.**já:**.ra	'airplane'
		qa.**rásˤ**.ha	'he bites her'
		ma.**xá:**.zin	'storages'
c.	*Antepenultimate*	**sá**.ma.ki	'fish SG'
		sa:.**má**.ħa.tu	'she forgave him'
		bit.**sáb**.ba.ħu	'they are swimming'

4. The acquisition of Arabic phonology

In this section, I review the literature on the acquisition of Arabic with emphasis on complex onsets. We start with the acquisition of phonology in general – the consonants, the syllables, the prosodic word and then focus on onset clusters.

4.1. Consonants

There are few studies on the acquisition of Colloquial Arabic consonants. All studies show that most of Colloquial Arabic consonants are acquired till the age of 03;11.

There are several studies that have dealt with the acquisition of consonants in Arabic dialects spoken in Israel: Rosenhouse (2000), who drew her data from 24 Arabic-acquiring children from different towns in northern Israel starting with the age 02;06, reports that most consonants were acquired till 03;00; the emphatics /sˤ, dˤ, tˤ/ and d͡ʒ and ʃ were acquired later, around the age 04;00. Abu-Dahud (2016), who studied 126 children that were acquiring Kfar- Kanna dialect in northern Israel, reports that children acquired most of the consonants till the age of 03:11. Massarwa (2007) and Abd El Kader (2018) studied the consonants acquisition in Taibeh dialect spoken in the center of Israel, which is the closest one to JA. Massarwa (2007) derived her data from forty children at the age of 03;00- 04;00, and the criterion they she was 75% of participants in the age group elicit the segment correctly in two different prosodic positions. According to Massarwa (2007), all consonants are acquired till the age 03;00 except /l, q, d, ʃ/ that acquired at age 04;00. Abd El Kader (2018) traced the acquisition of consonants in 8 children that acquiring Taibeh dialect between the ages 02;00- 03;00. He found that all consonants except dˤ are acquired till the age of 03;00.

The differences between the studies above are probably due to the different research methods, as well as the differences between the dialects since not all dialects include the same consonantal system.

The findings of this previous studies are quite similar to other studies on other dialects that did not belong to Palestinian dialects group (Omar 1973, for Egyptian Arabic; Amayreh & Dyson 1998, for Jordanian Arabic (more details in Appendix A).

4.2. Vowels

Vowels are acquired at early stages of acquisition in all languages. Massarwa (2007) found that all vowels are acquired before the age of 03;00. Abd El Kader (2018) who tested younger children found that vowels are acquired till the age of 02;03.

4.3. Prosodic word

Disyllabic and trisyllabic words are the most frequently found in Arabic, while monosyllabic and quadrisyllabic words are relatively rare (Huneety & Mashaqba 2016). Nevertheless, at the onset of speech, children produce monosyllabic CV words as a result of non-final or non-stressed syllable truncation (e.g. *bátˁtˁa* → *ta* 'duck'). This stage is rather short (Mashaqba 2015), since it concludes as the children reach the minimal word stage (Demuth and Fee 1995, Demuth 1996). At this stage, the children's productions fit a binary foot, be it either moraic (e.g. laj.mú:n → *mú:n* 'lemon') or syllabic (e.g. kalib → *ʔá.bib* 'dog').

Due to the size limit during the minimal word stage, the minimal word constraint, long words, with more than two syllables or more than two moras undergo truncation, where the surviving syllables are usually the acoustically prominent ones – the stressed and final ones (Ben-David & Bat-El 2017, Mashaqba et al. 2019). When these two prominent syllables compete, the final (unstressed) syllable has better chance to survive than the stressed (non-final) one (Ben-David & Bat-El 2017). So, a word like *za.rá:.fi* 'giraffe' develops by these steps: *fi* > *rá:.fi* > *za.rá:.fi.*

4.4. Syllables

As discussed above, Arabic has plenty of syllable shapes. The CV syllable is universally the most predominant type of syllables in child language as it is the least marked (Fikkert, 1994). Mashaqba et. al. (2019) studied the acquisition of syllable structure in Jordanian Arabic by 20 children divided into the four age groups (1;0-1;6, 1;7-2;0, 2;1-2;6, and 2;7-3;0). According to this study, the syllables CV, CVV, CVC, and CVVC appeared in the youngest group (01;00-01;06), with CV and CVC being the most common one. However, syllables with initial consonant clusters appeared later, at the age of 02;07-03;00, and they were relatively scarce. Throughout all ages, the most frequent syllable shape were CVC (38%) and CV (30%). That is, against universal markedness, CVC was more common that CV.

(12) Syllable shapes across age groups (Mashaqba et. al. 2019)

Syllable shape	*Age group*				*Total*	*Frequency (%)*
	1;00- 1;06	*1;07- 2;00*	*2;01- 2;06*	*2;07- 3;00*		
CV	43	32	33	45	153	30.0
CVV	25	9	15	12	61	12.0
CVC	40	49	60	41	190	38.0
CVVC	16	23	24	11	74	14.7
CCV	0	0	0	1	1	0.2
CCVV	0	0	0	0	1	0.2
CCVVC	0	0	0	6	6	1.2
CCVC	0	0	0	3	3	0.6
CCCVV	0	0	0	0	0	0.0
CCVCC	0	0	0	1	1	0.2
CVCC	0	0	0	11	11	2.2
CCVC	0	0	0	3	3	0.6
CVVCC	0	0	0	0	0	0.0

Universally, closed syllables are very limited in children first words. However, in languages that allow geminates, children tend to close the first syllable with a geminate in polysyllabic productions (e.g. *ʔarnab* → *ʔannab* 'rabbit').[6] This raises the number of CVC syllables in early stages of acquisition.

4.5. Word initial clusters

Universally, complex onsets are acquired rather late relative to other phonological structures. In Arabic, children acquire complex onsets around age 4 or 5 (Haelsing & Madison 1986), though clusters start emerging at age 02;07- 03;00, mostly in monosyllabic words (Mashaqba, 2019). The late acquisition can be attributed to several factors, such as the low frequency of the complex onsets in the ambient language, the complexity of complex onsets relative to singletons, their position at the beginning of the word since children are more faithful to the right edge of the target word (Ben-David and Bat-El 2017).

With respect to sonority, Daana (2009) found that Arabic-speaking children by the age of two are not sensitive to sonority distance between the two consonants in the cluster, and their productions are more affected by their ability to produce segments. She also found that frequency of the clusters in their ambient language (Ammani Arabic) plays a role in this stage and influenced their productions more than universal constraints, so they tried to simplify clusters that violate the universal principles more than others, and at this age children started to use epenthesis and prothesis more than C deletion. Her findings show also that even till the age of six, children didn't reach adult language and they still do cluster simplification especially in clusters with sonority fall profile such as *mʕ*.

[6] Note that a geminate straddle two syllables – to coda of one syllable and the onset of the immediately following syllable (e.g. *da**r.r**as* 'to teach'; cf. *daras* 'to study').

C-deletion (known as cluster reduction or truncation) is considered the most common strategy in cluster simplification among children acquiring various languages (e.g. Hebrew *klum* → *kum* 'nothing', English *blu* → *bu* 'blue'; Fikkert 1994, Bernhardt & Stemberger 1998, Ben-David 2001), and it is one of the persistent phonological processes during speech acquisition in children (McLeod, Doorn & Reed 2001). It progresses till the age of 5 with a few incidences in child speech through age 8 (Roberts, Burchinal, & Footo 1990). According to studies on cluster acquisition, children prefer to retain the less sonorous segment of the cluster (Barlow 1997, Ohala 1999, Gnanadesikan 2004).

Other simplification strategies in children were mentioned in many studies to be infrequent: Vowel epenthesis, in which vowel is inserted between the two consonants in the cluster; Coalescence, which is a production of one consonant containing features of both consonants in the cluster; metathesis, which is a transposition of the two consonants in the cluster - the reversal of segments (Greenlee 1974, Fikkert 1994, Bernhardt and Stemberger 1998, Ben-David 2001, Pater & Barlow 2003, Wheeler 2005, Daana 2009, Karni 2011, Alqattan 2015).

(13) Simplification strategies of initial consonant clusters

	Example from English and Hebrew		***Example from Arabic***	
C deletion	kliːn → kiːn 'clean'	English Pater & Barlow 2003	bwaːb→baːb 'doors'	Jordanian Arabic Danna & Khrais 2018
Epenthesis	gvina → gevina 'cheese'	Hebrew Karni 2011	bɾuːħi→bəɾuːħi 'alone'	Kuwaiti Arabic Alqattan 2015
Coalescence	tʁufa → kufa 'medicine'	Hebrew Ben- David 2001	ʒmaːl→baːl 'camels'	Jordanian Arabic Daana 2009
Metathesis	glida → gilda 'ice cream'	Hebrew Ben-David 2001	xʃuːm→ʃxuːm 'noses'	Kuwaiti Arabic Alqattan 2015

Studies on the acquisition of Arabic clusters reveal two additional strategies (Daana 2009, Daana & Khrais 2018) – prothesis and gemination. Prothesis is the insertion of /ʔi/ before the first consonant in the cluster (actually, it is the insertion of /i/ and /ʔ/ is a phonetic filler of the empty onset). Prothesis was also found, among Spanish-speaking children and adults as a strategy for modifying loan words with sC clusters to the ambient language (e.g. *skuł* → *eskul* 'school'; Carlisle 1991a, Yavaş & Barlow 2006). Gemination, the other strategy reported only for the acquisition of Arabic clusters is rather rare (e.g. *tra:b* → *tta:b* 'soil'; Daana & Khrais 2018).

With respect to the order at which clusters are acquired, we expect the effect of SSP and SDP (see §2), which together state that C_1 should be less sonorous than C_2 (SSP) and the greater the sonority distance between the consonants the better (SDP). These principles assume the following sonority scale (see the detailed scale in §2 above):

(14) The sonority scale (Yavaş 1998, Clements 1999)

Stops	Fricatives	Nasals	Liquids	Glides
1	2	3	4	5

less sonorous *more sonorous*

These principles provide a scale of sonority profile for clusters (e.g. *ts* > *tk*, *kn* > *nd*) (see table (3) in §2), and it is predicted that the better the profile earlier the cluster will be acquired (e.g. the cluster in *dmuːʕ* 'tears' is expected to be acquired before the cluster in *kta:b* 'book').

Below are the sonority distance values for complex onsets in JA with their sonority distance values. It is predicted that the higher the sonority distance the earlier the acquisition, i.e. DIST 3 > DIST 2 > … DIST -1.

(15) Words organized by sonority distance

Sonority profile	***Distance***	***Type***	***JA***	***Gloss***
Rise	1	Stop–Fricative	dfu:f	'tambourine'
		Fricative–Nasal	xmi:l	'thick'
		Nasal–Liquid	mla:ħ	'good PL.'
		Liquid–Glide	rjá:li	'spittle'
	2	Stop–Nasal	kmá:d͡ʒi	'piece of bread'
		Fricative–Liquid	zla:m	'men'
		Nasal–Glide	nja:ʕ	'cheeks'
	3	Fricative–Glide	swa:ka	'driving'
		Stop–Liquid	tla:l	'hills'
	4	Stop–Glide	kwa:m	'piles'
Plateau	0	Stop–Stop	kta:b	'book'
		Fricative–Fricative	xza:ni	'closet'
		Nasal–Nasal	mnawwir	'shining'
		Glide–Glide	j-waddi	'to send'
Fall	-1	Fricative–Stop	skamli	'stool'
		Nasal–Fricative	mfákkir	'he thinks'
		Liquid–Nasal	rmu:ʃ	'eyelashes'
		Glide–Liquid	wla:d	'children'
	-2	Nasal–Stop	mba:riħ	'yesterday'
		Liquid–Fricative	lsa:n	'tongue'
		Glide–Nasal	j-má:niʕ	'he refuses'
	-3	Glide–Fricative	j-ʃá:rik	'he shares'
		Liquid–Stop	rka:ðˁ	'running'
	-4	Glide–Stop	j-tˁabbil	'to nock'

In addition to the SSP and the SDP, the acquisition of segments must be taken into consideration in determining the order of cluster acquisition. For example, although the cluster *dr* is better than *dm* in terms of the SDP, it is possible that *dr* will be acquired after *dm* since r is acquired after m.

Finally, the frequency of the clusters needs to be taken into consideration, since frequency often plays a role in language acquisition. (Diessel 2007). In most cases, high frequency cluster are with better universal principles, but in some cases, they are not (see Jarosz 2017 for Polish).

The above-mentioned principles were addressed in several studies on complex onsets. In their study on Moroccan Judeo-Spanish, Adam & Bradley (2018) suggest several constraints that can affect the acquisition of a sequence of two consonants C_1C_2, and they took the sonority distance between two adjacent segments in the initial cluster into account. They assume that similarity avoidance constraints (like OCP) play a role when having two adjacent consonants. Carlisle (1991b) also investigates the effectiveness of SSP on production by 11 native speakers of Spanish. He found that the clusters that violate the SSP are more likely to be changed. Furthermore, Jarosz (2017) studied consonant cluster in polish by examining four native speaking children. She noted that although the frequency of Polish clusters contradicts the SSP, children are sensitive to the SSP and prefer onset clusters with larger sonority rises.

5. Research program

This study addressed the acquisition of initial consonant clusters in JA, taking into consideration the interaction of universal principles and language specific effects (see review in §2). In this section research questions and hypotheses (§5.1) are introduced and details regarding the research method used are provided (§5.2.).

5.1. Research questions and hypotheses

This research contains five main questions:

a. Universal principles

   i. Do universal principles (SSP, SDP, and SCL) play a role in the acquisition of initial consonant clusters?

   ii. What is the role of cluster frequency in the acquisition of initial consonant clusters (if any)?

b. Language-specific effects

   iii. How do universal principles interact with language specific effects?

c. Simplification strategies

   iv. What are the strategies children use to simplify complex onsets?

   v. Is there a correlation between some strategies and development?

The clusters in the study are divided into 3 main groups: (1) sonority rise, (2) sonority plateau, and (3) sonority fall. We hypothesize that clusters with sonority rise will be acquired first, then clusters with plateau and finally clusters with sonority fall.

Following Jarosz's (2017) study on the role of universal principles in the acquisition of Polish clusters, we expect universal principles to override frequency. We also hypothesize that the effect of universal principles will gradually diminish, as argued in Adam and Bat-El (2009) for the acquisition of Hebrew stress.

5.2. Research method

The empirical basis of the study was obtained via word elicitation.

5.2.1. Participants

Forty-six typically developing monolingual children from middle-class families participated in the study. According to parents in the personal interview, none of the participants had any history of speech language therapy, hearing loss, or any developmental delay. They were divided into six age groups[7]: 02;00– 02;06, 2;07–3;00, 03;01–03;06, 03;07–04;00, 04;01–04;06, and 04;07– 05;00. The youngest group included 6 children, the other groups each one included 8 children. The children were randomly selected, mostly from Jatt and a few from Baqa, a close-by village with many mothers who were born in Jatt (mentioned in (16)). Consent forms were sent to the parents directly (Appendix D), and they returned it to give their approval for participating in the study.

For the children from Jatt, the two parents were born in Jatt and are native speaker of JA. For the children from Baqa, their mothers were born in Jatt and are native speaker of JA, while the fathers were from Baqa (More details about the children are in appendix E).

(16) The participants

Age group	*Boys*	*Girls*	*From Jatt*	*From Baqa*	*Total*
1	3	3	6	0	6
2	3	5	6	2	8
3	3	5	6	2	8
4	3	5	7	1	8
5	5	3	8	0	8
6	2	6	8	0	8

5.2.2. Pretest

Given the age of the participants, some segments were expected to be deleted or replaced with others, not because of the cluster but rather because they have not yet been acquired. As mentioned earlier in §4.1 some consonants are acquired after the age of 03;00 (like the affricate

[7] These age groups were selected in light of Mashaqba et al. (2019) study of the acquisition of syllable structure in Jordanian Arabic (for more details see §4.3).

d͡ʒ, the stridents, the emphatics, and r). Therefore, a pre-test was conducted in order to map the segments that have been acquired and the strategy the children use in handling the segments that they have not acquired yet (e.g. replacement, deletion). This was competed to make sure that cluster errors in the main task are not due to the absence of a consonant from the child's inventory. The pre-test was an unmodified test, conducted before the main task. It examined the word initial consonant inventory of each child.

The test consisted of 21 picture words that allowed to produce all JA consonants that included in the initial cluster in the main task (b, m, n, t, tˤ, d, k, q, d͡ʒ, s, sˤ, z, f, θ, x, h, ħ, l, r, w, j). Each one of these segments appeared in initial position as a singleton in a mono or disyllabic word to ensure that the first syllable would not undergo truncation (Appendix A). Colourful pictures in computer slides were used to elicit the data from each child. To establish picture clarity, a pilot test was conducted before in 3 children and one adult.

At first, I intended to conduct the main task (and the pre-test) for the children myself at several kindergartens and homes in Jatt and Baqa. But, due to the COVID-19 pandemic, I could not reach the children easily. The pictures and instructions of the main test and the pretest were prepared in two separated documents, and they were sent to the parents by e-mail or WhatsApp. The instructions were detailed for the parents in writing and verbal guidance.

The first step was to pass the pre-test: The parent, whose mother dialect is JA, conducted the pre-test for the child, during which the child was video- or audio-taped. The parents asked the children in each picture "what do you see?", while the children were asked to name the pictures. If the child failed to name the picture spontaneously, he/she was given two pictures to determine which one of them is the target to make sure that he/she can identify the picture.

5.2.3. Main task

The task was a picture naming task. The purpose of this task was to get participants' initial consonant clusters productions.

The test includes 26 high frequency words with initial consonant clusters[8]:

[8] Some children produced the word *ħra:m* 'thin blanket' instead of the target word *lħa:f* 'thick blanket'. Since *ħra:m* has an initial consonant cluster, it was taken into account in the analysis.

(17) Stimuli of the main test

Sonority profile	***Cluster type***	***Word***	***Gloss***
Rise	Stop–Fricative	dha:n	‘paint’
		kθi:r	‘lot’
		qsˁi:ri	‘short FM’
	Stop- Nasal	dmu:ʕ	‘tears’
		kna:fi	‘a traditional sweet dessert’
	Stop–Glide	tˁwi:l	‘tall MS’
	Fricative–Nasal	ħma:r	‘donkey’
	Fricative- Liquid	ħra:m	‘thin blanket’
	Fricative- Glide	xja:ra	‘cucumber’
		swa:ra	‘bracelet’
	Nasal- Liquid	mra:	‘mirror’
Plateau	Stop- Stop	kbi:r	‘big’
		kta:b	‘book’
	Fricative- Fricative	xza:ni	‘closet’
		ħsˁa:n	‘horse’
		zɣi:ri	‘small FM’
Fall	Glide–Liquid	wla:d	‘boys’
	Glide–Fricative	wsa:di	‘pillow’
	Liquid–Nasal	rmu:ʃ	‘eyelashes’
	Liquid–Fricative	lħa:f	‘thick blanket’
		lsa:n	‘tongue’
	Liquid–Stop	lba:n	‘gum’
	Nasal–Affricate	nd͡ʒa:sˁa	‘pear’
	Nasal–Fricative	msakʕa	‘cold FM’
	Fricative–Stop	zba:li	‘trash’
		sba:ħa	‘swimming’
		ftˁu:r	‘breakfast’

16 words of them are monosyllabic words and 10 disyllabic words, all with penultimate stress (e.g. *swá:.ra* ‘bracelet’); 20 nouns and 6 adjectives (18).

(18) The numbers of various templates in the stimuli

	Monosyllabic	***Disyllabic***	
Template	**CCV:C**	**CCV:.CV**	**CCVC.CV**
Nouns	13	7	0
Adjectives	3	2	1

The target words in the main test are divided into 3 main groups according to their cluster sonority profile: Words with sonority rise clusters, words with sonority plateau clusters, and words with sonority fall clusters. 10 words are with sonority rise clusters, 5 words with sonority plateau clusters, and 11 words with sonority fall clusters.[9]

There were some more factors that were taken in consideration when choosing the specific words. In (18) the words of the main test.

All stimuli were high frequency words used in the children's life (e.g. using the word *kbi:r* 'big' but not the word *qbu:r* 'graves'). Other factors that were taken into consideration are the following:

a. Phonological: Tri-syllabic words were because they may undergo a truncation of the first syllable (see §4.2), especially in the young age groups (e.g. *mlo:.xíj.ji* 'very famous traditional food').

b. Morphological: Broken plurals were avoided (e.g. *kla:b* 'dogs') since they are acquired around age 5-6 years (Saiegh-Haddad, Hadieh & Ravid 2012). However, there are 3 broken plurals in the stimuli, since they are frequent (e.g. *wla:d* 'boys') and there were no frequent singular words with the same clusters that can replaced them. Also verbs were excluded, because they are known to be acquired after nouns cross-linguistically (Berman 1999). With the exclusion of verb, we also excluded heteromorphemic clusters (e.g. *n-lawwin* 'we will paint', *j-sʕalli* 'he will pray').

c. Applicational; There were no words that could not be shown as pictures, even if they are frequent (e.g. *mli:ħ* 'good').

The colored pictures were displayed to the children by slides on the computer. To make sure that the words are familiar enough to the children, two speech-and-language-therapists and one kindergarten teacher checked the list of the words before running the task on children. To ensure that the pictures were clear, a pilot test was conducted beforehand on three children and one adult. In addition, in order to ensure that the child distinguishes the word, when he/ she didn't name the picture, the parent was required to show him two pictures when one of them is

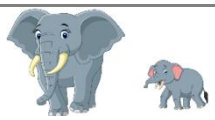
[9] In the case that a child produced *ħra:m* instead of *lħa:f,* the number of sonority rise words was 11 and the number of sonority fall words was 10.

the picture that the child didn't name, and ask the child to determine which picture refers to the word that the parent naming (for example: When a child didn't name the picture of 'breakfast', the parent stopped and showed him two pictures and then asked him "where is 'breakfast'?").

The main test was conducted twice at the same day for each child and the second experience was the decisive one. Finally, the recordings were strictly transcribed twice.

The main test was divided to two tasks: (i) Picture naming task (includes target words that are nouns) – the parent pointed at the target picture and asked the child "what is this?" or "what do you see?"; (ii) A completion of an analogue sentence (includes target words that are adjectives) – two pictures displayed in front of the child at the same time, the parent point at the right picture and says a sentence that appears in the same slide, then she points at the left picture and continues reading the sentence. The child is required to complete the partial sentence. Examples are given in (19).

(19) Instructions given to the child in the main task

	Picture in a slide	***Parent's production***	***Child's expected production***
Part A	Pointing at the horse 	"شو هذا؟" "What is this?"	"حصان" *ħsʕa:n* 'horse'
	Pointing at the bracelet 	"شو هاي؟" "What is this?"	"سوارة" *swa:ra* 'bracelet'
Part B	***Pictures in a slide***	***Parent's production***	***Child's expected production***
		"هون في فيل صغير وهون في فيل__" "Here a small elephant, and here a __"	"كبير" *kbi:r* 'big'
		"الشاي سخن والبوظة __" "The tea is hot, and the ice cream is _"	"مسكعة" *msakʕa* 'cold'

The children were video- or audio-taped by the parents. The parent who conducted the task was the one who speaks Jatt Arabic as a native dialect. Like the pre-test, if the child was unable to name the picture spontaneously, he/she was given two pictures to determine which one is the target (to know whether the child identify the word or not). I reserved the recordings from the parents and transcribed the children's productions. The main test was conducted twice at the same day for each child and the second experience was the decisive one. Finally, the recordings were strictly transcribed twice.

6. Universal constraints and language specific effects: Results and discussion

6.1. Results

In this section, I present the findings drawn from the productions of the forty-six participants. The findings show a clear effect of the universal principles along with language-specific effects.

We start with the pre-test results which examined the acquisition of singletons in word initial position, then discuss the interference of MSA, which leads to the exclusion of the MSA productions from the analysis. A general picture of the children's productions is given in §6.1.3, with the distribution of faithful productions across age groups and across the three sonority profiles. Then we turn to the simplification strategies the children employ in light of the age groups and the sonority profiles.

6.1.1. Pretest results

The pretest examined the children's production of singletons in word initial position, to make sure that cluster errors in the main task are not due to the absence of a consonant from the child's inventory (see §0).

As shown in (20), in all age group except group 6, at least one child replaced at least one target segments with another segments.

(20) Segments replacement in the six age groups

Age group	Name	s → θ	z → ð	ʃ → θ	x → ħ	ɣ → q	ʕ → ʔ	d͡ʒ → d	k → t	r → l	r → j	r→ d
1	AlM				*		*	*	*	*		
	SaG			*		*						
	OM							*		*		
	SiG											
	AmW	*	*					*		*		
	MahG											
2	QaW	*	*									
	EhW							*		*[10]		
	YaD										*	
	LaD	*										
3	AmM									*		
4	AmSh	*										
	RiW									*	*	
	FaW											*
5	NaSh	*										
	OmG	*										
6	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕

The pretest results show that in all cases except one, the target segment and its replacement had the same sonority value and thus the replacement did not interfere with our analysis. One child from group 4 (FaW) replaced /r/ with [d], so her two utterances with /r/ in the cluster (*rmu:ʃ, mra:*) were excluded from the analysis.

6.1.2. MSA interference

Consequently, some of the words produced by the children in our study were MSA words. Children are exposed to MSA (see §3) via books and the media, and there are parents and teachers who tend to use some MSA words in their daily conversation with the child.

In cases where a child replaced the target word with a completely different word it was easy to determine that he/she produced an MSA word (e.g. MSA *quma:ma* instead of JA *zba:li* 'trash'). However, in most cases, the children produced cognate words (see §3.1), i.e. words in which the difference between JA and MSA are is in the absence or presence (respectively) of a vowel

[10] The *r* → *l* replacement was not consistent for EhW, who produced /r/ correctly in some cases.

between the first two consonants. In such cases, we could not always decide whether the production is the result of cluster simplification with an epenthetic vowel /i/ or an MSA word.

As we study word initial cluster simplification, all MSA words and words suspected to be MSA words were excluded from the analysis. For example, the production *kiθi:r* for JA *kθi:r* 'a lot' was not excluded since the corresponding MSA word is *kaθi:r* and thus *kiθi:r* is the result of /i/ epenthesis. However, the production *ħisʕa:n* for JA *ħsʕa:n* 'horse' was excluded, although it also has an /i/ between the first two consonants, since this is an MSA word.

The number of excluded words in each age group, and their percentage, is provided in (22). As expected, the older the age group the higher the use of MSA words probably due to increase in exposure to books and the media though there is no difference between groups 3-6.

(21) MSA words excluded from the analysis

Age group	***Total***	***JA words***	***MSA words***	
1	156	134	22	14%
2	208	172	36	17%
3	208	170	38	22%
4	206	161	45	22%
5	208	163	45	22%
6	208	163	45	22%

The MSA words excluded from the analysis are evenly distributed among the three sonority profile groups (22) – around 32% (see leftmost column in (22)), thus suggesting that sonority does not play a role here. Note that most words suspected as MSA words were cognates (§3.1), while only two were unique: *msak.ʕa* → *ba:rida* (9 times) and *zbali* → *quma:ma, nifa:ja:t* (3 times).

(22) MSA productions (excluded from the quantitative analysis)

Sonority Profile		***JA***	***MSA***		***No. children***
Sonority fall	-1	ftˤu:r	futˤu:r	‘breakfast’	31
32% (87/275)	-1	wla:d	ʔawla:d	‘boys’	22
	-1	msakʕa	ba:rida	‘cold FM’	9
	-1	rmu:ʃ	rumu:ʃ	‘eyelashes’	6
	-1	sba:ħa	siba:.ħa	‘swimming’	3
	-1	zba:li	ziba:la	‘trash’	2
			nifaja:t		1
			quma:ma		2
	-2	nd͡ʒa:sˤa	ʔid͡ʒa:sˤa/ kummiθra	‘pear’	0
	-2	lħa:f	liħa:f	‘blanket’	1
	-2	lsa:n	lisa:n	‘tongue’	5
	-3	lba:n	ʕilka	‘tongue’	0
	-3	wsa:di	wisa:da	‘pillow’	5
Sonority plateau	0	kbi:r	kabi:r	‘big MS’	9
31% (67/215)	0	kta:b	kita:b	‘book’	14
	0	zɣi:ri	sˤaɣi:ra	‘small FM’	7
	0	xza:ni	xiza:na	‘closet’	6
	0	ħsˤa:n	ħisˤa:n	‘horse’	31
Sonority Rise	1	dha:n	diha:n	‘paint’	1
33% (85/259)	1	kθi:r	kaθi:r	‘lot’	3
	1	qsˤi:ri	qasˤi:ra	‘short FM’	19
	1	ħma:r	ħima:r	‘donkey’	29
	1	mra:	mirʔa:	‘mirror’	2
	2	dmu:ʕ	dumu:ʕ	‘tears’	14
	2	kna:fe	kuna:fa	‘kunafe’	2
	2	ħra:m	batˤtˤanijja	‘thin blanket’	0
	3	xja:r	qiθa:ʔ	‘cucumber’	0
	3	swa:ra	siwa:r	‘bracelet’	0
	4	tˤwi:l	tˤawi:l	‘tall MS’	19

Note that many of the excluded words could be due to epenthesis as well, either /i/ epenthesis (***si****ba:ħa, z****i****ba:la, li****ħ****a:f, li****s****a:n, wi****s****a:da, ki****t****a:b, xi****z****a:na, ħi****s****ˤa:n, di****h****a:n, ħi****m****a:r, mirʔa:*) or an echo vowel, i.e. an epenthetic mora filled with the copy of the following vowel (***fu****tˤu:r, r****u****mu:f,*

*du**m**u:ʕ*); only a few words were unambiguously MSA words (*k**a**bi:r, sˁ**a**ɣi:ra, k**a**θi:r, q**a**sˁi:ra, kuna:fa, tˁ**a**wi:l*).

6.1.3. Faithful productions

In this section we provide the distribution of the children's faithful productions with reference to the sonority profile of the cluster and then compare the results with the frequency of the clusters in Child Directed Speech.

6.1.3.1. The distribution of faithful productions

As shown in Figure 1, the percentage of faithful productions increases with age, along the decrease of unfaithful productions and no responses.

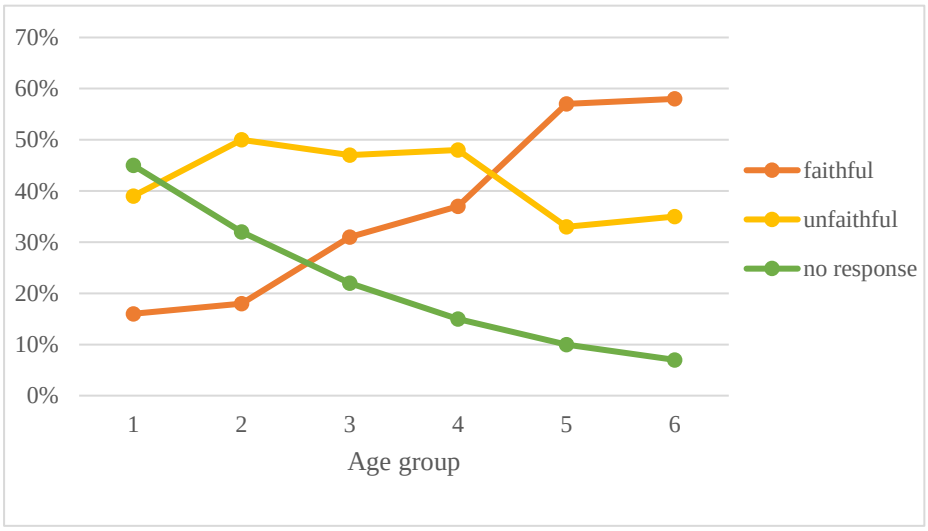


Figure 1 Faithful productions across age groups

The increase in percentage of faithful productions with age is expected, though notice that only in groups 5 and 6 the faithful productions exceed the unfaithful ones. The percentage of no responses is noticeably high in the youngest group but decrease with age as expected. Importantly, all children were able to identify the appropriate picture corresponding to the target word, with the exception of one child from group 1 (AmW) who could not identify *dmu:ʕ* 'tears' and *ftˁu:r* 'breakfast'. That is, most no-responses were not due to unfamiliarity with the target word.

Many words that exist in the comprehensive vocabulary of children do not exist in their expressive vocabulary. This can be due to several factors, such as the phonological complexity of the word (the length of the word, words with clusters, words with complex consonants like emphatics and affricates, etc.; Schwartz and Leonard 1982, Yavaş 1995). However, there were

no specific words in our study that many children did not pronounce thus suggesting that phonological complexity of the cluster did not play a role in the pronunciation of the words. For example, one child from group 1 produced the word *lba:n* 'gum' but not the word *kθi:r* 'a lot', while another child from group 4 produced *msak.ʕa* 'cold FM', but not *kna:fi* 'a traditional sweet dessert'.

As for the distribution of the faithful productions, Figure 2 below shows that they do not distribute evenly between the three sonority profiles.

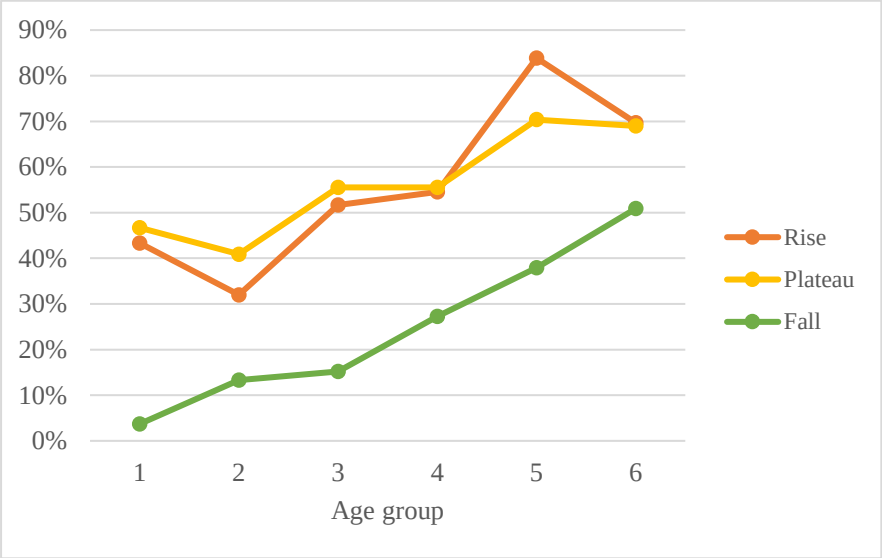


Figure 2 Faithful productions according to sonority profile

The percentage of faithful productions in sonority fall is the lowest across all age groups; this is expected given that sonority fall is the worst profile (see §2). However, the difference between sonority rise and sonority plateau is not as expected; in all age groups except group 5, the differences between sonority rise faithful productions and sonority plateau faithful productions are minimal (1%- 9%). In age group 5, the difference goes up in the favor of faithful productions with sonority rise (14%).

Although the children's faithful productions only partially distribute as expected from universal principles, in the following section we show that these results coincide with the distribution of clusters in Child Directed Speech.

6.1.3.2. Faithfulness and cluster frequency

Studies suggest that frequency plays a role in acquisition (see §1) such that the higher the frequency the earlier the acquisition. Two types of frequency should be taken into consideration – the frequency of the words selected for the stimuli and the frequency of the clusters. However, all words selected for the stimuli were high frequency words from the children's vocabulary at the ages 02;00- 05;00. Therefore, the frequency of words is not relevant in this study.

We drew our data from 67 minutes recording of Child Directed Speech (CDS), which yielded 1670 word types and 3822 tokens. 4 mothers were recorded speaking to12 children (ages: 02;00 – 07;00); 5 of the children participated in the current study. The mothers and the children are all born and currently residing in Jatt. The frequency of the clusters according to the sonority profile is presented in (23) below.

(23) Frequency of initial clusters in CDS

Sonority profile	***Types***		***Tokens***	
	no.	***%***	***no.***	***%***
Rise	50	38%	71	42%
Plateau	47	38%	55	32%
Fall	31	24%	44	26%
Total clusters	128	8%	170	4%
Total words	1670		3822	

As in other languages, words with initial clusters are not very common in JA – around 8% for types and 4% for tokens (cf. Hebrew – 4% cluster types; Ben- David and Bat-El 2016). As expected, in both types and tokens there are more clusters with sonority rise than sonority fall. However, for types only, the expected decline is not found between sonority rise and plateau. The percentages of the children's faithful productions provided in Figure 2 coincide the distribution of clusters in CDS (23). That is, the difference between rise and plateau is minimal in both frequency of clusters in CDS the children's faithful productions.

Another finding is presented in the detailed table in (24) below, which shows that against the SDP (see §2), the most frequent faithful cluster in each sonority profile is not the one with the greatest distance. In sonority rise, the most frequent cluster is stop–fricative with a sonority distance of 1, rather than stop-glide with a sonority distance of 4. The same goes for sonority fall, where the most frequent cluster is nasal–fricative with sonority distance of 2 rather than glide–stop with a sonority distance of 4.

(24) Cluster frequency in CDS by cluster type (tokens – 3822; types – 1670)

Sonority profile	*Sonority distance*	*Cluster type*	*Types*		*Tokens*	
			no.	*%*	*no.*	*%*
Rise	4	Stop–Glide	1	2%	2	3%
	3	Fricative–Glide	2	4%	8	11%
	3	Stop–Liquid	6	12%	7	10%
	2	Stop–Nasal	0	0%	0	0%
	2	Fricative–Liquid	5	10%	8	11%
	2	Nasal–Glide	1	2%	1	1%
	1	Liquid–Glide	0	0%	0	0%
	1	Nasal–Liquid	3	6%	6	8%
	1	Fricative–Nasal	5	10%	8	11%
	1	Stop–Fricative	28	56%	34	48%
		Total rise	**50**	**39%**	**71**	**42%**
Plateau	0	Stop–Stop	31	66%	37	67%
	0	Fricative–Fricative	1	2%	2	4%
	0	Nasal–Nasal	15	32%	16	29%
		Total plateau	**47**	**37%**	**55**	**32%**
Fall	-1	Glide–Liquid	2	6%	2	5%
	-1	Fricative–Stop	4	13%	11	25%
	-1	Nasal–Fricative	11	35%	13	30%
	-1	Liquid–Nasal	0	0%	0	0%
	-2	Glide–Nasal	1	3%	2	5%
	-2	Liquid–Fricative	0	0%	0	0%
	-2	Nasal–Stop	6	19%	8	18%
	-3	Liquid–Stop	0	0%	0	0%
	-3	Glide–Fricative	6	19%	6	14%
	-4	Glide–Stop	1	3%	2	5%
		Total fall	**31**	**24%**	**44**	**26%**

The unexpected distribution of clusters with respect to the SDP may suggest the effect of additional factors, in particular the frequency of consonants. This requires further study which focuses on CDS.

6.1.4. Cluster simplification strategies

The children participated in the study used four simplification strategies to avoid producing word initial consonant clusters.

(25) Simplification strategies

Strategy	***Target***	***Child***	***Gloss***
C_1 deletion	ħsˁa:n	sa:n	'horse'
C_2 deletion	dha:n	da:n	'paint'
Prothesis	lba:n	ʔilbá:n	'tongue'
Epenthesis	kbi:r	kibí:r	'big'

In addition, there were two cases of metathesis that improved the sonority profile of the cluster – both in the word *wsá:di* → *swá:di* 'pillow'.

The distribution of the repair strategies is given in Figure 3.

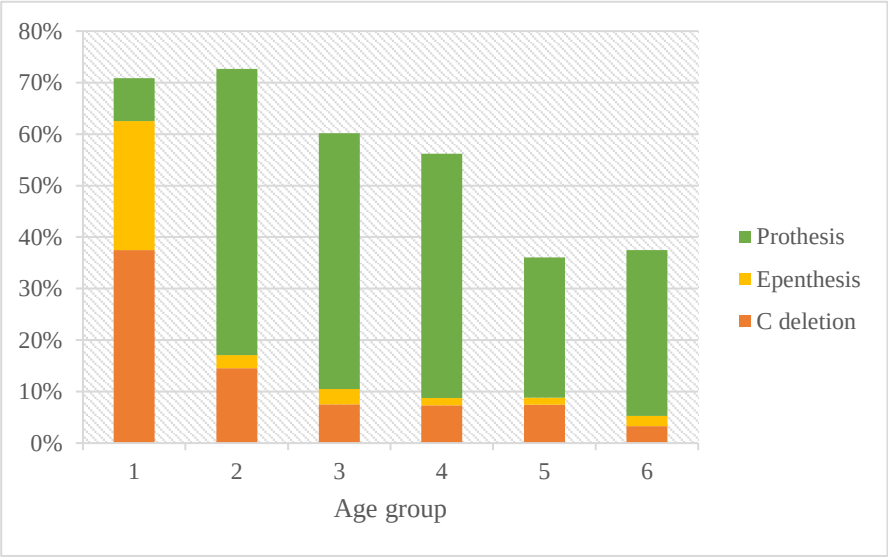


Figure 3 Repair strategies across age groups

C deletion, also known as truncation, is the most common cluster simplification strategy across languages in early stages of acquisition (see §1 and §4.4). The deleted consonant can be the more sonorous one (e.g. *kri:b* → *ki:b* 'close'), or the left-most one (e.g. *bsˁa:tˁ* → *sˁa:tˁ* 'carpet'). Deletion of the more sonorous consonant allows preserving a better onset as there is a universal preference for the least sonorous consonant in onset position in order optimize the syllable structure by maximizing the rise from the onset to the nucleus (Clements 1990), while deleting the first consonant allows to maintain the target contiguity between the onset and the following vowel and this respect the universal CONTIG.

Unlike C deletion, epenthesis is considered an uncommon simplification strategy (Chin and Dinnsen 1992, Fikkert 1994, Bernhardt and Stemberger 1998, Ben-David 2001), probably due

to the increased complexity imposed by the addition of a syllable. However, epenthesis is a more advanced strategy than C deletion (Ben-David 2001) since it allows preserving the two consonants of the target cluster. In Arabic the epenthetic vowel is /i/ (Herzallah 1990), but we found in our data also an epenthetic /a/ (e.g. *ftˁu:r* → ***fa****tˁu:r* 'breakfast') and an echo vowel (Kawahara 2007), i.e. an epenthetic vowel identical to the preceding vowel (e.g. *dha:n* → *d**a**ha:n* 'paint').

As for prothesis, this strategy is universally rare, limited mostly to Arabic dialects (see §4.4) and a few other languages where prothesis applies (see §4.4). As in Daana (2009), prothesis is by far the most common simplification strategy for words with initial consonant clusters in all age groups except group 1. The distribution of the repair strategy by sonority profile and age groups is given below:

(26) Repair strategies by sonority profile and age group

	Age group	***Faithful***		***C1 deletion***		***C2 deletion***		***Prothesis***		***Epenthesis***		***Metathesis***		***Total***
Rise	1	13	42%	4	13%	1	3%	5	16%	8	26%	0	0	31
	2	16	30%	0	0	4	7%	31	57%	3	6%	0	0	54
	3	31	48%	0	0	2	3%	26	40%	6	9%	0	0	65
	4	30	50%	0	0	1	2%	25	42 %	4	7%	0	0	60
	5	52	79 %	0	0	0	0	10	15%	4	6%	0	0	66
	6	46	64%	0	0	0	0	18	25%	8	12%	0	0	72
	Total	188	54%	4	1%	8	2%	115	33%	33	9%	0	0	348
Plateau	1	7	47%	1	7%	1	7%	1	7%	5	33%	0	0	15
	2	9	41%	2	9%	0	0	11	50%	0	0	0	0	22
	3	15	56%	1	4%	0	0	10	37%	1	4%	0	0	27
	4	15	53%	1	4%	0	0	11	39%	1	4%	0	0	28
	5	19	70%	0	0	0	0	6	22%	2	7%	0	0	27
	6	20	69%	0	0	0	0	8	28%	1	3%	0	0	29
	Total	85	57%	5	3%	1	1%	47	32%	10	7%	0	0	148
Fall	1	1	4%	21	75%	0	0	0	0	6	21%	0	0	28
	2	6	13%	13	29%	0	0	24	53%	1	2%	1	2%	45
	3	7	15%	9	20%	0	0	30	65%	0	0	0	0	46
	4	15	28%	8	15%	1	2%	30	56%	0	0	0	0	54
	5	22	38%	10	17%	1	2%	24	41%	0	0	1	2%	58
	6	29	51%	5	9%	0	0	23	40%	0	0	0	0	57
	Total	80	28%	66	23%	2	1%	131	45%	7	2%	2	1%	288

In the following subsections we discuss each simplification strategy independently with reference to the three sonority profiles.

6.1.4.1. C-deletion

C-deletion is considered the most common strategy in cluster simplification among children, especially in early stages (Ingram 1976). In our study, C-deletion was not as common as in other languages, with the exception of the youngest group (see Figure 3). This conforms to the finding that the first simplification strategy in children to deal with complex onset is to reduce it by C deletion (Dyson & Paden 1983, Fikkert 1994, Bernhardt & Stemberger 1998, Ben-David 2001, Mashaqba et2019).

Among the two consonants that can undergo deletion, C_1-deletion is by far the most common. Figure 4 below, displays the distribution of C-deletion across the six age groups, distinguishing between C_1- and C_2-deletion. The highest percentage of C-deletion was, as expected, in the youngest group; these percentages decreased with the increase with age.

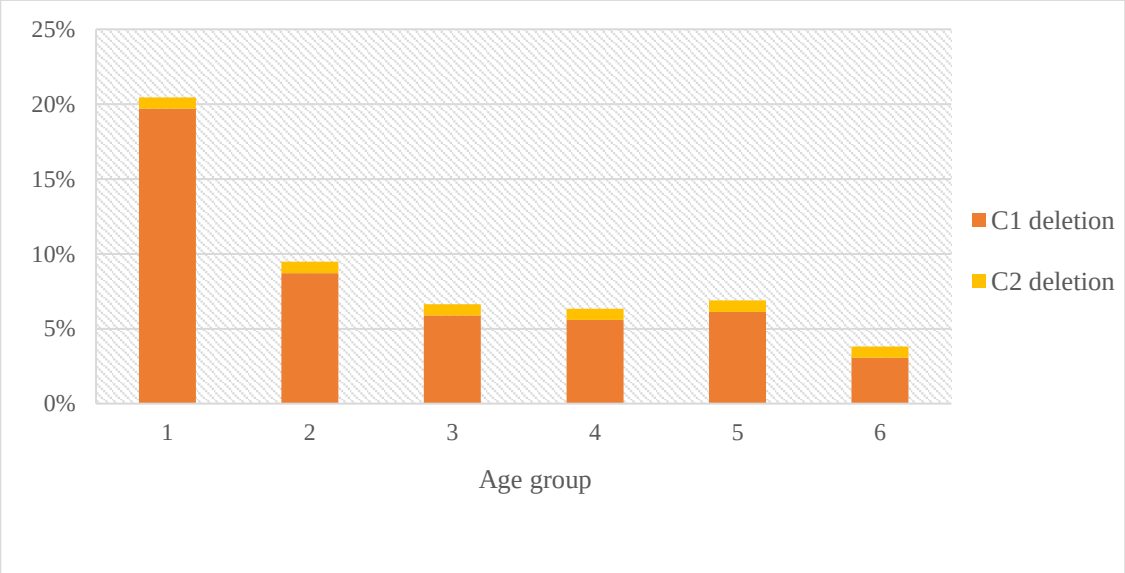


Figure 4: C-deletion across age groups

As shown above, 20% of the total targets in the youngest group were produced c- deletion; this percentage is noticeably higher than in the other age groups. The words that underwent C deletion are given below.

(27) C-deletion (C_1 and C_2) by word

	Word	*Age group*												*Total*	
		1		**2**		**3**		**4**		**5**		**6**			
C_1 deletion	lbaːn	5/5	100%	7/8	88%	4/8	50%	3/6	50%	5/8	63%	4/8	50%	28	65%
	lsaːn	¾	75%	4/8	50%	1/7	14%	2/8	25%	2/8	25%	1/8	13%	13	30%
	lħaːf	1/1	100%	0	0	½	50%	2/3	67%	½	50%	0	0	5	63%
	rmuːʃ	0	0	0	0	0	0	1/8	13%	0	0	0	0	1	13%
	msakʕa	4/5	80%	1/5	20%	1/3	33%	0	0	1/8	13%	0	0	7	33%
	nd͡ʒaːsˁa	6/6	100%	1/6	17%	1/7	14%	1/8	13%	1/8	13%	0	0	10	29%
	ftˁuːr	1/1	100%	0	0	1/7	14%	1/7	14%	0	0	0	0	3	20%
	zbaːli	1/6	17%	0	0	0	0	0	0	0	0	0	0	1	17%
	zɣiːri	0	0	1/8	13%	0	0	0	0	0	0	0	0	1	13%
	kbiːr	1/6	17%	1/7	14%	0	0	0	0	0	0	0	0	2	15%
	ktaːb	0	0	0	0	1/7	14%	0	0	0	0	0	0	1	14%
	knaːfi	2/3	67%	0	0	0	0	0	0	0	0	0	0	2	67%
	dmuːʕ	1/1	100%	0	0	0	0	0	0	0	0	0	0	1	100%
	mraː	1/6	17%	0	0	0	0	0	0	0	0	0	0	1	17%
	Total	29/44	66%	15/42	36%	10/41	24%	10/40	25%	10/34	29%	5/16	31%	79/217	36%
C_2 deletion	rmuːʃ	0	0	0	0	0	0	0	0	1/7	14%	0	0	1	14%
	ftˁuːr	0	0	0	0	0	0	1/7	14%	0	0	0	0	1	14%
	mraː	0	0	1/8	13%	0	0	0	0	0	0	0	0	1	13%
	dhaːn	0	0	1/6	17%	0	0	0	0	0	0	0	0	1	17%
	zɣiːri	1/5	20%	0	0	0	0	0	0	0	0	0	0	1	20%
	Total	1/5	20%	2/14	14%	0	0	1/7	14%	1/7	14%	0	0	5/33	15%

Looking at the words that underwent C_1 deletion, we can notice that about 90% (68/76) are words with sonority fall clusters, and the words that begin with the liquid *l* are about 68% (46/68). The words with the highest number of C1-deletion are *lbaːn* (n=28), *lsaːn* (n=13), *nd͡ʒaːsˁa* (n=10), *msakʕa* (7), and *lħaːf* (5). The first two words in this list underwent C-deletion in all age groups and were the only words that undergone C-deletion in group 6.

When comparing between C_1 and C_2 deletion, we can notice that in 70 cases the deletion was for the more sonorous segment (~91%): In the sonority rise words the deletion is mostly of C_2 (e.g. *dhaːn* → *daːn* 'paint'). In contrast, in sonority fall words the deletion is mostly of C_1 (e.g. *lbaːn* → *baːn* 'gum'). These findings conform with the principle that obstruents are preferred in the onset position in order to keep a large sonority distance between the onset and the

following vowel, and thus to maximize the syllable goodness with an obstruent onset. Also, deleting C_1 preserve the contiguity of the segments in the word. The role of continuity is solid given that the words where C_2 is deleted for segmental reasons have also instances of C_1 deletion: *rmu:ʃ* → *mu:ʃ* 13% / *ru:ʃ* 14%; *ftˤu:r* → *ftˤu:r* 20% *fu:r* 14%; *mra:* → *ra:* 17% / *mra:* 13%; *zɣi:ri* → *ɣi:ri* 13% / *zɣi:ri* 20%. The only word without inter-child variation was *dha:n*, with 17% C_2 deletion.

C_2 deletion is relatively rare – one occurrence for each word. C_1 deletion is the most common strategy, which allows maintaining the target contiguity between the onset and the following vowel.

The words with the highest number of C1-deletion are *lba:n* (n=28), *lsa:n* (n=13), *nd͡ʒa:sˤa* (n=10), *msakˤa* (7), and *lħa:f* (5). The first two words in this list undergone C-deletion in all age groups and were the only words that undergone C-deletion in group 6.

Figure 5 displays the distribution of C-deletion according to sonority profile, distinguishing between C1 and C2.

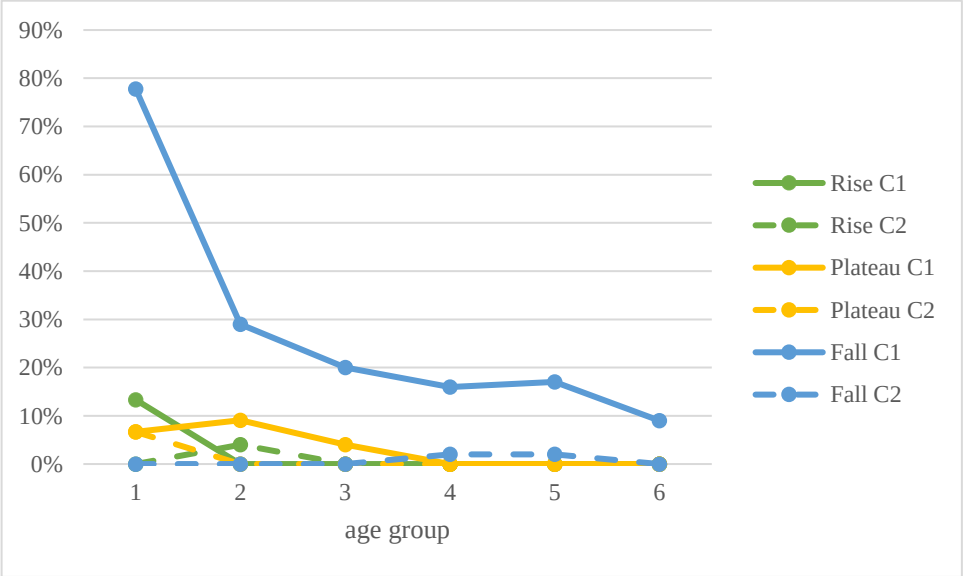


Figure 5 C-deletion across the sonority profile.

Hence, the distribution of C-deletion according to the sonority profile of the clusters shows that the highest percentages in of C-deletion are in the sonority fall group, and the deletion, mostly, of C_2.

6.1.4.2. Epenthesis

In this study, epenthesis was not prominent when compared to other strategies. Figure 6 shows that there was no visible effect to the sonority profile on the distribution of epenthesis, though it seems that sonority fall is the least preferred profile for epenthesis.

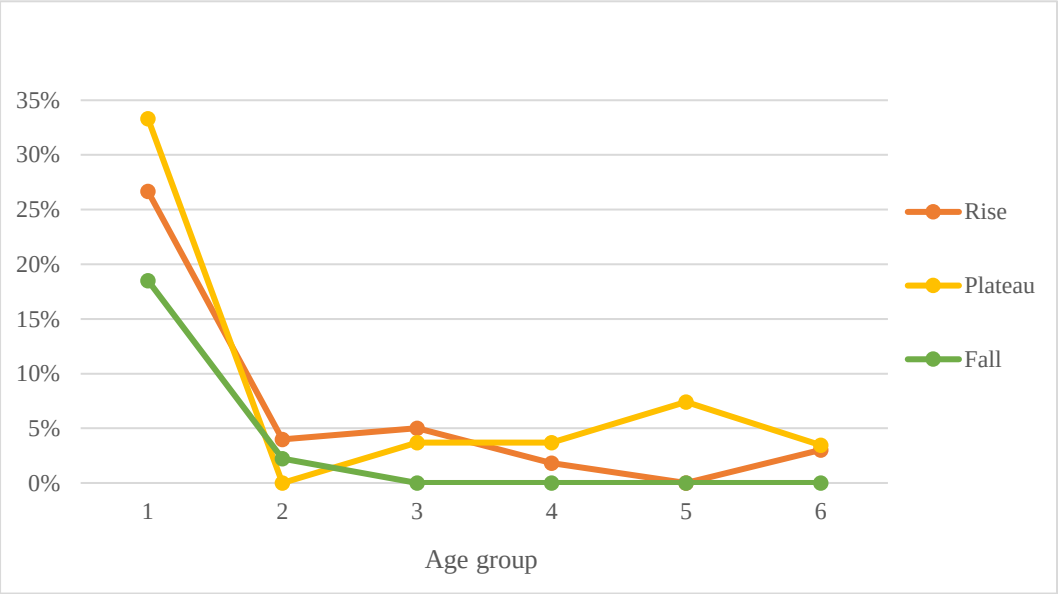


Figure 6 Epenthesis by sonority profile and age groups

Recall, however, from §6.1.2 that we excluded many words that could be suspected of epenthesis but were identical to MSA words. For all participants, vowel epenthesis resulted in 209 productions (13 types) that were prosodically identical (ignoring consonant replacement) to MSA words (e.g. *dha:n* → *diha:n* 'paint'), and 32 productions (15 types) that are with simplified clusters but not an MSA word (e.g. *kna:fi* → *kina:fi* 'a traditional sweet dessert') Without excluding these forms, the distribution of epenthesis would have been as in Figure 7.

The higher percentage of epenthesis is among the youngest age group. It can be concluded that at this age, children prefer to use a universal strategy to simplify clusters, such as epenthesis and not a language specific strategy, prothesis. The percentages of epenthesis in the other age groups are close.

The vowel *i* was the epenthetic vowel in 50% of the cases, supporting the claim that the epenthetic vowel in Arabic is *i* (Herzallah 1990). In the rest cases the epenthetic vowel was *a* or *u*. However, these *a* and *u* epenthetic vowels could be caused by a vowel harmony process. According to Watson (1995), vowel harmony occurs in specific cases, and epenthesis is one of them. Harmony can spread only to the immediately adjacent right or left vowel.

However, some words that were considered as MSA and excluded from the analysis as a result, may be words that underwent epenthesis and then VH. The percentages of the productions that considered as MSA after a vowel epenthesis process, and the words that underwent a certain vowel epenthesis are displayed in figure 7 below.

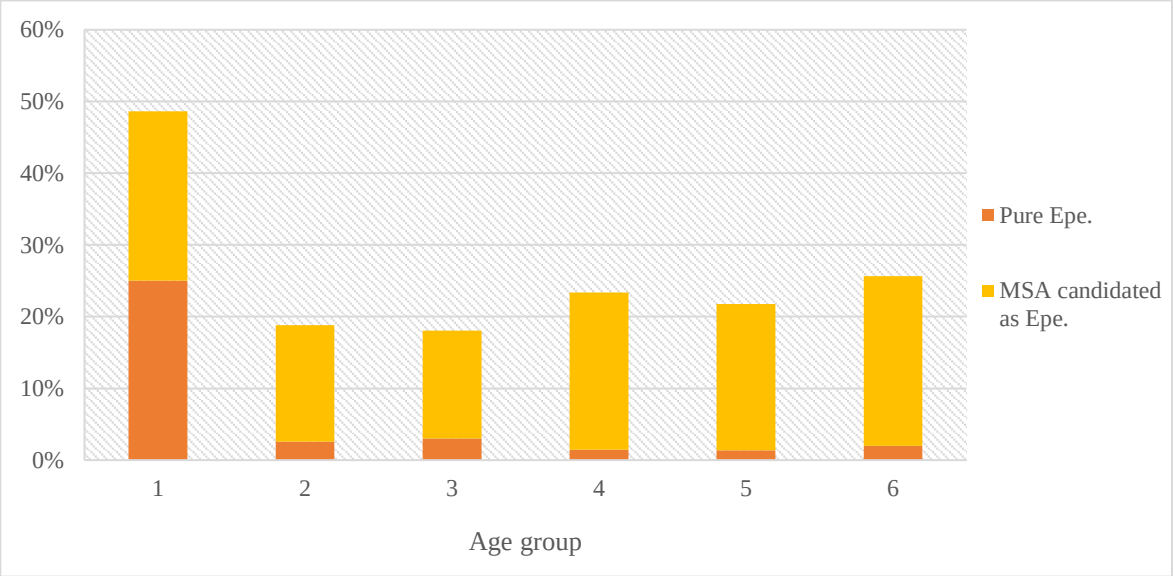


Figure 7 Percentage of epenthesis vs. MSA words that could be considered epenthesis

According to figure 7, epenthesis was common in the youngest group (25%) when comparing with the other groups. The percentages of epenthesis in age groups 2 to 6 were close (1%- 3%).

6.1.4.3. Prothesis

Prothesis is not a simplification strategy found cross linguistically. It occurs in languages that allow prothesis in their grammar, but it is hardly found in children acquiring languages without prothesis in their phonology grammar. We thus claim that this simplification strategy is a language-specific effect (see §2 and §4.5).

However, notice in Figure 3 that in group 1, the youngest group (age 2;0-2;6), the most common repair strategy is C deletion, as it is the case cross-linguistically. This is certainly the effect of universal principles, which, as argued in Adam and Bat-El (2009), emerge in children's speech before language-specific effects start taking over.

When observing the distribution of prothesis across sonority profiles (Figure 8) it seems that starting from group 3, prothesis is preferred in clusters with sonority fall (e.g. *lsa:n* → *ilsá:n* 'tongue').

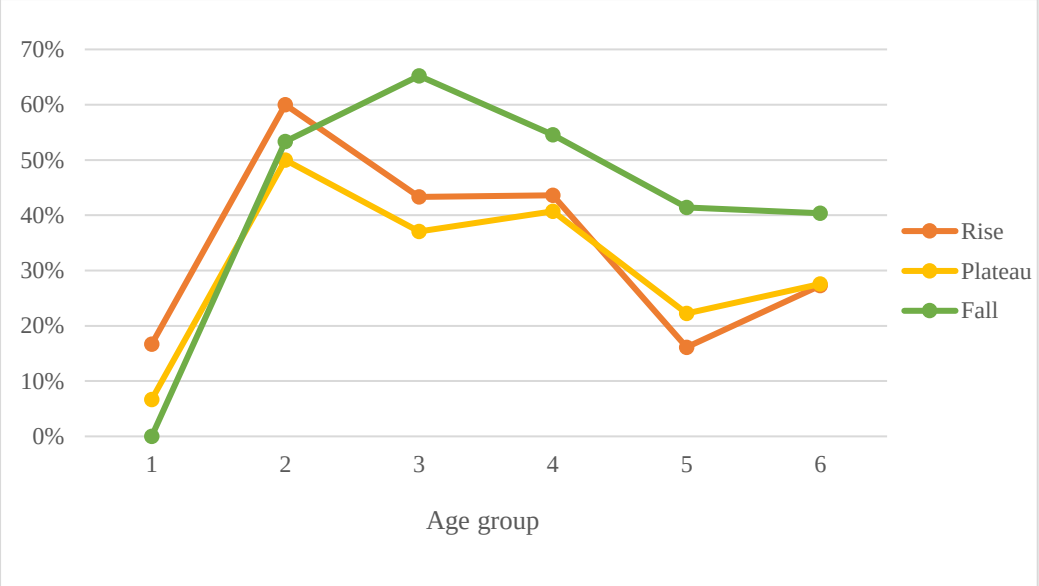


Figure 8 Prothesis by sonority profile and age group

We attribute this preference to the universal constraints: SYLLABLE CONTACT LAW (SCL; Murray and Vennemann 1983, Vennemann 1988) which gives preference sonority fall from a coda to the following onset, which, in combination with the SDP (§2) the greater the sonority distance between the segments the better. While prothesis in words with sonority fall results with a good syllable contact (e.g. *lban* 'gum' → *ʔi**lb**a:n*), prothesis in words with sonority rise results in a bad syllable contact (e.g. *bla:d* 'city' →*ʔi**bl**a:d*). Moreover, onsets prefer obstruents, so a sonorant in the onset is not good, and this is another reason why children prefer to prothesis and not epenthesis in sonority fall words (lba:n → *ʔi**lb**a:n, *liba:n*).

In contrary to prothesis, the highest occurrences of epenthesis are in sonority rise group when compared to sonority fall group (See figure 6 in §6.1.4.2). This can be explained, as the prothesis case, by SYLLABLE CONTACT LAW (SCL) and ONSET constraints. Prothesis on a word with sonority rise cluster creates a word with second onset that is sonorant, and that violates the SCL since the first coda is less sonorous than the following onset (e.g. *kna:fi* → kina:fi, **ʔi**kn**a:fi*).

6.2. Discussion

In this section, I review the manifestation of the universal principles that related to consonant clusters and the effect of the language-specific properties in the children's productions when handling cluster simplification.

6.2.1. Language specific effects

Language properties do play a role in the course of initial consonant clusters. As mentioned above, prothesis is a simplification strategy that does not obtained by children acquiring languages that do not have prothesis in their phonology. In this study, prothesis was used by children in all age groups, and was very common among children, but it comes into view starting from the second group (ages 02;06- 03;00). This is in line with Daana (2009) and Daana & Khrais (2018)[11] studies, that indicate that children start using prothesis significantly around the age 02;05, and interestingly, Daana & Khrais (2018) mentioned that prothesis was used by children to break clusters in Arabic only (not in English words).

6.2.2. Word frequency

First, no enough data were found in CDS regarding the frequency of the words used in the study (*kθi:r* – 7 times, *tˤwi:l* – 2 times, *kbi:r* – 2 times, *qsˤi:ri* – 1 time). According to the data driven from the CDS, not in all cases a high frequency of a cluster indicates to a high frequency of faithful production of this cluster. For example, the cluster Stop-Nasal appeared in two words (*dmu:* and *kna:fi*), in the one word the percentage of faithful productions in total was 57%, and in the other was 34%, but in the CDS corpus the percentage of Stop-Nasal was 0%. On the other hand, there were some high-frequency clusters that got a high percentage of faithful productions as well, i.e. the cluster Nasal-Fricative appeared in one word in the test and was produced correctly in 56% cases (the highest percentage in the sonority fall group), and it was the most frequent cluster in the CDS corpus.

However, when compare between the faithful production in sonority rise words and sonority fall words, and between sonority plateau words and sonority fall words, the SSP and the frequency of the words make the same predictions. But when compare between faithful productions in sonority rise words and plateau words, the expectation is that the percentages of faithful production in sonority rise will be higher than plateau, but this is not the case in this study, and this may be because there is no difference between the frequency of sonority rise and sonority plateau in the CDS corpus.

6.2.3. The role of universal principle

Even the initial clusters patterns are various in terms of sonority profile, in all age groups children's productions were better in sonority rise words when compared with sonority fall words (the difference between faithful productions in sonority rise words and faithful

[11] Note that the participants in Daana & Khrais (2018) were bi-lingual who speak Arabic and English.

productions in sonority fall words in each age group is 19%- 46%. And this may be because of the effect of frequency of the words (as mentioned above) and because of the universal principles also. However, according to universal principle we expected to get higher percentages of faithful productions in sonority rise words than the percentages of faithful productions in sonority plateau words, but this was not the case, and the explanation would be the high frequency of the sonority plateau words in CSD corpus.

Universal grammar effect is clear in the tendency of children in the youngest age group to simplify the clusters by C–deletion. Daana & Khrais (2018) divided the process of cluster simplification to stages. At the first stage (from the age 01;04 to 02;04) children tend to simplify initial consonant clusters via C deletion, like children acquiring other languages. The findings of this study indicate, also, that young children obey the universal properties in choosing C-deletion, significantly, to handle with consonant clusters. However, there were no children that truncated the whole cluster in the word. In most cases, the deleted segment was the more sonorous one (see §6.1.5.3), and this complies with another universal effect that the less sonorous consonant is preferred in the onset position. However, there were few cases in which the children's choice of C-deletion did not match the universals. Pater & Barlow (2003) showed that children tend sometimes to deviate from the universal constraints. Daana (2009) and Daana & Khrais (2018), also, displayed cases that did not obey the universal constraints (28). This may be because the desire of children to keep the continuance of the segments in the word.

(28) Examples from other studies that show a violation of universals in C deletion process

tfadˤdˤal → fadˤdˤal	'please enter'	(Daana & Khrais 2018)
rfu:f → lu:f	'shelves'	(Daana 2009)
snow → nəʊ	'snow'	(Pater & Barlow 2003)

The universal effect is reflected also in the epenthesis strategy: The high percentages of epenthesis in sonority rise words when compared to sonority fall words can be explained by the effect of SCL. Children tended to use epenthesis when this process did not create a word that violates SCL.

Contrary to expectations, according to the frequency of sequences in JA that derived from CDS, the most frequent cluster is the cluster with a small sonority distance in terms of SDP (Nasal-Fricative and Stop-Fricative). On the other hand, this can match the fact that JA has plenty of suffixes that b-, t-, m-, and n- are part of them, and the existence of many fricative segments in the language (i.e. *ħaðˤðˤir* 'she/he will prepare', *mɣatˤtˤa* 'covered MS').

7. Summary and Conclusion

This study addresses the role of universal principles and language-specific properties in acquisition, focusing on the initial consonant clusters in Jatt Arabic. Prothesis is a language-specific effect simplification strategy, which cannot be obtained by children if they do not have prothesis in their grammar. However, not all strategies obtained by children to simplify clusters are language-specific; the study shows that children tend to use, also, other strategies that considered as universal.

Jatt Arabic is a dialect that rich in initial consonant clusters that can respect or violate the SSP and the SDP. This feature made the dialect interesting and good to study in to figure out what affects the acquisition process, and whether this process is experience-dependent or affected by universal constraints also.

There are several studies on different dialects that traced the stages of initial consonant acquisition in Colloquial Arabic (Daana, 2009; Alqattan 2015; Ayyad 2011), but in contrary to these studies, the current study came to test the relation between the specific propertied of the language that children learn by dealing with this specific language and the universals that exist in all acquiring-language children.

In details, the experience-independent approach predicts that children, especially at the early stage of acquisition, will resort to deletion of one consonant of the cluster or more, they will use coalescence, metathesis, and epenthesis in order to handle with initial cluster. Also, the sonority profile of the cluster affects the acquisition of it regardless of its frequency in the language; so, words with sonority rise pattern will be acquired earlier than plateau and fall, since clusters that respect SSP and SDP are better than clusters that violate them. The experience-dependent approach claims that even the effect of universal constraints in the initial clusters acquisition process, the specific features (like prothesis) of the language that children are exposed to can affect the children's productions when handling with initial consonant clusters.

The findings reveal that the universal principles play a role in initial consonant cluster acquisition in JA. Children produced sonority rise words faithfully more than sonority fall words. They also used prothesis and epenthesis to simplify clusters when they took in consideration the violation of SCL in their outputs.

Frequency plays a role in cluster acquisition especially when look at the sonority rise faithful productions and sonority plateau faithful productions: The close percentages of faithful productions in these two groups of words can be because of the effect of the frequency in the

language, since we found that the frequency of the sonority plateau words is close to the frequency of sonority rise words.

As mentioned before, universal principles interact with language specific effects in two cases in the study; First, the much common strategy that children used in early stages is C-deletion, which is common universally, and this agree with Adam and Bat- El (2009) that shows the children's preference of universal properties at early stages of acquisition. Second, the using of prothesis and epenthesis in this study was, mostly according to SCL.

In this study the children used 4 strategies to simplify complex onsets: C- deletion, epenthesis, prothesis and metathesis. Metathesis was used in the same word in two children, and so was negligible. C- deletion was common in the youngest group and used especially in sonority fall words (the segments that were deleted, mostly, are liquids); Liquids are acquired late, so this deletion can be because of the cumulative complexity that children can't produce marked segments in a cluster even if they acquired them already as singletons, and this deletion may be because of the difficulty to perceive these initial segments. However, C- deletion, also, obeys the preference of obstruents in the onset. At older groups, we started to see more use of prothesis, and this may indicate that children tend to preserve more segments at the stage that they were able to produce 3 syllables.

MSA interference is an issue that needed to be checked strictly: MSA productions were notable productions across the oldest five age groups. This use of MSA may be because of the children exposure to MSA via book and media, and that is why, nearly, children from the youngest age group did not use MSA as much as the rest of age groups. Using MSA words can be a result of two different reasons: first, because MSA is a part of their daily language, especially when talking about formal missions like the test in this study. The other reasons is the desire to avoid producing initial clusters. In order to know more details about this issue, another research needed to be conducted.

This study has clinical implications. By this study we can predict which strategy considered as a developmental and which is/ are not. We can also predict at which age initial consonant clusters are expected to be acquired.

It should be taken into consideration that the findings presented here are based on 46 children, when six children only are in the first age group, and thus there is a need to add more children and to conduct a further study. Since some studies talked about truncation of the whole first syllable with the cluster in the onset, or a deletion of the entire clusters on the first stages of acquisition (around the age 01;06) it will be interesting to check this age and make a comparison with other dialects.

In this study, the interference and effect of the markedness of segments in the acquisition of initial clusters was not tested. So, a further study that focus on the segment's interference in the acquisition of initial cluster may lead to additional findings.

Finally, there is a need to build bigger CDS corpus that can help us more to determine what is the frequency of the specific words used in the test, and whether this frequency affect the acquisition of consonant clusters. Finally, testing the effect of OCP would be an interesting path of thinking that may lead to other interesting findings.

References

Abd El Kadir, F. (2018). Early phonological acquisition in Palestinian Arabic. M.A. thesis, Tel-Aviv University [in Hebrew].

Abu-Dahud, J. (2016). Development of segmental unit acquisition (consonants)in Northern Israeli spoken Arabic: Towards norms establishment: The case of Kfar-Kanna. M.A. thesis, Tel-Aviv University [in Hebrew].

Abu Salim, I. (1982). *A Reanalysis of Some Aspects of Arabic Phonology: A Metrical Approach*. PhD dissertation, University of Illinois at Urbana-Champaign.

Abu Salim, I. (1982). Syllable structure and syllabification in Palestinian Arabic. *Studies in the Linguistic Sciences* 12 (19), 1-28.

Abu Salim, I. & H. Abdel-Jawad (1988). Syllable patterns in Levantine Arabic. *Studies in the Linguistic Sciences* 18 (2), 1-2.

Abu Abbas, K. (2003). *Topics in the Phonology of Jordanian Arabic: An Optimality Theory Perspective.* PhD Dissertation, University of Kansas.

Abu Guba, M. N. (2018). Stress assignment in polysyllabic words in Levantine Arabic: An Optimality-theoretic analysis. *The Poznan Society for the Advancement of Arts and Science*, 7-24.

Adam, G. & O. Bat-El (2009). When do universal preferences emerge in language development? The acquisition of Hebrew stress. *Brill's Annual of Afroasiatic Languages and Linguistics* 1, 255-282.

Alghmaiz, B. (2013). Word-initial Consonant Cluster Patterns in the Arabic Najdi Dialect. MA thesis, Southern Illinois University Carbondale.

Al- Sughayer, Kh. (1990). Aspects of Comparative Jordanian and Modern Standard Arabic Phonology. PhD dissertation. Michigan State University.

Al-Tamimi, F., Kh. Abu-Abbas & R. Tarawnah (2010). Jordanian Arabic final geminates: An experimental clinical phonetic study. *Poznan Studies in Contemporary Linguistics,* 46(2), 111–125.

Alqattan, S. (2015). *Early Phonological Acquisition by Kuwaiti Arabic Children.* PhD dissertation, Newcastle University, UK.

Amayreh, M.M. & A.T. Dyson (1998). The acquisition of Arabic consonants. *Journal of Speech, Language & Hearing Research* 41, 642-653.

Amayreh, M.M. & A.T. Dyson (2000). Phonetic inventories of young Arabic-speaking children. *Clinical Linguistics & Phonetics* 14 (3), 193-215.

Ayyad, H.S. (2011). *Phonological Development of Typically Developing Kuwaiti Arabic-speaking Preschoolers*. PhD dissertation, The University of British Columbia, Vancouver, Canada.

Barlow, J. A. (1997). A Constraint-Based Account of Syllable Onset: Evidence from Developing Systems. PhD Dissertation. Indiana University.

Barlow, J. A. (2001) Optimality Theory and the Assessment and Treatment of Phonological Disorders. *Language, Speech, and Hearing Services in schools, 32(4), 242-256.* https://doi.org/10.1044/0161-1461(2001/022)

Ben-David, A. (2001). Language acquisition and phonological theory: Universal and variable processes across children and across languages. Ph.D. Dissertation, Tel Aviv University. [in Hebrew].

Ben- David A. & O. Bat-El (2016). Paths and stages in acquisition of the phonological word in Hebrew: From infancy to adolescence. In R. Berman (ed.) Acquisition and Development of Hebrew: From Infancy to Adolescence, 39-68. Amsterdam: John Benjamins

Ben-David, A. & O. Bat-El (2017). Stressed vs. final syllable in early speech: Which one is stronger? In E. Bar-Asher Siegal (ed.), *Proceedings of IATL 2014, MIT Working Papers in Linguistics 82*.

Berman, R. A. (1999). Children's innovative verbs vs. nouns: structured elicitations and spontaneous coinages. In L. Menn & N. BernsteinRatner (eds) Methods for Studying Language Production, 69-93. Mahwah, NJ: Lawrence Erlbaum.

Bernhardt, B. & J. Stemberger (1998). Handbook of Phonological Development: 85 From the Perspective of Constraint-Based Nonlinear Phonology. San Diego, CA. Academic Press.

Bloch, T (2011). Simplification strategies in the acquisition of consonant clusters in Hebrew. M.A. thesis, Tel-Aviv University. Indiana University.

Bokhari, H. A. (2020), A comprehensive analysis of coda clusters in Hijazi Arabic: An optimality- theoretic perspective. Ph.D. Dissertation,

Carlisle, R. (1991a). The influence of environment on vowel epenthesis in Spanish/English interphonology. Applied Linguistics 12(1), 76-95.

Carlisle, R. (1991b). The influence of syllable structure universals on the variability of interlanguage phonology. In A.D Volpe (ed), *The seventeenth LACUS forum 1990*, 135-145. Lake Bluff, IL: Linguistic Association of Canada and the United States.

Chin, S. B. & D. A. Dinnsen (1992). Consonant clusters in disordered speech: Constraints and correspondence patterns. Journal of Child Language. 19: 259– 285.

Chomsky, N. (1959). A review of B. F. Skinner's "Verbal behaviour." Language. 35, 26–58.

Chomsky, N. (1968). Language and mind. New York: Harcourt Brace Jovanovich.

Clements, N. H. (1990). The role of the sonority cycle in core syllabification. In J. Kingston and M.E. Beckman (eds), *Papers in Laboratory Phonology I: Between the Grammar and Physics of Speech,* 283-333. Cambridge: Cambridge University Press.

Clements, N. H. (1992). The sonority cycle and syllable organization. In W.U. Dressler, H.C.

Clements, N. H. (1999). 'Concrete' Manipulatives, Concrete Ideas. *Contemporary Issues in Early Childhood,* 1(1).

Luschützky, O.E. Pfeiffer, and J.R. Rennison (eds), *Phonologica 1988: Proceedings of the 6th International Phonology Meeting*, 63-76. Cambridge: Cambridge University Press.

Daana, H. (2009). *The Development of Consonant Clusters, Stress and Plural Nouns in Jordanian Arabic Child Language*. PhD dissertation, University of Essex.

Daana, H. & S. Khrais (2018). The acquisition of English and Arabic onset cluster: A case study. *English Linguistics Research*, 7(1).

Davis, S. (1990). Italian onset structure and the distribution of il and lo. *Linguistics* 28, 283-333.

Davis, S. (1995). Emphasis spread and grounded phonology. *Linguistic Inquiry* 26, 465-498.

Demuth, K. (1996a). Alignment, stress and parsing in early phonological words. Paper presented at the Proceedings of the UBC International Conference on Phonological Acquisition.

Demuth, K. (1996b). The prosodic structure of early words. In J. Morgan & K. Demuth (eds), *Signal to syntax: Bootstrapping from Speech to Grammar in Early Acquisition*. Mahwah, N.J.: Lawrence Erlbaum Associates, 171-184.

Demuth, K. (2007). The role of frequency in language acquisition. In I. Gülzow, N. Gagarina & Z. Sprachwissenschaft (eds), *Frequency effects in language acquisition.* Walter de Gruyter , 383- 388.

Demuth, K. & J. Fee (1995). Minimal words in early phonological development. Ms., Brown University and Dalhousie University.

Diab, M. & N. Habash (2007). Arabic dialect processing tutorial. Paper presented at the Human Language Technology Conference of the North American Chapter of the ACL.

Diessesl, H. (2007). Frequency effects in language acquisition, language use, and diachronic change. *New Ideas in Psychology*, 25 (2), 108-127.

Dodd, B., A. Holm, Z. Hua & S. Crosbie (2003). Phonological development: A normative study of British English-speaking children. *Clinical Linguistics & Phonetics* 17 (8), 617-643.

Dyson, A. T. & E. P. Paden (1983). Some phonological acquisition strategies used by two-year-olds. *Communication Disorders Quarterly*, 7(1).

Dyson, A. T. & M. M. Amayreh (2000). Phonological errors and sound changes in Arabic-speaking children. *Clinical Linguistics & Phonetics*, 14 (2), 79-109.

El-Badarin, M. & R. Bani -Yasin (1993) Consonant Clusters in Northern Jordanian Arabic Dialect. *Language Research*, 29 (2), 201- 242.

Fikkert, P. (1994). *The Acquisition of Prosodic Structure*. PhD dissertation, HIL/Leiden University. The Hauge: Holland Academic Graphics.

Ghasisin, L. & Z. Ghayoumi-Anaraki (2011). Study of developmental consonant cluster in 2-4 years old Farsi speaking children [in Farsi]. مجله پژوهش در 7 (3), 391- 398.

Gnanadesikan, A. (2004) Markedness and Faithfulness Constraints in Child Phonology. In Kager, R. Pater, J. and Zonneveld, W. (eds) Constraints in Phonological Acquisition. Cambridge University Press: Cambridge. 73- 108.

Gouskova, M., & N. Hall (2009). Acoustics of epenthetic vowels in Lebanese Arabic. In S. Parker (ed.), *Phonological argumentation: Essays on evidence and motivation.* 203-225). Equinox Publishing Ltd.

Grunwell, P. (1982). *Clinical Phonology*. London & Canbbera: Croom Helm.

Haelsing, P. C. & C. Madison (1986). A study of phonological processes exhibited by 3-, 4-, and 5- year- old children. *Language Speech and Hearing Services in Schools*, 17 (2), 107- 114.

Hamdi, R., S, Ghazali, and M, Barkat-Defradas. 2005. Syllable structure in spoken Arabic: A comparative investigation. *Interspeech* 2005, the 9th European Conference on Speech Communication and Technology.

Havelova, A. (2000). Arabic Dialects of Nazareth: A Dialectological and sociolinguistic description. PhD dissertation, Haifa University.

Hayes, B. (1980). A metrical theory of stress rules. PhD dissertation, MIT.

Hayes, B. (1986). Inalterability in CV Phonology. Language, 62(2), 321-351

Hayes, B. (1995). *Metrical Stress Theory: Principles and Case Studies*. Chicago: The University of Chicago Press.

Hayes, B. (1999). Phonetically Driven Phonology. Functionalism and formalism in linguistics, 1, 243-285.

Hayes, B., R. Kirchner & D. Steriade (2004). Phonetically Based Phonology: Cambridge University Press.

Herzallah, R. S. (1990). Aspects of Palestinian Arabic phonology: A non-linear approach. PhD dissertation. Cornell University.

Hitchcock, C. (n.d.). A brief introduction to the sounds of Levantine Arabic. Retrieved September 17, 2022, from https://www.livingarabic.com/brief-introduction-to-the-sounds-of-levantine-arabic

Holes, T. (1995). *Modern Arabic: Structures, Function and Varieties*. Longman: London.

Huneety, A. & B. Mashaqba (2016). Emphatic segments and emphasis spread in rural Jordanian Arabic. *Mediterranean Journal of Social Science,* 7 (5), 294-298.

Ingram, D. (1976) Phonological Disability in Children. London: Edward Arnold.

Ingram, D. (1986). Phonological development: Production. In P. Fletcher and M. Garman (eds.), *Language Acquisition Studies in First Language Development*, 223- 239. United Kingdom: Cambridge University Press.

Jarosz, G. (2017). Defying the stimulus: Acquisition of complex onsets in Polish. *Phonology* 34, 269-298.

Karni, N. (2011). Minimal violation of faithfulness: Chain shift and local conjunction in the acquisition of Hebrew onsets. M.A. dissertation. Tel-Aviv University.

Kawahara, S. (2007). Copying and spreading in phonological theory: Evidence from echo epenthesis. To appear in L.Bateman and A. Werle (eds.) *University of Massachusetts Occasional Papers in Linguistics: Papers in Optimality Theory III.*

Kaye, A. & J. Rosenhouse (1997). Arabic dialects and Maltese. In R. Hetzron (ed.), *The Semitic Languages*, 263- 311. London, Routledge.

Kiparsky, P. (2003). Syllables and moras in Arabic. In C. Féry and R. van de Vijver (eds), The Syllable in Optimality Theory, 147-182. Cambridge: Cambridge Academic Press.

Lahrouchi, M. (2017). The first steps in the acquisition of syllables and geminates in Tashlhiyt Berber a longitudinal two- case study.

Leben, W.R. (1973). *Suprasegmental Phonology*. PhD dissertation, MIT.

Lieven, E. (2010). Bilingual Language Acquisition. Human Development, 53(5), 256-263.

Łkaszewicz, B. (2007). Reduction in syllable onsets in the acquisition of polish: Deletion, coalescence, metathesis and gemination. Journal of Child Language 34:53-82.

Massarwa, H. (2007). Evolution of phonological skills of children aged 03;00 and 04;00 years who speak Palestinian Arabic by an articulation test. M.A. thesis, Tel-Aviv University [in Hebrew]

Mashaqba, B. (2015). *The Phonology and Morphology of Wadi Ramm Arabic*. PhD dissertation, University of Salford.

Mashaqba, B. & A. Huneety (2018). Emergence of iambs in Eastern Arabic: metrical iambicity dominating optimal nonfinality. *SKASE Journal of Theoretical Linguistics*. 15(3), 15-37.

Mashaqba, B., K. Al-Shdifat, A. Huneety, & M. Abu Alhala (2019). Acquisition of syllable structure in Jordanian Arabic. *Communication Sciences and Disorders* 24 (4), 953-967.

McCarthy, J. (1981). A prosodic theory of non-concatenative morphology. *Linguistic Inquiry* 12, 373-418.

McCarthy, J. (1982). Prosodic structure and expletive infixation. *Language,* 58 (3), 574-590.

McCarthy, J. (1986). OCP effects: Gemination and antigemination. *Linguistic inquiry* 17, 207-263.

McCarthy, J & A. Prince (1990b). Prosodic Morphology and Templatic Morphology. in M. Eid and J. McCarthy (eds). *Perspectives on Arabic Linguistics: Papers from the Second Symposium,* 1-54. Benjamins, Amsterdam.

McCormack, P. F. & T. Knighton (1996). Gender differences in the speech patterns of two and a half year old children. In P. McCormack & A. Russell (eds.), *Speech Science and Technology: Sixth Australian International Conference* (337-341). Adelaide: Australian Speech Science and Technology Association.

McLoed, Sh., J. V. Doorn & V. A. Reed (2001). Normal Acquisition of Consonant Clusters. *American Journal of Speech-Language Pathology,* 10, 99- 110

Morsi, R. (2003). *Phonological acquisition of normal Egyptian children from the age of two and half to five years.* Egypt: Phonetics Dep. Faculty of Arts, University of Alexandria.

Murray, R. W. & Th. Vennemann (1983). Sound change and syllable structure in Germanic phonology. Language, 59(3), 514-528.

Mustafawi, E. (2019). Arabic phonology. The Routledge Handbook of Arabic Linguistics.

Ohala, D. K. (1999). The influence of sonority on children's cluster reductions. *Journal of Communication Disorders, 32*(6), 397-422.

Omar, M. (1973). *The Acquisition of Egyptian Arabic as a Native Language*. Washington, DC: Georgetown University Press.

Roberts, J. E., M. Burchinal & M. M. Footo (1990). Phonological process decline from 2 ½ to 8 years. *Journal of communication disorders*, 23 (3). 2015- 217.

Pozdniakov, K. & G. Segerer (2007). Similar place avoidance: A statistical universal. *Linguistic Typology*, 11 (2), 307-348.

Rosenhouse, J. (1998-1999). Symbiosis of Colloquial Arabic, Literary Arabic and Hebrew in Arabic Child Language in Israel. Materiaux Arabes et Sudarabiques, new series, 77-112.

Rosenhouse, J. (2000) The acquisition of Arabic as mother tongue (mainly in Israel). *Oriente Moderno* 80 (1), 119-151

Saiegh- Haddad, E., A. Hadieh & D. Ravid (2012). Acquiring noun plurals in Palesinian Arabic: Morphology, Familiarity, and pattern frequency. *Language learning*, 62 (4), 1079- 1109.

Saiegh-Haddad, E. & B. Spolsky (2014). Acquiring literacy in a diglossic context: problems and prospects. In E. Saiegh-Haddad& M. Joshi (eds.), Handbook of Arabic literacy: insights and perspectives (225– 40). Dordrecht: Springer.

Schwartz, R. G. & L. B. Leonard (1982). Do children pick and choose? An examination of phonological selection and avoidance in early lexical acquisition. *Journal of Child Language, 9*(2), 319–336.

Selkirk, E. (1984). On the major class features and syllable theory. In M. Aronoff and R.T. Oerhle (Eds.), *Language Sound Structure*, 107-136. Cambridge, MA: MIT Press.

Shah, M. (2008) The Arabic language. In Rippin A. (ed.) *The Islamic World*. London: Routledge, 261–277.

Shahin, K. (2003). Vowel innovation in Arabic: Inductive grounding and pattern symmetry. In J. Lecarme (ed), *Research in Afroasiatic Grammar II*, (429- 446). John Benjamins Publishing.

Smolensky, P. (1996a) On the Comprehension! Production Dilemma in Child Language. Language Inquiry 27, 720- 731.

Steriade, D. (1982). *Greek prosodies and the nature of syllabification*. PhD Dissertation, MIT.

Stoel-Gammon, C. (1987). Phonological skills of 2-year-olds. *Language, Speech, and Hearing Services in Schools, 18,* 323-329.

Tomasello, M. (2003). Constructing a language: A usage-based theory of language acquisition. Cambridge, MA: Harvard University Press.

Watson, J. (1995). Vowel Harmony in Arabic. CMEIS, University of Durham, DHI3T.

Watson, J. (1999). 'The directionality of emphasis spread in Arabic'. Linguistic Inquiry, 30, 289-300.

Watson, J. (2011). Word stress in Arabic. In M. van Oostendorp, C.J. Ewen and E.V. Hume (Eds.), *The Blackwell Companion to Phonology* v.5, 2990-3018. Oxford, UK: Wiley-Blackwell.

Wheeler, M. (2005). Cluster reduction: Deletion or coalescence. *Catalan Journal of Linguistics*, 4(1).

Yavaş, M. (1995). Phonological selectivity in the first fifty words of a bilingual child. *Language and speech.* 38 (2), 189-202.

Yavaş, M. (1998). Phonology: Development and Disorders: Singular Publishing Group.

Yavaş, M. & J. Barlow (2006). Acquisition of #sC clusters in Spanish-English bilingual children. *Journal of Multilingual Communication Disorders* 4(3), 182-193. *(6) (PDF) Toward a generative theory of language transfer: Experiment and modelling of sC prothesis in L2 Spanish*. Available from:

Yip, M. (1998). Identity avoidance in phonology and morphology. In S. Lapointe, D. Brentari, and P. Farrell (eds), *Morphology and its Relation to Phonology and Syntax*, 216-245. CSLI, Stanford.

Appendix A: A comparison of consonant acquisition in various Arabic dialects

C	**EA** Omar (1973)	**EA** Morsi (2003)	**JordanianA** Amayreh & Dyson (1998)	**NIA** Rosenhouse (2000)	**TA** Massarw (2007)	**NIA** Abu-Dahud (2016)	**TA** Abd El kadir (2018)
	N=37	N=30	N=180	N=24	N=40	N=126	N=8
b	01;06	02;06-03;00	02;00-03;10	02;00	<03;00	<03;00-03;11	<02;00
t	02;00	02;06-03;00	02;00- 03;10	02;00	<03;00	<03;00-03;11	<02;00
d	02;00	02;06-03;00	02;00- 03;10	02;00	<04;00[12]	<03;00-03;11	<02;03
k	02;00	02;06-03;00	02;00- 03;10	02;00	<03;00	<03;00-03;11	<02;06
q	06;06	*	>06;04	05;00	<03;00[5]	*	**
ʔ	01;06	02;06-03;00	>06;04	02;00	<03;00	<03;00-03;11	<02;00
f	02;03	02;06-03;00	02;00- 03;10	02;00	<03;00	<03;00-03;11	<02;03
s	02;00	02;06-03;00	04;00- 06;04	02;00	**	<04;00	**
z	02;00	02;06-03;00	>06;04	03;00	**	<04;00	**
ʃ	06;06	03;00-04;00	04;00- 06;04	05;00	<04;00	<04;00	<03;00
x	02;00	02;06-03;00	04;00- 06;04	03;00	<03;00	<03;00-03;11	<02;06
ɣ	02;00	04;00-05;00	04;00- 06;04	03;00	<03;00	<03;00-03;11	<02;06
ħ	03;00	02;06-03;00	02;00- 03;10	03;00	<03;00	<03;00-03;11	<02;06
h	01;06	02;06-03;00	04;00- 06;04	02;00	<03;00	<03;00-03;11	<02;03
ʕ	04;06	02;06-03;00	>06;04	03;00	**	<03;00-03;11	<02;09
n	02;00	02;06-03;00	02;00- 03;10	02;00	<03;00	<03;00-03;11	<02;00
m	01;06	02;06-03;00	02;00- 03;10	02;00	<03;00	<03;00-03;11	<02;00
r	06;06	04;00-05;00	04;00- 06;04	03;00	<04;00	<04;00	**
l	02;00	02;06-03;00	02;00- 03;10	02;00	<04;00[5]	<03;00-03;11	<02;06
w	01;06	02;06-03;00	02;00- 03;10	03;00	<03;00	<03;00-03;11	<02;00
j	01;06	02;06-03;00	02;00- 03;10	03;00	<03;00	<03;00-03;11	<02;00
θ		*	>06;04	05;00	**	*	<02;09
ð		*	>06;04	05;00	**	*	<03;00
d͡ʒ	04;00	*	>06;04	03;06	<03;00	*	**
ðˤ	03;06	*	>06;04	05;00	**	*	**
sˤ	03;06	03;00-04;00	>06;04	03;06	**	<04;00	**
tˤ	03;06	04;00-05;00	>06;04	05;00	04;00[5]	03;00-03;11	**
dˤ	03;06	04;00-05;00	>06;04	05;00	**	*	**

EA – Egyptian Arabic, JoA- Jordanian Arabic, TA- Taibeh Arabic, NIA- North Israel Arabic (different dialect in each study) * – Segment does not exist in the dialect, ** – segment acquired after the maximum age studied.

[12] The segment acquired at this age among girls only.

Appendix B: List of words for the pre-test – word initial singletons

	Segment	*Word*	*Gloss*
1.	b	ba:b	‘door’
2.	t	tu:t	'strawberry'
3.	d	da:r	'house'
4.	tˤ	tˤa:.bi	'ball'
5.	k	ka.lib	'dog'
6.	d͡ʒ	d͡ʒa.mal	'camel'
7.	m	mo:.zi	'banana'
8.	n	na:r	'fire'
9.	f	fi:l	'elephant'
10.	θ	θim	'mouth'
11.	s	sin	'teeth'
12.	z	za.rif	'bag'
13.	sˤ	sˤu:sˤ	'chick'
14.	x	xa.ru:f	'sheep'
15.	ɣ	ɣe:.me	'cloud'
16.	ħ	ħa.li:b	'milk'
17.	ʕ	ʕe:n	'eye'
18.	h	haw.waj	'fan'
19.	r	ra:s	'head'
20.	l	luʕ.bi, liʕ.bi	'toy'
21.	w	wa.lad	'boy'

Appendix C: Vowels that shift words from JA to MSA

Cluster Type		*JA Word*	*MSA Word*	*Gloss*	*Epenthetic V*
Stop–Stop	1.	kbi:r	k**a**bi:r	'big'	a
	2.	kta:b	k**i**ta:b	'book'	i
Stop–Fricative	3.	dha:n	d**i**ha:n	'paint'	i
	4.	kθi:r	k**a**θi:r	'lot'	a
	5.	qsˤi:ri	q**a**sˤi:ra	'short FM'	a
Stop–Nasal	6.	dmu:ʕ	d**u**mu:ʕ	'tears'	u
	7.	kna:fi	k**u**na:fa	'a traditional dessert'	u
Stop–Glide	8.	tˤwi:l	tˤ**a**wi:l	'tall MS'	a
Fricative–Fricative	9.	xza:ni	x**i**za:na		i
	10.	ħsˤa:n	ħ**i**sˤa:n		i
	11.	zɣi:ri	sˤ**a**ɣi:ra		a
Fricative–Stop	12.	zba:li	z**i**ba:la	'trash'	i
	13.	sba:ħa	s**i**ba:ħa	'swimming'	i
	14.	ftˤu:r	f**u**tˤu:r	'breakfast'	u
Fricative–Nasal	15.	ħma:r	ħ**i**ma:r	'donkey'	i
Fricative–Glide	16.	xja:r	qiθa:ʔ	'cucumber'	
	17.	swa:ra	s**i**wa:r*	'bracelet'	i
Nasal–Affricate	18.	nd͡ʒa:sˤa	ʔid͡ʒa:sˤa	'pear'	
Nasal–Fricative	19.	msakʕa	ba:rida	'cold FM'	
Nasal- Liquid	20.	mra:	m**i**r**ʔ**a:	'mirror'	
Liquid–Stop	21.	lba:n	ʕilki	'gum'	
Liquid–Fricative	22.	lħa:f	l**i**ħa:f	'blanket'	i
	23.	lsa:n	l**i**sa:n	'tongue'	i
Liquid–Nasal	24.	rmu:ʃ	r**u**mu:ʃ	'eyelashes'	u
Glide–Fricative	25.	wsa:di	w**i**sa:da	'pillow'	i
Glide–Liquid	26.	wla:d	**ʔa**wla:d	'boys'	

Appendix D: Parents approval on participate in the study

استمارة موافقة

أنا الموقع أدناه:

الوالدة:	الاسم الشخصي واسم العائلة	رقم الهوية
	العنوان	

الوالد:	الاسم الشخصي واسم العائلة	رقم الهوية
	العنوان	

أ. أنا صرح بهذا انني موافق على اشتراك ابني/ ابنتي/ ابنائي في البحث "اكتساب المباني العنقودية للحروف في اللغة العربية".

ب. أصرح بأن السيدة علا غرة قامت بشرح التالي:

البحث "اكتساب المباني العنقودية للحروف في اللغة العربية" يُعقد في فرع علم اللسانيات في جامعة تل ابيب، وهدفه فحص المرحلة العمرية التي يتم فيها اكتساب هذا المبنى.

- البحث منوط بلقاء (او اثنين) مع الأطفال. بحيث تكون مدة اللقاء حوالي 10 دقائق.
- يتم تسجيل اللقاء، ويتم فيما بعد توثيق ردود/ إجابات الأطفال كتابيا وتحليل النتائج بواسطة الباحثة.
- خلال اللقاء تقوم الباحثة بعرض صور عن طريق الحاسوب للأطفال.
- بإمكاني الحصول على تسجيلات ابني/ ابنتي في أي وقت، والباحثة موافقة على الإجابة على الأسئلة المتعلقة بتطورات البحث.

1. لي كامل الحرية في اتخاذ قرار عدم المشاركة في البحث او إيقاف الاشتراك في أي وقت اريد، من دون ان يؤثر ذلك على حقوقي، ومن دون المس بي بأي شكل من الاشكال.
2. مؤكدٌ لي ان البحث محاط بالسرية التامة فيما يتعلق بشخصي وشخص ابنائي خلال كتابة البحث او عرض نتائجه في المؤتمرات المختلفة.
3. مؤكدٌ لي الحصول على إجابات لأي أسئلة قد تخالجني، والتمكن من استشارة أي طرف اخر فيما يتعلق باتخاذ قرار للمشاركة في البحث او الاستمرار فيه او إيقاف الاشتراك به.

ج. أصرح بذلك أنني موافق طواعية، كما وانني قد فهمت كل ما كُتب أعلاه كاملا

الوالدة:	الاسم	التوقيع	التاريخ
	تلفون	بريد الكتروني	
الوالد:	الاسم	التوقيع	التاريخ
	تلفون	بريد الكتروني	

تم الحصول على الموافقة أعلاه بواسطتي، وهذا بعد ان قمت بشرح كل ما كتب أعلاه للمشترك/ة في البحث، وتأكدت من فهمه/ ـا لكل ما تم شرحه.

الباحث الرئيس: بروفيسور أوتي بات- إيل

التوقيع	التاريخ
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مساعدة البحث: السيدة علا غرة

التوقيع	التاريخ
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Appendix E: Participants details

	Age group	*Name*	*Gender*	*D. Birth*	*D. Record*	*Age*	*Jatt/ Baqa*
1		SaG	F.	15/05/2020	27/07/2022	02;02	J
2		AlM	M.	03/05/2020	27/07/2022	02;02	J
3	**(1)**	OmW	M.	01/08/2020	05/08/2022	02;00	J
4	**02;00- 02;05**	MahG	M.	17/03/2020	01/08/2022	02;04	J
5		SiG	F.	17/03/2020	01/08/2022	02;04	J
6		AmW	M.	15/05/2020	26/07/2022	02;02	J
7		YaD	M.	09/12/2018	22/09/2021	02;09	B
8		SaH	F.	29/09/2018	05/04/2021	02;06	J
9		JaSh	F.	14/01/2019	01/11/2021	02;09	J
10	**(2)**	LaD	F.	02/06/2019	25/09/2021	02;06	B
11	**02;06- 03;00**	EhW	M.	29/03/2019	28/09/2021	02;06	J
12		QaW	M.	03/04/2019	03/10/2021	02;06	J
13		SaW	F.	20/10/2018	17/06/2021	02;08	J
14		FatW	F.	15/09/2018	24/04/2021	02;07	J
15		LoZ	F.	25/08/2018	26/11/2021	03;03	B
16		FaQ	F.	24/09/2017	25/10/2020	03;01	J
17		JaW	F.	17/01/2017	21/02/2020	03;01	J
18	**(3)**	AmG	M.	17/07/2018	28/10/2021	03;03	J
19	**03;01- 03;06**	RoA	F.	07/09/2018	12/01/2021	03;04	B
20		NuN	F.	09/10/2018	20/11/2021	03;01	J
21		YaN	M.	24/04/2021	30/10/2021	03;06	J
22		AmM	M.	01/07/2018	18/11/2021	03;04	J
23		MiW	F.	07/10/2017	26/09/2021	03;11	J
24		RiW	F.	16/09/2017	24/09/2021	04;00	J
25		SaA	M.	15/08/2017	10/06/2021	03;10	B
26	**(4)**	JuKh	F.	02/08/2017	20/07/2021	03;11	J
27	**03;07- 04;00**	FaW	F.	14/08/2017	26/06/2021	03;09	J
28		AdW	M.	14/08/2017	26/06/2021	03;09	J
29		ZaM	F.	28/05/2017	06/04/2021	03;11	J
30		AmSh	M.	25/03/2017	14/04/2021	04;00	J
31		KiW	M.	02/02/2017	11/05/2021	04;02	J
32		JaM	F.	17/01/2017	17/05/2021	04;04	J
33		MaG	F.	18/02/2017	26/04/2021	04;02	J
34	**(5)**	SoKh	F.	20/11/2016	15/06/2021	04;06	J
35	**04;01- 04;06**	OmG	M.	28/03/2017	06/09/2021	04;05	J
36		AlW.	M.	24/10/2017	12/02/2021	04;01	J
37		AhN	M.	16/09/2017	24/11/2021	04;02	J
38		NaSh	M.	19/11/2017	21/01/2022	04;02	J
39		AbW	M.	26/02/2017	28/09/2021	04;07	J
40		JaW	F.	18/01/2017	28/09/2021	04;08	J
41		MiW	F.	12/11/2016	25/09/2021	04;10	J
42	**(6)**	AdM	M.	18/02/2017	18/11/2021	04;09	J
43	**04;07- 05;00**	NuW	F.	14/11/2016	27/10/2021	04;11	J
44		MaO	F.	18/02/2017	06/12/2021	04;11	J
45		SiSh	F.	04/06/2017	06/12/2021	04;06	J
46		SaW	F.	24/12/2016	30/11/2021	04;11	J

Appendix F: Repair strategies by sonority profile and age group

	Age group	*Faithful*	*C1 deletion*	*C2 deletion*	*Prothesis*	*Epenthesis*	*Metathesis*	*Total*
Rise	1	13 42%	4 13%	1 3%	5 16%	8 26%	0 0	31
	2	16 30%	0 0	4 7%	31 57%	3 6%	0 0	54
	3	31 49%	0 0	2 3%	26 39%	6 9%	0 0	67
	4	30 51%	0 0	1 2%	25 42 %	4 7%	0 0	61
	5	52 79 %	0 0	0 0	10 15%	4 6%	0 0	68
	6	46 64%	0 0	0 0	18 25%	8 11%	0 0	73
Plateau	1	7 47%	1 7%	1 7%	1 7%	5 33%	0 0	15
	2	9 41%	2 9%	0 0	11 50%	0 0	0 0	22
	3	15 56%	1 4%	0 0	10 37%	1 4%	0 0	27
	4	15 53%	1 4%	0 0	11 39%	1 4%	0 0	28
	5	19 70%	0 0	0 0	6 22%	2 7%	0 0	27
	6	20 69%	0 0	0 0	8 28%	1 3%	0 0	29
Fall	1	1 4%	21 75%	0 0	0 0	6 21%	0 0	28
	2	6 134%	13 29%	0 0	24 53%	1 2%	1 2%	45
	3	7 154%	9 20%	0 0	30 65%	0 0	0 0	46
	4	15 28%	8 15%	1 2%	30 56%	0 0	0 0	54
	5	22 38%	10 17%	1 2%	24 41%	0 0	1 2%	58
	6	29 51%	5 9%	0 0	23 40%	0 0	0 0	57

Appendix G: Prothesis across age groups

Age group	*Rise*		*Plateau*		*Fall*	
	no.	***%***	***no.***	***%***	***no.***	***%***
1	5	17%	1	7%	0	0%
2	30	60%	11	50%	24	53%
3	26	43%	10	37%	30	65%
4	24	44%	11	41%	30	55%
5	10	16%	6	22%	24	41%
6	18	27%	8	28%	23	40%

Appendix H: Epenthesis across age groups

Age group	*Rise*		*Plateau*		*Fall*	
	no.	***%***	***no.***	***%***	***no.***	***%***
1	8	27%	5	33%	5	19%
2	2	4%	0	0%	1	2%
3	3	5%	1	4%	0	0%
4	1	2%	1	4%	0	0%
5	0	0%	2	7%	0	0%
6	2	3%	1	3%	0	0%

Appendix I: C-deletion across age groups

Age group	*Rise*				*Plateau*				*Fall*				*Total*	
	C_1		C_2		C_1		C_2		C_1		C_2		C_1	C_2
1	4	13%	1	3%	1	7%	1	7%	21	75%	0	0%	26	2
2	0	0%	2	4%	2	9%	0	0%	13	29%	0	0%	15	2
3	0	0%	0	0%	1	4%	0	0%	9	20%	0	0%	10	0
4	0	0%	0	0%	1	4%	0	0%	8	15%	1	2%	9	1
5	0	0%	0	0%	0	0%	0	0%	10	17%	1	2%	10	1
6	0	0%	0	0%	0	0%	0	0%	5	9%	0	0%	5	0

אוניברסיטת תל-אביב TEL AVIV UNIVERSITY

הפקולטה למדעי הרוח על שם לסטר וסאלי אנטין
בית הספר לפילוסופיה, בלשנות ולימודי מדע
החוג לבלשנות

רכישת הצרורות התחיליים בערבית מדוברת בדיאלקט של ג׳ת

חיבור זה מוגש כעבודת גמר מחקרית לקראת התואר
״מוסמך אוניברסיטה״ (M.A.) באוניברסיטת תל אביב

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עולא ותד

העבודה הוכנה בהנחיית:

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ד״ר אביבית בן-דוד

אוקטובר 2022

תקציר

במהלך רכישת שפה, ילדים משתמשים באסטרטגיות רבות המסייעות להם להתמודד עם צורות עיצורים שהם רוכשים. ישנן שתי גישות הנוגעות לרכישת השפה: הראשונה טוענת כי רכישת השפה היא תלוית ניסיון (Tomassello 2003), ולכן הכישורים הלשוניים ורכישת השפה שזורים ביכולות קוגניטיביות אחרות; והשנייה טוענת כי מלבד התהליך התלוי בחוויה ישנם אילוצים אוניברסליים בלתי תלויי ניסיון המשפיעים על הרכישה (חומסקי 1959, 1968).

כדי לבדוק בסוגיה זו, חקרנו את רכישת צרורות תחיליים בערבית מדוברת (בדיאלקט ספציפי- דיאלקט של ג׳ת). בניגוד לערבית הסטנדרטית המודרנית, ערבית של ג׳ת מאפשרת צרורות תחיליים המשתנים בפרופיל הסונוריות שלהם: לערבית של ג׳ת יש שפע של צרורות תחיליים המפרים עקרונות אוניברסליים במיוחד כאשר לוקחים בחשבון את המורפמות -n, -m, j- (לדוגמה, המילים lbu:b ׳זרעים׳, j-sʕawwitʕ ׳הוא יצביע׳ מפרים את ה- SSP). בדומה לשפות אחרות, ילדים שרוכשים ערבית מדוברת משתמשים באסטרטגיות פישוט שונות כדי לפשט את הצרורות התחיליים במיוחד בשלבים הראשונים של הרכישה. השמטה של עיצור לפחות מהצרור, החדרה של תנועה בין שני העיצורים בצרור (אפנטיסיז), שיכול עיצורים (מטטיסיז), הכפלה, ו- coalescence הן אסטרטגיות שהוזכרו במחקרים שונים שחקרו רכישת צרורות תחיליים (Mcloed, Doorn &Reed 2001, Ben-David 2001, Danna 2009). מלבד אסטרטגיות קודמות אלה, פרוטיסיז (החדרה של תנועה לפני שני העיצורים בצרור) היא אסטרטגיה שנמצאה במחקר Daana (2009) וב- Danna & Khrais (2018) . אסטרטגיה זו היא אסטרטגיה ספציפית לשפה שילדים שרכשו ערבית מדוברת השתמשו בה, ולא תועדה אצל ילדים שרכשו שפות אחרות. שימוש בפרוטיסיז תואם את טענת Kiparsy (2003) שלפי הסיווג שלו ערבית הפלסטינית, ולכן ערבית של ג׳ת, הינה שייכת לקבוצת ה- VC dialects שהתנועה המוחדרת בקבוצת הדיאלקטים הלאה מוחדרת לפני העיצור הראשון ולא בין שני העיצורים בצרור.

כאמור, ילדים שרוכשים שפות אחרות שאין להן פרוטיסיז בדקדוק שלהם, אינם מפשטים צרורות תחיליים באמצעות אסטרטגיה זו (בן-דוד 2001, בן-דוד ובת-אל 2016, Mcloed, Doorn &Reed 2003, Alqattan 2015), ולכן פרוטיסיז, היא ככל הנראה אסטרטגיה תלוית ניסיון שילדים משיגים עם החשיפה לשפה הספציפית. לכן בהתייחס לשתי הגישות הנ״ל, הגישה תלוית-הניסיון מנבאת שילדים נוטים להשתמש בפרוטיסיז יותר מאשר באסטרטגיות אחרות. במקביל, הגישה הבלתי- תלוית- ניסיון מנבאת כי רכישת הצרורות התחיליים תהיה מושפעת מהעקרונות האוניברסליים, כך שמילים שמכבדות עקרונות אוניברסליים יירכשו מוקדם יותר ממילים המפרות אותם, והם ישפיעו, גם, על בחירת אסטרטגיות פישוט הצרור שילדים משתמשים בהם.

במחקר זה בחנו 46 ילדים חד לשוניים, בעלי התפתחות טיפוסית, רובם מג׳ת (כפר באזור המשולש בישראל) ומעטים מבאקה (עיירה סמוכה לג׳ת עם אימהות רבות מג׳ת במקור). הילדים חולקו לשש קבוצות גיל: 02;00- 02;05; 02;06-03;00; 03;01- 03-06; 03;07-04;00; 04;01- 04;06; 04;07- 05;00. המשימה שניתנה לילדים הייתה שיום תמונות והשלמת משפטים בתבנית של אנאלוגיות, הילדים הוקלטו והתגובות שלהם תועתקו. המילים במשימה היו משלושה סוגים שונים: (1) מילים עם פרופיל סונורי עולה, (2) מילים עם פרופיל סונורי קבוע- plateau, ו- (3) מילים עם פרופיל סונורי יורד. מידע אודות שכיחות המילים בשפה הושג דרך קורפוס דיבור מכוון-ילדים (CDS).

במחקר זה בחנו שלושה אילוצים אוניברסליים הקשורים לצרורות תחיליים ולאסטרטגיות המשמשות לפישוט צרורות: SSP (Steriade 1982, Selkirk 1984, Clements 1990), SDP (Clements 1990 1992), ו- SCL (Murray &Vennemann 1983, Vennemann 1988).

הטענה היא שגם אילוצים אוניברסליים וגם תכונות ספציפיות של השפה משחקים תפקיד ברכישת צרורות תחיליים בדיאלקט של ג׳ת.

מהממצאים עולה כי ילדים הרוכשים ערבית של ג׳ת משתמשים בשלוש אסטרטגיות עיקריות לפישוט צרורות תחיליים: השמטה של עיצור אחד בצרור, החדרה של תנועה בין שני העיצורים בצרור (אפנטיסיז), והחדרה של תנועה לפני העיצור הראשון במילה (פרוטיסיז). למרות שהשמטה של עיצור אחד בצרור היא אסטרטגיה נפוצה לפישוט צרורות בשפות שונות (בן-דוד 2001, עבור עברית; Łkaszewicz 2007, עבור פולנית), במחקר זה זו הייתה האסטרטגיה השכיחה ביותר בקבוצת הגיל הצעירה ביותר בלבד, וזה תומך בטענה כי ההשפעה של האוניברסליות משחקת תפקיד בהתפתחות השפה, והיא ניכרת, במיוחד, בשלבי רכישה מוקדמים (אדם ובת-אל 2009), ממצא זה תומך גם בממצאיה של Daana (2009) שהראתה שילדים מתחילים להעדיף אסטרטגיות ספציפיות לשפה סביב גיל 02;06. הירידה באחוזי השימוש בשמטה של עיצור מהצרור מלווה בעליה בשימוש באסטרטגיה הספציפית לשפה ״פרוטיסיז״ וזה מראה שילדים מעדיפים לשמר יותר עיצורים כשהם מגיעים לשלב שבו הם יכולים להפיק יותר משתי הברות במילה. בשוואה בין פרוטסיז לאפנטיסיז נראה כי אחוזי השימוש באפנטיסיז ירדו עם ההטבה בפרופיל הסונורי של הצרורות sonority, וזה יכול להצביע על כך ש- SCL משחק תפקיד בבחירת האסטרטגיה לפישוט צרור. יתר על כן, הממצאים מצביעים על כך שאחוזי ההפקות הנאמנות של הילדים שהם גבוהים יותר במילים עם פרופיל סונורי עולה יכול להיות בגלל ההשפעה של SSP וגם בגלל השכיחות הרבה של מילים מהסוג הזה בשפה. במקביל, הממצאים מראים שאין הבדל בין אחוזי ההפקות הנאמנות של המילים בעלות הפרופיל הסונורי העולה לעומת המילים בעלות הפרופיל הסונורי הקבוע-plateau , וזה בניגוד למה שצפוי לפי SSP. ההסבר לדמיון בין האחוזים בשתי קבוצות המילים האלו הוא השכיחות של המילים בשפה- כי לפי CDS נמצא כי המילים בעלות הפרופיל הסונורי הקבוע- plateau דומה מאוד לשכיחות של המילים בעלות הפרופיל הסונורי העולה.

מכאן, במחקר זה נמצא כי שכיחות של המילים בשפה ועקרונות אוניברסאליים משפיעים על תהליך רכישת הצרורות התחיליים אצל ילדים. בנוסף, נמצא גם שאסטרטגיות הפישוט מכילות אסטרטגיה ספציפית לשפה שילדים מתחילים להשתמש בה באופן ברור עם העלייה בגיל.