

## Cluster Reduction in Child Phonology Revisited

**Mohamed-Basil K. Al-Azzawi**  
**Department of Translation**  
**College of Arts**

**Anmar H. Sa'eed**  
**Department of English**  
**College of Arts**

### **1. INTRODUCTION:**

It is remarkably noticed that young children produce simplified versions of adult speech. Consonant clusters, characterized as complex structures, are no exception in this regard. That is to say, a child using words containing consonant clusters resorts to manipulating these clusters in different ways so as to get them into simpler structures. A set of such processes include cluster reduction, epenthesis, coalescence, substitution and metathesis (Stemberger & Bernhardt, 1999). Cluster reduction, the focal issue of this study, is described as a characteristic aspect of young children's productions, especially those whose ages range between 2 and 3 years (see Smith, 1973 ; Barlow & Gierut, 1999 ; McLeod et al., 2001a ; 2001b; Kirk & Demuth, 2003 ; among others).

'Cluster reduction' involves the dropping of one or more consonants from the cluster. Grunwell (1987: 217, quoted in McLeod et al., 2001a: 102) defines cluster reduction as "the deletion of one or more consonants from a cluster so that only a single consonant occurs at syllable margins". Cluster reduction is attested in both onset and coda clusters and it results in simple non-branching constituents in most respects. Thus, cluster reduction, to quote Smith's (1973) words, "leads to an 'ideal' canonical form of alternating consonants and vowels" (p.168). Kula and Tzakosta (ms.) state that this is "attributed to the need to try and fit these complex structures into the children's relatively simple CV syllable template".

Cluster reduction in young children is not a random process in the sense that the child may delete any consonant in the cluster to produce a simpler structure. Various studies report that the process of cluster reduction is a systematic one. Pater and Barlow (2003), for example, state that “[w]hen children reduce onset clusters to singletons, they are usually systematic in terms of what consonant from the cluster they retain” (p.488). The subsequent section sheds light on the main patterns of cluster reduction that have been singled out in the literature of child phonology.

## **2. Patterns of Cluster Reduction:**

Much of the previous literature on the acquisition of consonant clusters has focused on whether children’s reduction patterns are best explained in terms of ‘sonority’ (Ohala, 1999; Pater and Barlow, 2003; Barlow, 2005 ; among others), ‘headedness’ (Goad and Rose, 2004), or ‘contiguity’ (van der Pas, 2004). In what follows, we intend to discuss these various patterns of cluster reduction and disclose the nature of principles they rely on to account for cluster reduction. Examples from the literature will be provided so as to show how these different patterns work. Special focus will be made on onset clusters.

### **2.1. The Sonority Pattern:**

One of the patterns of cluster reduction that has gained ground cross-linguistically is one that resorts to the linguistic phenomenon of sonority. Various researchers have shown that cluster reduction proceeds systematically by retraining the least sonorous segment (e.g. Ohala, 1999; Gierut, 1999; Barlow, 2003, 2005; Pater and Barlow, 2003; Fikkert and Freitas, 2004; among others). The ‘Sonority Pattern’ views cluster reduction

as a function of the overall complexity of the syllable in which the cluster occurs. It, thus, implies that “syllable initial cluster reduces to whichever consonant in the cluster creates a maximal sonority rise and syllable final clusters reduce to whichever consonant in the cluster creates a minimal sonority descent” (Ohala, 1999: 402). It is proposed that children reduce clusters in such a way that the resulting syllable exhibits the most optimal syllable contour, characterized by the occurrence of syllable type CV with the least sonorous consonant assuming the C node. Such a syllable type is described as an optimal syllable (Ohala, 1999: 401-2). To illustrate this pattern, examples from a number of languages that lend support to the ‘sonority pattern’ are cited below.

(1) Cluster Reduction in terms of “Sonority Pattern”:

a. English (Smith, 1973 and Gnanadesikan, 1995)

1. play /pleɪ/ → [beɪ] Amahl (2; 3.23)
- great /greɪt/ → [ge:t] Amahl (2; 4.10)
- star /sta:/ → [da:] Amahl (2; 3.21)
- spade /speɪd/ → [beɪd] Amahl (2; 4.17)
- skin /skɪn/ → [gɪn] Amahl (2; 2)
2. clean /kli:n/ → [kɪn] Gitanjali (2; 3)
- please /pli:z/ → [pɪz] Gitanjali (2; 3)
- sky /skaɪ/ → [gaɪ] Gitanjali (2; 3)
- skin /skɪn/ → [gɪn] Gitanjali (2; 3)

b. European Portuguese (Freitas, 2003 and Fikkert and Freitas, 2004):

- crème /'krɛm/ → ['kɛm] Ines (1; 5.11) ‘cream’
- braso /'bɾasɐ/ → ['bɾɐ] Joao (2; 4.30) ‘arm’
- step /stɛp/ → [tɛp] Tirza (1; 11.9) ‘scooter’

c. Spanish (Barlow, 2005)

plato /plato/ → [pato]	BL4 (2; 8) 'plate'
fresa /ffesa/ → [fesa]	BL4 (2; 8) 'strawberry'
cruz /kfus/ → [kus]	BL4 (2; 8) 'cross'

d. Greek (Kula and Tzakosta (ms.)

— /'kreas/ → ['ceas]	Bebis (1; 10) 'meat'
— /'trone/ → ['tone]	Bebis (2; 01.05) 'eat'
— /'prasino/ → ['pati]	Dionisis (2; 01.16) 'hole'

These examples reveal that the 'sonority pattern' does not depend on the position of the consonant in the cluster. Thus, it is sometimes the first and sometimes the second consonant being deleted. The process of reduction mainly draws on the Sonority Sequencing Principle (SSP) and the Sonority Hierarchy (SH) which constrain the syllable structure (Clements, 1990) <sup>1</sup>.

## 2.2. The Head Pattern:

It has been reported that some children incline to reduce the cluster to its more sonorous consonant with the least sonorous consonant being deleted from the cluster, in contrast to the sonority pattern (see Barlow, 2003; Freitas, 2003; Pater and Barlow, 2003; Goad and Rose, 2004; van der Pas, 2004, among others). To carry out this discussion we intend to provide examples from English (Smith, 1973) and Dutch (van der Pas, 2004) which diverge from the sonority pattern.

### (2) Cluster Reduction to the Most Sonorous Segment:

<sup>1</sup> According to the SSP " onsets of syllables maximally rise in sonority to the nucleus, and codas fall (or remain level) in sonority from the nucleus" (Gierut, 1999: 709). The SH, on the other hand, is a scale that arranges consonants according to sonority (see Ohala, 1999: 400; Gierut, 1999:710; see also Sa'eed, 2006: 36f).

a. English (Amahl)

sleep /sli:p/ → [wi:p] (2; 03.25)

[li:p] (2; 06.27)

slip /slip/ → [wip]/ [lip] (2; 05.06)

smell /smel/ → [mɛn] (2; 02)

snake /sneik/ → [ɲe<sup>i</sup>k] (2; 02)

[neik] (2; 08.07)

swing /swiŋ/ → [wiŋ] (2; 02)

b. Dutch

— /slak/ → [lak] Len (1; 10.10 – 1; 10.24)

— /vlix/ → [liɣ] Saar (1; 11.8 – 2; 0.8)

— /slapə/ → [lapə] Hannah (1; 10.29 – 1; 11.06)

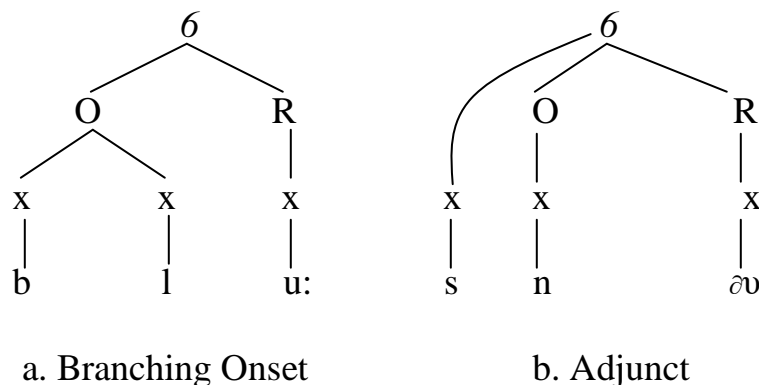
In these examples the cluster is reduced to its more sonorous segments /l/, /n/, /m/, /w/ with the fricative deleted being less sonorous.

Goad and Rose (2004) argue that such examples should be accounted for in terms of syllable ‘headedness’. In other words, it is claimed that in cluster reduction, children show a preference for preserving ‘heads’ of subsyllabic structures, e.g. heads of onsets (van der Pas, 2004: 6; see also Spencer, 1986: 12ff). This pattern is known as the ‘Head Pattern’.

Goad and Rose (2004: 110f) propose that the ‘head pattern’ draws on the underlying phonological representation of syllables, where children are claimed to be aware of the prosodification of syllables<sup>1</sup>. Thus, /s/ C-clusters are viewed to be composed of an adjunct (or appendix) /s/ plus a simple onset (i.e. a singleton), whereas C /sonorant/ - clusters are considered as

<sup>1</sup> Goad & Rose (2004) argue that the ‘sonority pattern’ and the ‘head pattern’ are representative of two distinct stages in development that differ in the degree to which inputs are elaborated by the children.

branching clusters (Selkirk, 1982; see also Gierut, 1999; Boyd, 2002; Yildiz, 2005). In Figure (1), we provide the syllabic representation of the words ‘blue and snow’ in a and b, respectively.



**Figure (1): The Representation of ‘blue’ and ‘snow’**

The structural representation given in (b) above suggests that /s/ does not count as a constituent of the syllable onset but it is immediately linked to the syllable node (Yildiz, 2005: 168f); cf. Spencer’s 1986 ‘premargin’. Thus, according to such account, the head of an initial /s/ C-cluster is the C (where C is any consonant), whereas the head of all other initial – obstruent + sonorant clusters is the obstruent<sup>1</sup>.

It follows from this that determining the ‘head’ of the syllable neither relies on the position of the consonant nor on its sonority value but rather on its underlying representation.

<sup>1</sup> For a discussion about the unique structural and behavioural status of /s/c-clusters, see, among others, Gierut, 1999 ; Barlow, 2003 and Yildiz, 2005.

### 2.3. The Contiguity Pattern:

The ‘sonority pattern’ and the ‘head pattern’ above account for a large body of data exhibiting cluster reduction, yet some instances of cluster reduction, as provided in the literature, do not coincide with the predictions of either pattern (Pater and Barlow, 2003; Fikkert and Freitas, 2004; van der Pas, 2004; see also Ohala, 1999: 409-416). Van der Pas (2004), for example, studying reduction in patterns in consonant clusters and in syllable truncation (or deletion), has found that some instances of onset cluster reduction can be better accounted for in terms of contiguity. A number of children she studied, 3 out of 7, were prone to delete the first element in the cluster, and hence preserved the consonant adjacent to the vocalic element. Assuming two representations: input and output, the contiguity pattern entails that “segments adjacent in the input should be adjacent in the output” (van der Pas, 2004: 2). That is to say, in an onset cluster of two consonants C1 and C2, C2 is always retained because it is contiguous to the vocalic element of the syllable. This pattern can be represented formally as follows:

(3)

$$C1 C2 V \rightarrow \emptyset C2 V$$

Examples illustrating this pattern are given in (8) below mainly based on those given by van der Pas (2004) and Freitas (2003).

#### (4) Cluster Reduction to C2

##### a. Dutch (van der Pas, 2004: 5)

— /blat/	→ [lat]	Len (1; 10.10)
— /draið/	→ [laið]	Hannah (1; 10.29)
— /sxuna/	→ [ɣuna]	Hannah (1; 10.29)

##### b. European Portuguese (Freitas, 2003: 35)

bicicleta /bisi'keta/ → [bsi'leta] Luis (2; 2.27) 'bicycle'

flores /flofi/ → ['loli] Marta (1; 7.17) 'flowers'

Similar patterns of cluster reduction, i.e. retention of the second consonant in the cluster, are attested in the data of Pater and Barlow (2003). Working within the framework of Optimality Theory, they chose to account for such examples in terms of constraints conflict. Pater and Barlow, strongly arguing in favour of the 'sonority pattern', maintain that all onset cluster reduction is sonority-driven and that divergences from the sonority pattern are caused by three well-motivated conflicting constraints: \*Fricative, \*Dorsal, and Max Labial (p.489). In other words, they resort to evidence from the child's phonological system, where the child is prone to processes such as 'stopping', 'fronting', etc. to account for the occurrence of this divergence. The examples given in (5) illustrate the patterns of reduction attested in Pater and Barlow's data:

(5)

- |    |                               |                  |
|----|-------------------------------|------------------|
| a. | swing /swɪŋ/ → [wɪŋ]          | Julia (1; 7.1)   |
|    | cracker /krækə/ → [wækə]      | Julia (1; 8.7)   |
|    | snake /sneɪk/ → [nek]         | Julia (1; 11.22) |
| b. | snow man /snəʊ mæn/ → [nomæn] | Trevor (1; 11.4) |
|    | sneeze /sni:z/ → [ni:z]       | Trevor (1; 10.5) |

These examples reveal that all onset clusters are reduced to their second consonant, i.e. to the most sonorous consonant.

Although Pater and Barlow, strongly adhere to the sonority pattern and proceed to account for data that diverge from this pattern, we believe that these examples can be better accounted for in terms of the 'contiguity pattern'.



Van der Pas (2004), by way of arguing in favour of the contiguity pattern, states:

The effective role of contiguity may be attributed to a general tendency to preserve as much of the target syllable structure as possible, thus being maximally faithful to the input, reflected in child and adult language.”(p.6)<sup>1</sup>

In what has preceded we explained three different patterns that have been proposed to account for cluster reduction in child phonology. We believe that the “sonority pattern”, though a well-established pattern cross-linguistically, cannot account for all instances of cluster reduction and it better applies to languages whose syllable structure and cluster formation abides by the SSP, e.g., English, Spanish, etc. In languages such as Arabic, specifically MA, whose cluster patterning is heterogeneous in that it deviates, in many respects, from the SSP, MA children’s cluster reduction cannot pattern within the sonority-driven pattern.

The ‘head pattern’, on the other hand, in most respects resembles the sonority pattern except for its account for the unique behaviour of the /s/ C-clusters. Van der Pas (2004: 7) conveniently proposes that both the ‘sonority pattern’ and the ‘head pattern’ are in fact sonority patterns. Therefore, we believe that this pattern cannot account for all instances of cluster reduction in MA children’s data.

The ‘contiguity pattern’, however, focuses mainly on the position of consonants relative to the nucleus of the syllable, where the consonant closer to the nucleus is preserved. We believe that our data abide by this pattern perfectly well (see section 4. for data analysis), and therefore

---

<sup>1</sup> Such phenomenon, van der Pas maintains, recurs in loanword adaptation (see examples on p.6)

cluster reduction in MA children will be accounted for in terms of this pattern.

### **3. Data Collection and Procedure:**

The spontaneous productions of 13 Mosuli Arabic speakers (aged 1; 10-3; 09) were collected cross-sectionally and longitudinally for a period of time extending from 4 to 11 months (based on monthly observation). A 20-30 minute recording was made for each subject in every session.

A transcription was made of all the texts, using the IPA symbols. The transcription maintained throughout this study was a broad phonetic transcription. Minute details about the children's productions, however, have not been afforded since utmost attention was paid to the pronunciation of the consonant clusters. All target words with onset clusters have been identified and when different pronunciations of the same word appeared in the child's productions along the sessions, all produced forms of the same word were re-considered and analysed. Out of this process a corpus of 2012 word tokens with onset clusters were obtained as the data to be analysed in this study.

### **4. Data Analysis and Results:**

MA (similar to Standard Arabic in most respects) has a rather simple syllable structure in that only two-element consonant clusters are allowed word initially and word finally, and hence the syllable structure in MA can be represented by the following formula: C1-2 V C0-2. Any two consonants may assume the initial and final positions in MA words with some exceptions (see Sa'eed, 2006: 87-95; see also Erwin, 1967; Ghalib, 1984; and Abdul-Sattar, 1989, for Iraqi Arabic).

The current section provides analysis to the data so as to disclose the main patterns of cluster reduction of initial consonant clusters in MA children. A descriptive approach that mainly draws on the principles of the syllable structure theory is adopted in this regard.

Cluster reduction showed high percentages in the productions of the 4 younger subjects; it ranged between 100% and 0% in each session (Mean: 32.3%, SD: 24.5%). The high scores of cluster reduction in the productions of these subjects were plainly attested at the earliest sessions; the subsequent sessions, however, revealed a relative decrease in the percentages of cluster reduction from both cross-sectional and longitudinal perspectives.

As seen from 2, patterns of cluster reduction have been reviewed so as to bring into light the modes by which young children simplify consonant clusters. Three patterns of cluster reduction have been reviewed, viz. the ‘sonority pattern’, the ‘head pattern’ and the ‘contiguity pattern’. Examining the data with respect to the ‘sonority pattern’, where it is claimed that cluster reduction involves deleting the most sonorous consonant, reveals that many instances in the data abide by the predictions of this principle. Thus, cluster reduction to the least sonorous consonant constituted 54.48% (176 word tokens out of 323) of all cluster reduction instances. This is exemplified in the following examples:

(6)

- |    |                        |                     |               |
|----|------------------------|---------------------|---------------|
| a. | /jʂʌjjih/ → [ʂʌjjih]   | ‘he shouts’         | Hala (2; 02)  |
|    | /mqass/ → [qʌθθ]       | ‘scissors’          | Hala (2; 03)  |
|    | /nkasayit/ → [kaθayit] | ‘it got broken’     | Hala (2; 03)  |
| b. | /jqu:lu:n/ → [qu:lu:n] | ‘they say’          | Dalia (2; 04) |
|    | /lse:nu/ → [se:nu]     | ‘his or its tongue’ | Dalia (2; 05) |
|    | /mhammad/ → [hammad]   | ‘proper name’       | Dalia (2; 05) |

- c. /mqass/ → [tʌss] 'scissors' Mahmoud (2; 08)  
 /lbe:ħa/ → [be:ħa] 'yesterday' Mahmoud (2; 08)  
 /[taya:li/ → [tala:li] 'he bought me' Mahmoud (2; 09)
- d. /ʔju:n/ → [ʔu:n] 'eyes' Dalia (2; 10)  
 /lse:n/ → [se:n] 'tongue' Dalia (2; 10)
- e. /lse:n/ → [te:n] 'tongue' Omar (2; 08)  
 /sna:n/ → [ta:n] 'teeth' Omar (2; 08 – 2; 09)  
 /gla:s/ → [da:s] 'glass' Omar (3; 0)

The above examples demonstrate that the preserved consonant in the reduced clusters is the least sonorous one.

However, the data demonstrated instances of cluster reduction where the preserved consonant was the most sonorous consonant. These instances constituted 26.3% (85 word tokens out of 323) of all instances of cluster reduction:

(7)

- a. /[taye:tu/ → [ʃaye:tu] 'I bought' Omar (2; 11)  
 /kθi:γ/ → [θi:γ] 'a lot' Omar (2; 09)  
 /blu:z/ → [lu:z] 'blouse' Omar (2; 10)  
 /ħwa:s/ → [wa:s] 'clothes' Omar (2; 10)
- b. /twaqʔi:n/ → [waqʔi:jim] 'you drop them' Mahmoud (2; 09)  
 /hnu:ka/ → [nu:ka] 'there' Mahmoud (2; 10)  
 /[taya:li/ → [ʃaya:li] 'he bought me' Mahmoud (2; 10)  
 /kfu:fi/ → [fu:fi] 'my gloves' Mahmoud (2; 10)
- c. /kfu:f/ → [fu:f] 'gloves' Dalia (2; 10)  
 /kθi:γ/ → [fi:γ] 'a lot' Dalia (2; 11)

Apart from these target clusters that attest a sonority difference between the 1<sup>st</sup> and the 2<sup>nd</sup> consonants of the cluster, there are many target words that show no sonority difference between the two consonants of the cluster. In other words, the sonority difference in these target clusters is ‘zero’ (see Figure (2) for the SH and (3) for the Sonority Distance in Sa'eed, 2006: 36 and 37, respectively). Cluster reduction in such words is exemplified by the following examples from the data:

(8)

- |    |   |                |                 |
|----|---|----------------|-----------------|
| a. | /ħsa:n/ → [θa:n]                                    | ‘horse’        | Hala (2; 02)    |
|    | /sfind <sub>3</sub> a:j/ → [sind <sub>3</sub> a:bi] | ‘sponge’       | Hala (2; 03)    |
|    | /ttammaʃtu / → [tʌmmaʃtu]                           | ‘I watched’    | Hala (2; 05)    |
| b. | /ħsa:n/ → [sa:n]                                    | ‘horse’        | Dalia (2; 05)   |
|    | /zɣa:ɣ/ → [za:ɣ]                                    | ‘small (pl.)’  | Dalia (2; 11)   |
| c. | /ħsa:n/ → [ħa:n]                                    | ‘horse’        | Omar (2; 09)    |
|    | /zɣe:ɣi/ → [ze:ɣi]                                  | ‘small (fem.)’ | Omar (3; 01)    |
| d. | /ttalʕi:n/ → [talʕi:n]                              | ‘you show’     | Mahmoud (2; 11) |
|    | /zɣajjiɣ/ → [zajjiɣ]                                | ‘small’        | Mahmoud (3; 02) |

In the examples provided above we notice that both consonants of the cluster are either plosives or fricatives and so determining the sonority value of the preserved consonant is out of the question.

Earlier in 4, it has been stated that onset clusters in MA are heterogeneous in nature in that they do not abide by the SSP where it is proposed that onset clusters rise in sonority to the centre (Clements, 1990). The examples provided in (6) reveal that while the ‘sonority pattern’ can

account for about half of the instances of cluster reduction in the MA data, it leaves the other half (a considerable number of words) unaccounted for (45.5% of the data); specifically those provided in (7) and (8).

In order to obtain a global understanding of the patterns of cluster reduction the data were re-examined in terms of the position of the reduced (or deleted) consonant. Examination of the data from all the subjects, i.e. the 13 MA subjects, revealed that cluster reduction to the 2<sup>nd</sup> consonant of the cluster exhibited higher percentages than cluster reduction to the 1<sup>st</sup> consonant (See Table (1)).

#### (9) Cluster Reduction in MA Subjects' Production

1. C1C2 → C1Ø: (10.84%) (59 word tokens)

2. C1C2 → ØC2: (89.14%) (264 word tokens)

This pattern of cluster reduction is demonstrated by the following:

(10)

#### 1. C1C2 → C1Ø

a. /t̪aya:li/ → [ʔaya:li] 'he bought me' Mahmoud (2; 11)

/z̪ajjiy/ → [z̪ajjiy] 'small' Mahmoud (3; 01)

/wajja/ → [ajja] 'a little' Mahmoud (3; 02)

b. /s̪na:n/ → [sa:n] 'teeth' Omar (2; 09)

/t̪aye:tu/ → [ʔaye:tu] 'I bought' Omar (2; 11)

/gla:s/ → [da:s] 'glass' Omar (3; 0)

c. /x̪ja:ya:j/ → [ʔa:ya:j] 'cucumbers' Dalia (2; 10)

/z̪ya:γ/ → [za:γ] 'small (pl.)' Dalia (2; 11)

#### 2. C1C2 → ØC2

a. /h̪sa:n/ → [θa:n] 'horse' Hala (2; 02)

/mqass/ → [qʌss] 'scissors' Hala (2; 03)

- /nkasayit/ → [kaθayit] 'it got broken' Hala (2; 03)
- b. /lbe:s/ → [be:s] 'under pants' Omar (2; 07)
- /mhammad/ → [hammad] 'proper name' Omar (2; 08)
- /kθi:γ/ → [θi:γ] 'a lot' Omar (2; 08)
- c. /twaqʕi:n/ → [waqʕi:jim] 'you let them fall' Mahmoud (2; 09)
- /jḍi:b/ → [di:b] 'brings' Mahmoud (2; 09)
- /lbe:ħa/ → [be:ħa] 'yesterday' Mahmoud (2; 10)
- d. /kbi:γ/ → [bi:γ] 'old, big' Ihāb (2; 11)
- /jkaffi/ → [kaffi] 'enough' Ihāb (2; 11)

In (2.3) the principles of the 'contiguity pattern', which accounts for cluster reduction in terms of proximity to the vocalic element (or the centre of the syllable), were reviewed. The data from MA subjects demonstrate conformity to this pattern as shown in (9).

In order to properly assess the validity of the above stated findings, a statistical analysis was carried out to compare the percentages of cluster reduction to the 1<sup>st</sup> and to the 2<sup>nd</sup> consonant. Thus, a T-Test analysis which involved paired-samples statistics was used. The results obtained from this analysis revealed a significant difference between the two patterns, i.e. cluster reduction to the 1<sup>st</sup> consonant and cluster reduction to the 2<sup>nd</sup>: (P = .0, where variance is significant if P ≤ .05). The variance was significant with respect to the 2<sup>nd</sup> pattern and as shown by the following statistics: (P (2-tailed) = .0, t = -11.070).

Given that the head pattern resembles the sonority pattern in many respects and that MA does not properly abide by the SSP, we may simply suggest that the 'head pattern' would not account for cluster reduction in MA unless it is assumed that the 'head' of these clusters is the 2<sup>nd</sup> consonant.

**Table (1): A Summary of the Incidence of Cluster Reduction in MA Subjects' Productions in Terms of Cluster Type**

Cluster Type	Preserved Consonant	Number	Percentages
1. C1 (Obs) + C2 (Son) →	C1 (Obs)	20	6.19%
2. C1 (Son) + C2 (Obs) →	C2 (Obs)	137	42.414%
3. C1 (Obs) + C2 (Son) →	C2 (Son)	31	9.59%
4. C1 (Son) + C2 (Obs) →	C1 (Son)	—	—
5. C1 (Obs) + C2 (Son) →	C1 (Obs)	41	12.69%
6. C1 (Son) + C2 (Obs) →	C2 (Obs)	94	29.1%
		<b>323</b>	<b>99.984%</b>

## **5. Conclusion:**

In this paper, we have discussed cluster reduction in MA children's productions in an attempt to identify the pattern(s) that these children utilize in simplifying initial clusters. Among the three patterns that have been observed cross-linguistically, the contiguity pattern has shown significant applicability by MA children.

Formerly in this study, section 4., the heterogeneity of initial consonant clusters in MA was hinted at. Part of the heterogeneity of these clusters is due to their deviance from the predictions of the SSP and the Sonority Distance. A question may be raised here, are initial clusters in MA true clusters or sequences of abutting consonants? This question may provide initiatives for future research by tracing the developmental path of MA children acquiring their native language.





## REFERENCES

- Abdul-Sattar, M. A. (1989). A Contrastive Study of Consonant Clusters in Standard English and Iraqi Arabic (Unpublished M.A. Thesis), University of Basrah.
- Barlow, J. A. (2003). "Asymmetries in the Acquisition of Consonant Clusters in Spanish". Canadian Journal of Linguistics, 48 (3/4): 179-210.
- \_\_\_\_\_ (2005). "Sonority Effects in the Production of Consonant Clusters by Spanish-Speaking Children". In selected Proceedings of the 6<sup>th</sup> Conference on the Acquisition of Spanish and Portuguese as First and Second Language, ed. by David Eddington, 1-14. Somerville, MA: Cascadilla Proceeding Project.
- Barlow, J. A. and Gierut, J. A. (1999). "Optimality Theory in Phonological Acquisition". Journal of Speech, Language and Hearing Research, 42: 1482-1498.
- Boyd, J. K. (2002). "On the Representational Status of /s/-Clusters". Available at: <http://www.ling.ucsd.edu/~boyd/s-clusters.pdf>. pp.1-55.
- Clements, G. N. (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. New York: Cambridge University Press, 283-333.
- Erwin, W. M. (1963). A Short Reference Grammar of Iraqi Arabic. Washington, D. C.: Georgetown University Press.
- Fikkert, P. and Freitas, M. J. (2004). "The Role of Language Specific Phonotactics in the Acquisition of Onset Clusters". Linguistics in the Netherlands, 21, 58-68.
- Freitas, M. J. (2003). "The Acquisition of Onset Clusters in European Portuguese". Probus, 15, 27-46.

- Ghalib, G. B. M. (1984). An Experimental Study of Consonant Gemination in Iraqi Colloquial Arabic. (Unpublished Ph.D. Thesis). UK: University of Leeds.
- Gierut, J. A. (1999). "Syllable Onsets: Clusters and Adjuncts in Acquisition". **Journal of Speech, Language and Hearing Research**, 42, 708-826.
- Gnanadesikan, A. E. (1995). "Markedness and Faithfulness Constraints in Child Phonology". ROA 67 (<http://roa.rutgers.edu>).
- Goad, H. and Rose, Y. (2004). "Input Elaboration, Head Faithfulness and Evidence for Representation in the Acquisition of Left-Edge Clusters in West Germanic". In R. Kager, J. Pater, and W. Zonneveld (eds.), **Fixing Priorities: Constraints in Phonological**
- Kirk, C. and Demuth, K. (2003). "Onset and Coda Asymmetries in the Acquisition of Clusters". Proceedings of the 27<sup>th</sup> Annual Boston University Conference on Language Development, by B. Beachley, A. Brown, and F. Conlin, (eds.). Somerville, MA: Cascadilla Press, 437-448.
- Kula, N. C. and Tzakosta, M. (ms.). "Acquisition of Complex Structures in Greek: A GP and OT Approach". To appear in Glossologia, version May 2006. Available at: [www.nancykul.net/kulaizakosta2005.pdf](http://www.nancykul.net/kulaizakosta2005.pdf).
- McLeod, S.; J. Van Doorn and V. A. Reed (2001a). "Normal Acquisition of Consonant Clusters". **American Journal of Speech Language Pathology**, 10, 99-110.
- \_\_\_\_\_. (2001b). "Consonant Cluster Development in two-Year-Olds: General Trends and Individual Difference". **Journal of Speech-Language Hearing Research**, 44, 1144-1171.
- Ohala, D. K. (1999). "The Influence of Sonority on Children's Cluster Reductions". **Journal of Communication Disorders**, 32, 397-422.
- Pater, J. and Barlow, J. A. (2003). "Constraint Conflict in Cluster Reduction". **Journal of Child Language**, 30, 487-526.

- Sa'eed, A. H. (2006). The Acquisition of Arabic Consonant Clusters by Preschool Mosuli Children. (Unpublished Ph.D. Thesis), University of Mosul.
- Selkirk, E. (1982). "The Syllable". In V. H. Hulst and N. Smith (eds.), **The Structure of Phonological Representation**. Dordrecht: Foris, 337-383.
- Smith, N. V. (1973). **The Acquisition of Phonology: A Case Stud.** Cambridge: Cambridge University Press.
- Spencer, A. (1986). "Towards a Theory of Phonological Development". **Lingua**, 68, 3-38.
- Stemberger, J. P. and Bernhardt, B. (1998). "Phonological Constraints and Morphological Development". Available at: [http://www.linguistics.ubc.ca/People/stemberger/S\\_B\\_1997.pdf](http://www.linguistics.ubc.ca/People/stemberger/S_B_1997.pdf).
- Van der Pas, B. (2004). "Contiguity in Phonological Acquisition". Available at: [www.unix.oit.umass.edu/~Pater/VanderPas.pdf](http://www.unix.oit.umass.edu/~Pater/VanderPas.pdf). pp.1-12
- Yildiz, Y. (2005). "The Structure of Initial /s/ - Clusters: Evidence from L1 and L2 Acquisition ". In M. Tzakosta, C. Levelt and T. Van de Weijer (eds.), **Development Paths in Phonological Acquisition**. (Special Issue of Leiden Papers in Linguistics 2.1), 163-187.