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The acquisition of diphthongs by Romanian-speaking children

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The paper aims to identify the factors that may influence the acquisition of diphthongs (such as their position in the word, the stress on the syllable in which they occur, and the type of diphthong under consideration, i.e. falling or rising), the patterns in diphthong acquisition, as well as to trace a developmental path in between the ages 1;6 and 3 years, given the fact that these vocalic sounds emerge before the age of 2 and seem to be acquired when children turn 3 and a half years of age. To achieve these aims, I have employed six longitudinal corpora of children aged between 00;11.17[2] and 3;1. The findings indicate that, to a large extent, Romanian-acquiring children pattern with the children speaking other languages in terms of the age of emergence of diphthongs, as well as in diphthong simplification to one of the vowels, but they also differ from these in that they present a larger range of error patterns in diphthong acquisition, as well as inter- and intra-child variation.

Keywords: *diphthongs, Romanian language, error patterns, phonological acquisition*

1. Introduction

The acquisition of phonology represents a major stage in children's linguistic development and the acquisition of twin vowels or diphthongs, in particular, is rather challenging, as from a phonetic point of view diphthongs "contain two vocalic targets, but this does not always map onto the phonological status of these targets" (Zárate-Sández 2011, 164). While the acquisition of these vocalic sounds has been studied for languages such as Spanish (Zárate-Sández 2011; Kehoe et al. 2008), Putonghua, English, Egyptian Arabic, Turkish, Maltese, Cantonese, and German (Hua and Dodd 2006), or Indonesian (Aprilia 2022), in Romanian linguistics the topic has hardly been tackled, so my paper tries to fill this niche.

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[2] There is consensus among scholars in the field of language acquisition to render their subjects' ages in this way. This reads 'eleven months and 17 days'.

Diphthongs are described as combinations of two vowel sounds pronounced within a single syllable, with a single outflow of air. In the production of a diphthong the tongue glides from a first vocalic element (i.e., starting point) to a second, differently articulated element that constitutes the target to which the transition is made (see Gimson 1980; Ladefoged 1982). Unlike in English, where both elements of a diphthong are considered vowels (this being the reason why English diphthongs are also called *twin vowels*), in Romanian the situation is slightly different, in that one of the constituents is a full (syllabic) vowel, whereas the other is a (non-syllabic) semivowel. Irrespective of their denomination or structure, such complex phonemes are quite difficult to pronounce by children, as they involve the coordination of the lips, tongue, and palate (Fletcher 1973) and, as such, they are prone to systematic errors. On the other hand, since diphthongs contain vocalic sounds in their composition, in order for children to produce them, it would be necessary to have already mastered the monophthongs of their mother tongues. According to Mousa (2015), the full mastery of the constituent elements of a diphthong constitutes a prerequisite for their acquisition, which means that diphthongs will emerge a little later than simple vowels (monophthongs).

Most of the studies on the acquisition of phonology and theories of phonological development have primarily focused on consonants, assuming that vowels emerge and stabilise early, without problems. Ball and Gibbon (2002, xv quoted in Zajdo 2002, 362) contend that for a long time, vowels "were no more than the poor relations of consonants". This may account for a comparatively scarcer body of literature on the acquisition of vocalic sounds as compared to consonants. On the other hand, the majority of the existing studies on the acquisition of the vocalic system focused mainly on the English language (Smith 1973 and 2009; Dodd et al. 2003, to mention just a few). While most of these studies are in agreement with respect to the early emergence of vowels (starting with the babbling period, around the age of 6 months), they vary with respect to the age when these sounds are fully acquired/stabilised (Smith 1973, 2009 – age 4). These differences may be caused by factors such as "the test target words, criteria for age of acquisition, methods of analysis, etc." (Ha et al. 2009, 168).

In the field of Romanian linguistics no scholar, to my knowledge, has endeavoured to investigate the acquisition of vocalic sounds in general, so this paper is an attempt to contribute to the body of literature on the acquisition of diphthongs with data from Romanian-speaking children. The analysis is a descriptive, qualitative one, as the number of subjects is too low to qualify for statistical data. One possible secondary outcome of the research would be to provide speech pathologists with much-needed data to identify the causes of some children's phonological delays or problems.

In order to be able to see whether the children in the current study pattern with or differ from peers acquiring other mother tongues, it is appropriate to review previous studies on the topic in the next section of the paper. A brief presentation of the Romanian diphthongs is contained in section 3. Then, section 4 presents the research methodology. The main part of the paper is dedicated to the analysis of the emergence and stabilization of diphthongs, as well as to the strategies (error patterns) identified in the Romanian children's attempts at producing these complex vocalic sounds (section 5). The last section of the study contains the conclusions.

2. Literature review

One of the most interesting studies on the acquisition of phonology is Neil Smith's (1973) investigation of his own son's (Amahl) linguistic development, between the ages of 2;2 and 4 years. His study was an extensive generative, rule-based account of the child's phonological development, showing that Amahl did not mispronounce words randomly, but followed certain patterns or phonological processes, such as stopping of fricatives, final consonant devoicing or simplification of diphthongs, as in *Adrian* /ei.dri.ən/ => [e:.dri:].[3]

Later on, in 2009, the same author was the first to carry out a cross-generational case study, bringing forth important findings based on the analysis of his son's and grandson's phonological development. In what diphthongs are concerned, he pointed out that until the age of 22 months, his grandson only added two diphthongs to his vocalic inventory, namely /au/ and /ei/, while a month later, a third one, /əu/, emerged. Until 28 months of age, Smith's grandson had already acquired five diphthongs: /au, ei, əu, ai, and iə/, with some phonetic variation, especially for /ai/, which was realised either as [æi] ("*five* became [fæid]") or as a long monophthong [æ:] ("*nine* became [næ:n]") (Smith 2009, 74). Between the ages of 2;5 and 2;7, the child enriched his diphthong repertoire with new items, i.e. [oi, əi], making it almost complete, only that frequently unsystematic phonetic variation was noticed, in that that "[ɔi] alternated with [ɔ^{e}]; [ai] with [a^{i}], [æ^{i}] and [æ^{e}], [æə] with [aiə], etc." (Smith 2009, 80). The author mentioned that at around the age of 4 years, his grandson's acquisition of segmental phonology was complete.

[3] It is common practice in language acquisition studies to render the adult pronunciation between slants: / /and the child's production between square brackets: [ ].

Another monograph worth mentioning is Hua's (2002) study of the phonological development of children having Putonghua (the standardized version of Chinese spoken in mainland China) as their mother tongue. Unlike English, which contains 8 diphthongs, Putonghua has 9 such vocalic sounds, i.e. /ae, ei, ɑo, ou, ia, iɛ, uɑ, uo, yɛ/. Hua's research was based on two types of data: experimental and longitudinal. In the experimental study, 134 children aged between 1;6 and 4;6 were asked to produce target words in a picture-naming task. If they failed, they were asked to imitate the investigator. In the longitudinal study of four children recorded approximately between the ages of 1;0 and 2;0, the findings indicated that first diphthong to emerge was /ei/ and the last /yɛ/. She also pointed out that these complex sounds were prone to systematic errors, the most frequent being the reduction to simple vowels.

> *The vowel retained was the louder and more sonorant vowel of a diphthong. The children tended to produce the second element of ongliding diphthongs when the reduction took place. For example, 12% of the children realised /ua/ as /A/ once or several times in their speech production and none of them realised it as /u/. The first element of offgliding diphthongs was most often maintained. Thus, more children replaced /ao/ with [A] than with [o]*. (Hua, 2002, 57).

Hua and Dodd (2006) edited a volume on the acquisition of a number of languages (Putonghua, Maltese, Turkish, Egyptian Arabic, Telugu, and German) by both normally developing children and also by children with speech disorders. What the authors show is that not all the languages investigated contain diphthongs in their sound inventories and in those that do have such complex sounds, the children's tendency is to reduce them to simple vowels.

Smaller-scale studies focused on the phonological development of children speaking less familiar languages, such as Indonesian (Fitriana and Augustina 2018), Palembang (Aprilia 2022) or Korean (Ha et al. 2009). As far as diphthongs are concerned, no mention is made concerning the emergence or stabilization of these sounds in Indonesian. In Korean, on the other hand, until the age of 3 years, most of the diphthongs have been acquired, while some others (especially those having /w/ as their first constituent - /wa, we, waj, wej/), are not acquired even by the age of 5 (Kwon 1981, quoted in Ha et al. 2009, 165). The general tendency of producing single vocalic sounds rather than diphthongs is also mentioned in these three studies.

3. Romanian diphthongs

Romanian has got seven vocalic sounds (a, e, i o, u, ă, î/â), out of which a, ă, and î/â are always full vowels, whereas the other four could be both full vowels or could turn into semivowels (/ĕ/, /ĭ/, /ŏ/, and /ŭ/[4]. Unlike the full vowels, which could form syllable nuclei and carry stress, the semivowels cannot; they could be part of a diphthong or triphthong[5]. Thus, Romanian diphthongs, unlike the English ones (where both constituents are full vowels), are always made up of a vowel (V) and a semivowel (Sv). Depending on the order of the constituents, Romanian diphthongs are classified into *rising* (Sv+V), as in *seară* /'s**ĕa**.rə/[6] 'evening', *două* /'do.**ŭə**/ 'two', steaua /'st**ĕa.ŭa**/ 'the.star' or *falling* (V+Sv), as in *cai* /k**aĭ**/ 'horses', *trei* /tr**eĭ**/ 'three', *ou* /**oŭ**/ 'egg' or *leu* /l**eŭ**/ 'lion'. There are certain situations in which a semivowel followed by a vowel sound does not form a diphthong: these are the cases in which the semivowel is part of the consonantal sounds /tʃ/, /dʒ/[7] and of the palatal /ǩ/, and /ǧ/, rendered graphically as *ce/ci, ge/gi, che/chi,* and *ghe/ghi* (Bârlea and Cerkez 2005). Thus, in words like *geam* /'ǧam/ or /dʒam/ 'window' or *cheamă* /'ǩa.mə/ 'call', despite the spelling, there is no diphthong in pronunciation. Romanian, like most Romance languages, is one of the world languages with a large number of diphthongs (altogether 23, out of which 13 falling and 10 rising), being followed by Finnish (18), Korean (10) and English (8) (McLeod 2005). The diphthongs of Romanian are as follows: rising – /ĭa, ĭe, ĭo, ĭu, ĕa, ĕo, ŭa, ŭə, ŭɨ, ŏa/ and falling – /aĭ, aŭ, əĭ, əŭ, ɨĭ, ɨŭ, eĭ, eŭ, iĭ, iŭ, oĭ, oŭ, uĭ/.

According to Chițoran (2002), Romanian has got only two genuine (real) diphthongs, i.e. /ĕa/ and /ŏa/, all the others mentioned above being actually vowel-glide combinations. This position also accounts for the different transcription systems used for words containing diphthongs vs. vowel-glide combinations (i.e. /o̯a/ vs. /wa/). But, since in schools children are taught the traditional view according to which Romanian has got 23 diphthongs in its vocalic inventory, at this moment it is convenient for me to adopt this view, too, like most traditional phoneticians.

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[4] In line with Ene (2010), due to the limited resources of *Word,* I have opted for the use of the breve (˘) diacritical mark placed on the top of the less prominent element of the diphthong. In most of the Romanian academic papers, semivowels are marked by the inverted breve diacritical mark – a convex semicircle – placed under the grapheme: /i̯/.

[5] According to Ene (2010: 18), semivowels, just like the consonants, are strongly dependent on a full vowel sound.

[6] For the sake of simplicity, diphthongs will be rendered as in the examples above. Some older scholars (Weigand 1903 and Lombard 1935) linked the constituents of the diphthong: [ɛa͡], [ɔa͡].

[7] In studies on Romanian phonetics and phonology, the symbols for such sounds are /č/, /ǧ/.

Worth mentioning is the fact that the diphthong /ĭĭ/ (rendered by *ii* in the spelling of the words) is always falling, since the second sound is a semivowel, as is the case of the articulated plural form of the noun *co.ˈpil* 'child' – *co.ˈpii* 'children' – *co.ˈpi.ii* /ko.ˈpi.**ĭĭ**/ 'the.children'.[8]

According to Rosetti (1986, 94), Romanian diphthongs take the stress on the most open vocalic element (***a**ˈi, **a**ˈu e**a'**, i**a'**, **e'**u*[9] etc.). In what their *position* is concerned, diphthongs with /ĭ/ as a glide can occur in any position, whereas those in which the glide is /ŭ/ usually appear in word-final, stressed position, as in *bou* /ˈboŭ/ 'ox', *grîu* /ˈgrɨŭ/ 'wheat'. The diphthong /ĕa/ occurs in stressed syllables (ˈ*pleacă* /ˈplĕa.kə/ 'leave!) or in word-final position (ˈ*cartea* /ˈkar.tĕa 'the.book'), and very rarely in unstressed syllables in word-mid position (*dumneata* /dum.nĕa.ˈta/ 'polite form of *you* (sg.)'). As far as the diphthong /ŏa/ is concerned, this can be found only in stressed contexts: *roagă* /ˈrŏa.gə/ 'he prays/begs/asks', *foarte* /ˈfŏar.te/ 'very'.

In exceptional cases, one may come across pronunciations, which contract/merge the vowels of a hiatus into a diphthong, a process known as *syneresis*, according to which the first vowel of the hiatus becomes a semivowel, leading to a rising diphthong, as in *prieten* /pr**i**.ˈ**e**.ten/ > /ˈpr**ĭe.**ten/ 'friend' or *sanie* /ˈsa.ni.e/ > /ˈsa.n**ĭe**/ 'sledge'. In child language, as the liquid sounds /l, r/ are rather problematic to pronounce at an early age, they are often glided and will form a diphthong with an adjacent full vowel, as in *piele* /ˈp**ĭe.**le/ > [ˈp**ĭe.ĭe**] 'skin'.

Sometimes, in Romanian, diphthongs are created by pronouncing in one syllable two morphological words, spelled with a hyphen, as in *mi-**a** /**ĭa**/ zis* 's/he told me' or *n**u-i** /**uĭ**/spune* 'don't tell him/her'.

4. Research methodology

This section provides information about the research questions, the data collection and transcription, as well as the derived qualitative and quantitative measures.

4.1. Hypothesis and research questions

The hypothesis of the current study is that, given the complex structure of diphthongs, the physiological limitations in infants will prevent them from producing these vocalic sounds in the first stages of their linguistic development,

[8] In Romanian, the indefinite article precedes the noun it determines, whereas the definite one is attached to the end of the noun, forming with this a single graphical and sonorous unit.

[9] This is Rosetti's notation.

and, as such, they will be prone to systematic errors. Derived from this, the study aims to provide answers to the following research questions:

a) when do diphthongs emerge in the speech of Romanian children?
b) which factors influence the acquisition of diphthongs (type of diphthong – rising/falling, their position in the word, or word-stress)?
c) what coping strategies do young Romanian-speaking children use when confronted with the production of diphthongs?
d) when do Romanian diphthongs stabilize (when are they considered to have been acquired)?

4.2. The data

In order to find answers to the above-mentioned research questions I have employed longitudinal data from six Romanian-acquiring children recorded by three scholars, each for a different research aim. These are Bianca's audio recordings made by Larisa Avram in 2001 (https://talkbank.org/DB/), Sophie Kern's recordings of 4 children (Alice - 00;11:17 – 02;00.04, Ana - 00;11.17 – 1;02.10, Matei - 01;03.16 – 2;01.11 and Vlad - 01;01.10 – 02;00.11)[10], carried out between 2001 and 2002 (https://phon.talkbank.org/access/Romance/Romanian/KernRomanian.html), and Ioana Stoicescu's (2013) corpus of Iosif, which I received from the researcher herself on a CD. All children were recorded at home, for one hour, in interaction with their parents, grandparents, or the interviewer. In Avram's and Stoicescu's corpora, the children were visited almost every week, Bianca from the age of 01;05.19 until she turned 02;11.22 and Iosif between the ages 1:11 and 3;1). The children in Kern's corpus were visited every two weeks by an interviewer (Adina), from the ages of 0:11 to 2;1. All children were developing normally, both from a linguistic and from a physical point of view. The reasons for opting for longitudinal data bases are twofold: on the one hand, my aim was to identify when diphthongs emerge and how they develop in close relationship with the children's acquisition of their vocabulary. On the other hand, in keeping with Fikkert (2007, 11), "it is important to consider a child's whole vocabulary at certain stages to gain deeper understanding" of why certain phonological errors take place.

From these recordings I have extracted all the words, which in adult production should contain diphthongs. Further on, the examples produced by

[10] For all the children in the longitudinal corpora, the recordings started much earlier, but since only vocalization were present in them, I decided to start the analysis only from the recording where the subjects produced the first identifiable words. This accounts for the differences in age spans between the information on ChiLDES and in the current paper.

children were transcribed using IPA[11], grouped according to the type of diphthongs contained (rising or falling), and examined for the types of errors encountered.

From the children's speech the following quantitative and qualitative measures were derived, in line with Hua (2002):

> ***Phoneme emergence*** *- a phoneme was considered to have emerged when the child has produced the sound at least once, irrespective of whether it was the correct target.*
> ***Phoneme stabilisation*** *– (...) a sound was considered stable when the child produced it correctly at least two of three opportunities.* (Hua 2002, 53)

5. Data analysis

A major objective of this study was to identify the age of emergence of diphthongs in the sound inventory of the Romanian-acquiring subjects. This could be achieved by taking a look at the longitudinal data of the 6 children. The table below contains the diphthongs produced by the subjects at different ages in their phonological development.

5.1. Age of emergence of diphthongs in the longitudinal study

Age	Alice (Kern)	Anna (Kern)	Vlad (Kern)	Matei (Kern)	Bianca (Avram)	Iosif (Stoicescu)
1;4		ĭa, aŭ				
1;5			aĭ			
1;6				aĭ (sound play)	eĭ, ĕa	
1;7				ĭa	ŏa, oĭ	
1;9;21						
1;11			aŭ	iĭ, uĭ	ĭe	
2;0	ĭo			aĭ, ĕa, ŏa		ĭu, ĕa, ĭa, ŭa
2;1				eĭ, ŭa, ĭe, ĭu, ĭa, əŭ	aĭ, ĭa,	ŏa, ĭe, ŭə
2;2					iŭ, oŭ	əŭ
2;3						eĭ
2;4						
2;7						eŭ

[11] I have combined the IPA with some symbols that are typical of Romanian phonetics, such as the symbols for the semivowels, mentioned in section 3 of the paper.

Age	Alice (Kern)	Anna (Kern)	Vlad (Kern)	Matei (Kern)	Bianca (Avram)	Iosif (Stoicescu)
2;8						aĭ, oĭ
2;11					aŭ	ĭo
3;0						ĭu
Total/child	**1**	**2**	**2**	**12**	**10**	**14**

Table 1. Age of emergence of diphthongs

As revealed by Table 1, the 6 children (3 girls and 3 boys) show different ages when they produced diphthongs for the first time. Anna produced the first diphthongs in spontaneous speech at the age of 1;4: /ĭa/ in *cheia* ['ke.ĭa] 'the.key' and /aŭ/ in the interjection *bau* [baŭ] 'boo', used when you want to scare someone. Before this age, in her vocabulary one could come across other words that involve diphthongs in their production, but the girl simplified them to monophthongs, as we shall see in section 5.2.

In Matei's and Bianca's cases, diphthongs emerged two months later (i.e. at the age of 1;6), the boy producing the diphthong [aĭ] in sound play [aĭ- aĭ- aĭ- aĭ], and a month later the diphthong [ĭa] in the word *aia* /'a.ĭa/ 'that.fem'. Bianca's first diphthongs had the vowel /e/ as a nucleus. She produced /eĭ/ in *clopoței* 'bells', in which she dropped the lateral liquid: /klo.po.'tseĭ/ > [ko.po.'tseĭ] and /ĕa/ in *cartea* 'the.book', where the rhotic liquid was missing: /'kar.tĕa/ > ['ka.tĕa]. From the age of 1;6, we notice a steady increase in the repertoire of diphthongs of these two children, so that by the time the recordings ended, both of them were able to produce a considerable number of diphthongs in an adult-like manner. Thus, out of the 23 diphthongs of Romanian, at the time the recordings stopped (i.e. age 2;1), Matei had acquired 12, /aĭ, ĭa iĭ, uĭ, ĕa, ŏa, eĭ, ŭa, ĭe, ĭu, ĭa, əŭ/, examples in this respect being: *nenea* ['ne.ĕa] 'children's form of address for men', *copiii* [ko.'pi.iĭ] 'the.children', *(h)aide* /'haĭ.de/ > ['aĭ.de] 'come', *poate* ['pŏa.te] 'can/is able', *Matei* [ma.'teĭ] (the child's name). Bianca's vocalic inventory at the age of 2;1 comprised 7 diphthongs, but it increased to 10 until the age of about 3 years, when the recordings ceased: /eĭ, aĭ, ĭa, ŏa, oĭ, ĕa, ĭe, iŭ, oŭ, aŭ/: *miere* ['mĭe.re] 'honey', *doa(r)me* ['dŏa.me] 's/he.sleeps', *b(r)oasca* ['bŏas.ka] 'the.turtle', *(ș)tiu* [tiŭ] 'I.know', *metr(r)ou* [me.'toŭ] 'underground', *stai* [staĭ] 'stay!', *ca(r)tea* ['ka.tĕa] 'the.book', *neag(r)ă* [nĕa.gə] 'black.fem.', etc. As far as these diphthongs are concerned, since the children (Matei and Bianca) used them correctly in most of the contexts that required them, we could state that they have been acquired. There were attempts at producing words containing other diphthongs, but these underwent all kinds of changes, which will be discussed further (section 5.2).

As compared to Anna, Bianca, and Matei, Alice's vocabulary at the age of 2;0 was quite reduced, which accounts for the existence of only one lexical item that required a diphthong, i.e. *doi* /doĭ/ 'two', which, like Anna, she reduced to the lengthened full vowel [do::], three times in the same recording session. She, nevertheless, produced the diphthong [ĭo] ten times in the same session to refer to herself, using the non-standard pronunciation of the first person singular pronoun *eu* /eŭ/ 'I'.

With respect to Vlad, his first production of a diphthong occurred at the age of 1;05.11 in the farewell salutation frequently employed by young children, i.e. *tai-tai* 'bye-bye', a reduplicated word in which he deleted the semivowel of the first syllable [ta-taĭ]. A second diphthong in his sound inventory emerged six months later (1;11.07) in the game 'peek-a-boo', whose Romanian version is *cucu-bau* /kuku-baŭ/and which the child produced appropriately.

The 14 diphthongs recorded in Josif's corpus emerged in a time span of little over one year, starting with the age of 2, when the first recording of the child took place, and 3;1, when the recording finished. At the age of 2;0, Iosif could pronounce appropriately the diphthongs /ĭu, ĕa, ĭa/: *(ș)tiu* [tiŭ] 'I.know', *steag* /'stĕag/ > [tĕak][12] 'flag', *iarbă* /'ĭar.bə/ > [dĭa.pə] 'grass'. A month later, he acquired /ĭe/ which stabilised starting with the age of 2;3: *fluier* /'flu.ĭer/ > ['pu.ĭer][13] 'flute/pipe', *baie* ['ba.ĭe] 'bath'. Almost each and every month until the age of 3, a different diphthong appeared in the child's phonetic inventory, so that when the recording stopped, he could produce 14 out of the 23 double vowels of his mother tongue, the last addition being /ĭo/ (which posed problems to Iosif from the age of 2;0): *creion* [kre.'ĭon] 'pencil'.

In Table 1, one can notice that the order of acquisition of the Romanian diphthongs differs from one child to another. A common aspect is represented by the rising diphthongs /ĭe, ĭu, ĭa/ which emerged at around the same age (approximately 2 years) for Matei, Bianca, and Iosif. As the examples produced by the children show, no clear-cut conclusion could be drawn with respect to a preference for rising over falling diphthongs, except for Vlad, who produced only falling ones. Matei, Bianca and Iosif, each produced a fairly balanced number of falling and rising diphthongs: Matei: 5 falling and 7 rising, Bianca: 6 falling and 4 rising, whereas Iosif had 8 rising and 6 falling diphthongs in his sound inventory at the age of 3;1. Another point worth mentioning is the fact that word stress did not seem to affect the emergence and acquisition of the diphthongs, as most of the

[12] Iosif's production of the word is also affected by other phonological processes: cluster reduction (st > t) and devoicing of the final consonant (g > k).

[13] For a long period of time, Iosif would replace the labiodentals (f, v) with the bilabial plosives (p, b), a phenomenon also mentioned by his mother in one of the recordings.

words in the children's vocabularies were mono- or disyllabic, and in the latter, the vocalic sounds appeared both in stressed and unstressed syllables: *baie* ['ba.**ĭe**] 'bath' vs. *fluier* /'flu.ĭer/ > ['pu.**ĭe**r] 'flute/pipe'.

As mentioned above, the children's lexicons do contain words that presuppose the production of other diphthongs, but these were quite problematic and were subjected to a number of phonological processes, as presented in the next section of the paper.

5.2. Error patterns in the acquisition of Romanian diphthongs

According to Hua (2010, 28), "error patterns understood as children's simplifying strategies, [are] a set of mental operations that change or delete phonological units as a result of the natural limitations and capacities of human vocal production and perception". As a result, children's productions are quite different from those of the adults and often difficult to understand by those who are not familiar with the toddlers. In the corpus under investigation, a number of such patterns have been identified, as will be shown in what follows.

5.2.1. Diphthong reduction

The most frequent solution in dealing with these complex vocalic sounds the children in the study employed was ***diphthong reduction*** **(monophthongisation / smoothing),** a vowel shift in which the diphthong becomes a monophthong. In most of the cases, the sound that was retained was the more sonorous one (i.e. the full vowel), this being sometimes lengthened. Children acquiring any language that does contain diphthongs in its sound inventory will at some point in their development make use of this strategy.

Child		**Lexical item**	**Adult pronunciation**	**Child's pronunciation**	**Phono. process**
Anna	1;00	*pui-pui* 'chicken'	/'puĭ- 'puĭ/	['pu-'pu]	/uĭ/ > /u/
	1;1	*nenea* (polite form of addressing a man)	/'ne. ĕa/	['ne.na]	/ĕa/ > /a/
	1;2	*cheia* 'the.key'	/'k'e.ĭa/	['k'e. a]	/ĭa/ > /a/
Anna	1;2	*uite!* 'look!'	/'uĭ.te/	['u.te] [e.te] Vlad	/uĭ/ > /u/
Vlad	1;5				
Matei	1;11				
Bianca	1;11				

Child		Lexical item	Adult pronunciation	Child's pronunciation	Phono. process
Matei	1;8	*trei* 'three'	/'treĭ/	[te::]	/ eĭ/ > [e::]
	1;8	Doamne 'Lord'	/'dŏam.ne/	['da.me]	/ŏa/ > /a/
	2;00.28	*oamenii* 'the.people'	/'ŭa.me.niĭ/	['a.me.niĭ]	/ŭa/ >/a/
Bianca	1;11.05	*cartea* 'the.book'	/'kar.tĕa/	['ka.ta]	/ĕa/ > /a/
Iosif	2;7	*bibliotecă* 'book-shelf/library'	/bi.blĭo.'te.kə/	[bi.po.'te.kə]	/ĭo/ > /o/

Table 2. Simplification of diphthongs to the full vowel

As one can see, the diphthongs under consideration are either rising or falling, some of them occurring in stressed syllables, others in unstressed ones. At this moment, I cannot state whether the position of the diphthong in the word or word stress have any influence on the children's strategy. What is interesting to mention is that apart from difficulties in producing the diphthongs, some children also seem to have problems with the production of the rhotic consonant /r/ (Bianca 1;11;05) and of the lateral liquid /l/ (Iosif, 2;7), especially when these sounds appear in clusters (tautosyllabic or heterosyllabic). In these cases, the two children chose to drop the problematic sounds. Also interesting is Vlad's production of the imperative form of the verb *uite!* 'look!', which he initially pronounced as ['e.te]. My assumption for this production is that he deleted the problematic diphthong in the first syllable of /'uĭ.te/ and simply copied in its stead the vowel sound in the second syllable.

In some cases, the process of diphthong simplification resulted in the **preservation of the weaker/less sonorous sound** of the combination, i.e. the semivowel, contradicting the general tendency, attested for children acquiring other mother tongues. Only two subjects in the study, Matei and Bianca, resorted to this process, a little before their second year of age.

Child		Lexical item	Adult pronunciation	Child's pronunciation	Phono. process
Bianca	1;10.01	*pîi.ne* 'bread'	/'pɨĭ.ne/	['pi.ne]	/ɨĭ./> /ĭ/ > /i/
	1;10.20	*cîi.ne* 'dog'	/'kɨĭ.ne/	['ki.ne]	
	1;9.21	*a ieșit* 'he went out/it has come out'	/ ĭe.'ʃit/	[i. 'ʃit]	/ĭe/ >/ĭ/ > /i/
Matei	1;10	Matei (child's name)	/ma. 'teĭ/	[ma.'ti::]	/eĭ/ >/ĭ/ > /i/
	1;11.02	*bei* 'you. drink'	/'beĭ/	['bi::]	

Table 3. Simplification of diphthongs by reducing the full vowel

Since these two children preserved the least sonorous constituent of the diphthong, i.e. the semivowel, which cannot, as such, form a syllable nucleus, this has been reinforced to its syllabic counterpart, namely /i/. As in the previous type of diphthong reduction, this kind of simplification was again accompanied by the lengthening of the vocalic sound. The analysed examples show that each of the children has a "special" diphthong that undergoes this kind of reduction: Bianca /i̯i/ and Matei /eĭ/.

5.2.2. Deletion of diphthongs

In the recordings of three of the subjects in the study I have come across another way of dealing with the complex sounds, namely **total deletion.**

Child		**Lexical item**	**Adult pronunciation**	**Child's pronunciation**	**Phono. process**
Matei	2;00.28	*două* 'two.fem'	/'do.**ŭə**/	[do:]	/'do.~~ŭə~~/
Bianca	1;10.01	*iaurt* 'yoghut'	/**i̯a**.'urt/	[ut]	/~~i̯a~~.'urt/
	1;10.20	*pierdut* 'lost'	/p**i̯e**r.'dut/	[dut]	/p~~i̯e~~r. 'dut/
Vlad	2;0	*mamaie* 'granny'	/ma.'ma**.i̯e**/	[ma.'ma]	/ma.'ma~~.i̯e~~/
		tataie 'grandpa'	/ta.'ta.**i̯e**/	[ta.'ta]	/ta.'ta.~~i̯e~~/

Table 4. Cases of diphthong deletion

In all these examples, the deleted syllables containing the problematic diphthongs did not bear word-stress and they occurred in all three legal positions (bolded in the examples): word-initially, word-medially, and word-finally. If we cannot make any correlation between the phonological phenomenon and diphthong position in the word, we could say that the lack of stress on the syllable containing the diphthong may have determined its deletion by the children. Unstressed syllables are less prominent and, as such, more difficult to grasp by the children, who tend to delete them. So, in this case, we could speak of a problem of perception, rather than production, in line with Hua (2010).

Worth mentioning are the two terms Vlad used in addressing his grandparents. Despite the fact that he omitted the last syllable, which is made up by the diphthong only, he preserved the stress-pattern (i.e. stress on the second

syllable). This could be his own way of making the distinction between addressing his parents, /'ma.ma/, /'ta.ta/, with stress on the first syllables of the two terms and his grandparents, with stress on the second syllable

5.2.3. Diaeresis

Another phenomenon I came across in the Romanian-speaking children's production of diphthongs was the separation of the constituents of these complex sounds between two syllables, creating in this way a hiatus. In linguistics, this phenomenon is known under the term ***diaeresis***.

Child		**Lexical item**	**Adult pronunciation**	**Child's pronunciation**	**Phono. process**
Bianca	1;11.05	Mikey Maus	/'m**aŭ**s/	['m**a**.**u**s]	/aŭ/ > /a-u/
		maimuță 'monkey'	/m**aĭ**. 'mu.tsə/	[m**a**.**i.**'mu.tsə]	/aĭ/ > /a-i/
Matei	1;9.00	*aia* 'that.fem'	/'a.**ĭa**/	['a.**i.a**]	/ĭa/ > /i-a/
Iosif	2;00.23	*creion* 'pencil'	/kre.' **ĭo**n/	[ki.l**i**.'**o**n]	/ĭo/ > /i-o/

Table 5. Division of the diphthong constituents between two syllables

Again, no correlation can be made between the phonological phenomenon of diaeresis, the type of diphthong (rising or falling) or the position of the diphthong in the word. In two situations, the diphthong appeared in syllable-initial position, in one other example in word-mid position, and in another in syllable-final, unstressed position. Still, a word on Iosif's pronunciation of the word *creion* 'pencil' would be in order here. At the age of approximately 2 years, his rhotic consonant was still problematic; consequently, he often substituted it with the lateral liquid /l/. But consonant clusters, especially those containing liquid sounds, pose problems not only to Romanian children, but also the children acquiring other languages, such as English (Barlow 2005) or Portuguese (Ramalho and Freitas 2017), to mention just a few. Thus, what Iosif did was to replace the /r/ with /l/ in the onset in the first syllable, then to separate the diphthong elements in two syllables, and finally, to copy the first vocalic sound and epenthesise it, breaking the consonant cluster:

(1) Iosif, 2;0.23: /kre.ĭon/ > 1. [kr > kl]; 2. [ĭo > i.o]; 3. [kl.**i**.on] > [ki.li.on][14]

[14] Vocalic epenthesis is sometimes employed by Iosif to break consonant clusters (see Buja 2024, forthcoming).

5.2.4. Epenthesis

The addition of the vocalic /i/ sound in front of an already existing vowel in the syllable/word transforms it into a semivowel, which together with the full vowel will form a legitimate diphthong in Romanian. Two of the children in the study, Bianca and Iosif, made recourse to this process, a possible reason for that being ease of articulation.

Child		**Lexical item**	**Adult pronunciation**	**Child's pronunciation**	**Phono. Process**
Bianca	1;11.05	*păun* 'peacock'	/pə.ˈun/	[pə.ˈ**ĭu**n]	i-epenthesis
Iosif	2;1	*noi bem* 'we drink'	/bem/	[b**ĭe**m]	i-epenthesis

Table 6. Cases of epenthesis

An explanation for Iosif's production of the example above might be a general tendency among the Romanian speakers to diphthongize the vowel /e/, a characteristic related to the basis of articulation. Thus, many words that start with the letter 'e', such as *eram* 'we.were', *erbivor* 'herbivore'*, eu* 'I', are pronounced with the diphthong /ĭe/. Bianca's example could be considered a "phonetic accident". One might think that she epenthesised the semivowel to break the hiatus in the word, but a look at her examples in 5.4.3., produced at the same age (i.e. 1;11.05) shows that she is rather fond of hiatuses, so much so that she divides the diphthong constituents between two syllables (diaeresis).

5.2.5. Liquid vocalisation giving rise to diphthongs

In a couple of situations diphthongs have emerged in the pronunciation of the children in the study due to the fact that they have problems in uttering the liquid consonants. These are often vocalised, and if followed by vowels, they will give rise to diphthongs.

Child		**Lexical item**	**Adult pronunciation**	**Child's pronunciation**	**Phono. Process**
Bianca	1;10.29	*mare* 'big'	/'ma.re/	['ma.'**ĭe**]	/r/ > [ĭ]/[j]
	1;11.12	*te rog 'please'*	/te 'rog/	[te ˈ**ĭo**k]	
	2;01.11	*creț* 'curly'	/'krets/	['k**ĭe**ts]	
		spală 's/he washes'	/'spa.lə/	['pa.**ĭə**]	/l/ > [ĭ]/[j]

Child		Lexical item	Adult pronunciation	Child's pronunciation	Phono. Process
Iosif	2;2	*treabă* 'work'	/'trĕa.bə/	['tĭ**a**.bə]	/r/ > [ĭ]/[j]
Matei	2;01.13	*nu pleca!* 'don't go!/don't leave'	/ple.'ka/	[p**ĭe.** 'ka]	/l/ > [ĭ]/[j]

Table 7. Diphthongs resulting from liquid gliding

In all these examples, except for *spală,* the vocalisation of the liquids to [ĭ], combined with the existing full vowel in the syllable, could be interpreted as diphthong production, as all of the outcomes of these combinations are legitimate Romanian diphthongs. As for Bianca's example *spală* 's/he washes', since the gliding of the lateral liquid combined with the existing vowel in the second syllable does not give rise to a diphthong that is attested in Romanian, it would be safer to treat this as a glide-vowel sequence. Smith (2009) also mentions this process of liquid vocalisation in his grandson's phonological development, specifying that in many cases this error pattern results in sundry diphthongs, many of them not attested in English, as is the case of [i:^{u}], for instance (Smith 2009, 84). One striking difference between the children in my study and Smith's grandson relates to the fact that the vocalization of liquids precedes the full vowel in the Romanian syllables, whereas in English, it follows it.

5.2.6. Metathesis

One last phenomenon encountered in the production of a diphthong is the reversal of its constituents. Two of the six children investigated (Vlad 1;11.07 and Iosif 2;0) employed it: Vlad in producing the word, i.e. *pui* 'chicken', while Iosif (2;00) in *oaia* 'the.sheep'. Since *pui* is a monosyllabic word, whose nucleus consists of the diphthong /uĭ/, the reversal took place between the full vowel and the semivowel, /uĭ/ turning into /iŭ/. This change of order also brought about a change in the sonority level of the two constituents, in the first case /u/ being a full vowel, while /ĭ/ a semivowel, whereas in the children's production the /u/ turned into its semi-vocalic pair, while the semivowel /ĭ/ into its full vocalic pair. This phenomenon is what Kersville et al*.* (2009 quoted in Oxbury and McCarthy 2019, 2208) describe as "reversal of Diphthong Shift, i.e. the onset of the diphthong shifts anti-clockwise in the vowel space". Let us now consider Iosif's production of *oaia* 'sheep'. This is a disyllabic word, each of the syllables being made up of a rising diphthong:/'ŭa.ĭa/. What the child did was two reverse the syllables, a case of *metathesis:* ['ĭa.ŭa]. As this is the only example in the entire corpus, we could also assume that it could have been a slip of the tongue.

As Hua (2002, 54) contends, "[t]he importance of error patterns lies in that they can be understood as children's simplifying strategies. Therefore, they are a useful descriptive tool in describing and classifying the substitution patterns in the children's speech".

5.3. Inter-and intra-child variation

In the longitudinal data under consideration, one can notice both inter-and intra-child variations. The diphthong which caused most of these variations was /ŏa/. Thus, at the age of 1;11, Bianca would sometimes monophthongise it to /a/, i.e. the full vowel (in five tokens), some other times to /o/ (i.e. the semivowel [ŏ] turning into the full vowel [o]):

(2) Bianca (1;11.12) *foame* 'hunger' /'fŏa.me/ > ['fa.me] / ['fo.me] vs. *groază* 'horror, dread' /'grŏa.zə/ > ['go.zə]

Iosif and Matei, on the other hand, alternated the target-faithful production of the same diphthong with its version reduced to the full vowel:

(3) Iosif (2;1) *broască* 'frog' /'brŏas.kə/ > ['bŏas.kə][15] vs. *vioară* 'violin' /vi.'ŏa.rə/ > [bi.'a.rə][16]

(4) Matei (2;00.13) *foame* 'hunger' /'fŏa.me/ > ['fŏa.me] vs. *bom.boa.ne* 'candies' /bom.'bŏa.ne/ > [bom.ba.ne].

But children also differ in the way in which they pronounce the same words. Thus, if Matei reduced the /ŏa/ to [a] in the word *candies*, Bianca reduced it to [o], pronouncing the word [bom.bo.ne]. On the other hand, as we have already seen above (5.2.1 and 5.2.6), in dealing with the diphthong /uĭ/, Vlad (1;11.07) and Anna (1;2.10) made recourse to different phonological processes: *metathesis*, the former and *smoothing*, the latter:

(5) pui 'chicken' /puĭ/ > [pĭu] (Vlad) vs. [pu] (Anna).

[15] Remember that Iosif had problems with the consonant clusters containing liquids. In this example, he simply dropped the problematic rhotic sound.

[16] As Iosif's mother explained in one of the recording sessions, the child would frequently replace the labio-dental fricatives /v/ and /f/ with the bi-labial stops /p/ and /b/.

All the subjects in the study simplified (monophthongised) diphthongs in their phonological development, but then each showed preference for other phonological processes: Vlad and Iosif for metathesis, Matei and Bianca for the vocalization of liquids which gave rise to diphthongs, and Iosif and Bianca for unnecessary vocalic epenthesis.

6. Conclusions

As revealed by the analysis, the acquisition of diphthongs is not an easy task for the children acquiring Romanian. Apart from the fact that as compared to other languages, Romanian has a larger number of such vocalic sounds, the grammar of our mother tongue also enables the production of diphthongs, so this increases the children's cognitive load. Below are some examples in this respect.

(6) Iosif (2;2): /ĭe/ - *ba.**ie*** ['ba.ĭe] 'bath' & *mi-e* [m**ĭe**] *cald 'I'm hot'*
1st.pers.pron.Dat – be.1st.pers.sg.Pres
(2;9): /aĭ/ - *st**ai!*** [staĭ] *'stay!' & ăsta-i* [əs.t**aĭ**] 'this is'
dem.pron.masc. – be.3rd.pers.sg.Pres
(3;0): /ĕa/ - n**ea**.gră 'black.fem' & *te-am* [t**ĕa**m] *păcălit 'I have fooled you*
2nd.pers.pron.Ac. – aux. have.1st.pers.sg. Pres

These examples show that a description of the acquisition of diphthongs cannot be made without considering the interface between phonology and morpho-syntax.

The analysis proved that diphthongs **emerge** in the phonetic inventory of the subjects at different ages and in a random order. For some, they start appearing quite early (at the age of 1;2 for Anna), for others (Vlad, Bianca, and Matei) at around the age of 1;6, while for Alice rather late (2;0). The emergence seems to be strongly related to the richness of the children's vocabulary. A possible limitation of the current study in what the identification of the emergence of diphthongs is concerned is the fact that the corpora employed had different inception dates, these being dictated by the research interests of each of the three scholars that created them.

With respect to the **acquisition** of Romanian diphthongs, if for Matei, Bianca, and Iosif these seem to stabilize shortly after they emerge, for Anna, Alice and Vlad there is not enough data to enable solid conclusions. In order to have clear evidence in this respect, we either need more longitudinal corpora or experimental data coming from children aged between 3 and 4 years. If in some languages

(Korean, English) most of the diphthongs are acquired around the age of 4, in Putonghua, some stabilize only at the age of 6, others at 8 years of age (Hua 2002).

In what concerns the factors impacting the emergence and acquisition of these complex vocalic sounds, no correlation could be drawn with the type of diphthongs (falling or rising), but there seems to be some correlation with their position in the word. Thus, a couple of the diphthongs occurring in word-final position were prone to simplification: /eĭ/ > [e::] and /oĭ/ > [o:]. Here are some examples from Bianca (1;8) *trei* [te::] 'three', Matei (1;10) *Matei* [ma.ti::] (the child's name), *bei* [bi::] 'you.drink', and Anna (2;0) *doi* [do:] 'two'. In the corpus under investigation there is also some correlation between the acquisition of diphthongs and word-stress in that the complete deletion of these sounds occurred only in the unstressed syllables of longer words, which are quite scarce in their vocabulary. In order to identify the effect of stress, one has to wait for the children's lexicon to comprise plurisyllabic lexical items.

The analysis also indicated that for the children who have been recorded for a longer period of time the number of diphthongs increased steadily. Thus within a time-span of almost 7 months, 12 diphthongs emerged in Matei's speech. Bianca, on the other hand, acquired 10 diphthongs over a longer period of time (between 1;6 and 2;11), while Iosif had acquired 14 out of the 23 diphthongs of his mother tongue within a year (between the ages 2;0 and 3;0). Unlike in Hua's (2002) study, where a certain order of diphthong emergence and stabilization was mentioned, in the current study the data was not rich enough to offer us a clear-cut image.

As far as the strategies employed by the Romanian children in coping with the production of diphthongs are concerned, the analysis indicated a much larger range than attested in the literature. A universal strategy is that of reducing/simplifying the diphthongs to the full vowel. But apart from that, the children in our study also made recourse to other strategies, such as simplification to the vowel sound corresponding to the semivowel, metathesis, epenthesis, and diaeresis. The data have also shown inter-and intra-child variations, which confirm that the acquisition of diphthongs is quite a challenging process. To get a more accurate picture on this process, longitudinal data should be complemented by an experimental study tailored for a larger number of children, aged between 3 and 4 years.

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