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DERIVATIONAL NETWORKS OF ONOMATOPOEIA

Abstract: This paper presents research on the word-formation properties of onomatopoeia, or words imitating natural sounds. The research is conducted with the model of derivational networks, a relatively new approach to the theory of derivational paradigms, introduced for the first time in the book Derivational Networks Across Languages. The main aim of the analysis is to discover whether onomatopoeia can become a productive word-formation bases, and if so, how productive, and what kind of derivatives can be created. The research also compares English and Slovak onomatopoeia. The paper is divided into three main sections: part 2 introduces the concept of derivational networks and discusses its evolution through the works of Czech and Slovak linguists. Part 3 discusses the notion of onomatopoeia, what it is, and how it is understood and defined for the purpose of this research. Finally, part 4 presents the research itself, including the methodology, results, and discussion.

Key Words: iconicity, word-formation, onomatopoeia, derivational networks

Introduction

Derivational paradigms have long been subject to numerous disputes in the linguistic sciences. Recently, cross-linguistic research introducing a new approach to the derivational paradigms has been published in the book Derivational Networks Across Languages, edited by Bulgarian and Slovak linguists Lívia Körtvélyessy, Alexandra Bagasheva a Pavel Štekauer. Their method of derivational networks provides an in-depth analysis of derivational paradigms and confirms not only their existence, but also usefulness. In this paper I build upon the foundations laid in their book and use derivational networks to specifically examine the derivational properties of onomatopoeic words.

Thus, in this paper I describe both the concept of derivational networks and the notion of onomatopoeia in more detail and establish a definition for onomatopoeia which will be used in the research. In the end, the results from my research are presented.

Derivational Networks

The concept of *derivational networks* is relatively new in linguistic morphology. The idea itself, however, is closely related to the notion of morphological paradigms, specifically their understanding in Czech and Slovak linguistic tradition. The theory of derivational networks is inspired primarily by the work of Dokulil (1962), Furdík (2004) and Horecký (1989), being an expansion on their theory of derivational nests.

According to Furdik (2004) and Dokulil (1962), derivational paradigms combine with so-called *derivational chains* to create a new structure – *derivational nests.* As Furdík (2004) defines it, a derivational chain is a series of motivated units, starting with an original, unmotivated unit, and followed by more complex units, each one motivated by the preceding one. As an example, he provides the chain of the Slovak lexeme *písať* 'to write', as can be seen in Table 1 (Furdík, 2004).

Table 1: Derivational chain of Slovak *písať* (Furdík 2004)

Unmotivated unit		**I**	**II**	**III**	**IV**	**V**
Slovak	*písať*	*za-písať*	*zapis-ovať*	*zapisova-teľ*	*zapisovateľ-ka*	*zapisovateľk-in*
English	'write'	'write down'	'write down' (durative)	'recorder' (male)	'recorder' (female)	'belonging to a female recorder'

Furdik's *derivational paradigm*, on the other hand, is a group of derivatives, each of which is derived immediately from the same motivating unit and not motivated between themselves, as can be seen in Table 2 with an example of the Slovak lexeme *škola* 'school' (Furdík 2004).

Table 2: Derivational Paradigm of Slovak *škola* (Furdík 2004)

Motivating Unit		**Motivated Units**	
Slovak	**English**	**Slovak**	**English**
škola	'school'	*škol-ák*	'pupil'
		škol-ník	'janitor'
		škôl-ka	'kindergarten'
		škol-stvo	'education system'
		škol-ička	'school' (diminutive)

Within the chain, each motivated unit can become a motivating unit for several other units. Derivational paradigms can be thus merged with derivational chains. The result would be an organised system of interconnected units, all

derived from one unmotivated unit. Furdík terms it as a *nest* (Slovak 'hniezdo'), in Dokulil's terminology it is called *family* (Czech 'čeleď').

The theory of derivational networks builds upon these foundations but with altered terminology and one extra dimension. In this model, the vertical dimension represents all direct derivatives of a single word-formation base (Furdik's derivational paradigm), and the syntagmatic dimension represents all linear derivations of a single word-formation base (Furdik's derivational chain) (Körtvélyessy et al. 2020). However, a derivational network is not complete until the third, semantic dimension, is added to a paradigm. As stated by Körtvélyessy et al. (2020: 11) "a combination of derivatives from the same base simultaneously identifies a combination of semantic categories realized in the process of consecutive derivations. Semantics thus functions as an indispensable third dimension of our model". Each derivative is thus assigned its semantic category based on the last derivational step. An example of one line of syntagmatic dimension of a Slovak lexeme *dom* 'house' could be *dom → domček → domčekový*, with the semantic categories being DIMINUTIVE for the first order, and QUALITY for the second. (Körtvélyessy et al. 2020).

All three dimensions together form a derivational network, defined by Körtvélyessy et al. (2020: 11) as "a network of derivatives derived from the same word-formation base (simple underived word) with the aim of formally representing specific semantic categories". An example of such a network is provided with the base onomatopoeic word snap in Table 3:

Table 3: Derivational Network for the English *snap*

1st order		**2nd order**					**3rd order**
Durative	*Resultative*	*Action*	*Quality*	*Agent*	*Reversative*	*Privative*	*Manner*
1A snap		2A1 snapping					
			2A2 snapping				
			2A3 snappy				3A3a snappily
				2A4 snapper			
					2A5 unsnap		
						2A6 snapless	
	1B snap						

For a better reading of the table, each derivative is identified with a number. Based on the numbers, it is possible to observe from what base each new word is derived, and thus track its derivational history, e.g. word 1A motivates words 2A1-2A6 in the 2nd order, one of which (2A3) motivates word 3A3a in the 3rd order.

The model of derivational networks thus provides a brand-new perspective on derivational paradigms and the complexity of derivational processes. Such a model can capture the complexity of derivational relations, which the two-dimensional models could not accomplish.

Onomatopoeia

To properly conduct the research it is necessary to define how this paper treats onomatopoeia. In general, onomatopoeic words are understood as a direct imitation of what we hear, i.e. natural noises or sounds imitated by means of speech sounds (Marchand 1960). It is an iconic imitation of extralinguistic reality which has universal features. But it is important to recognise that an onomatopoeic word is not an icon itself, and its 'universality' has boundaries as well.

According to Körtvélyessy (2020: 7), "each onomatopoeic word is a combination of the underlying sound-imitation principle and a symbolic layer". It is because each language has its own specific phonological system and its own system of transcription, and those systems are employed when creating onomatopoetic words. External sounds are, therefore, transcribed differently in each language and, as a result, English dogs bark *woof-woof*, while Slovak dogs bark *hav-hav*. Consequently, it is inevitable for the onomatopoeic words to be in each language conventionalised, and thus gain a certain degree of symbol. As a result, Körtvélyessy (2020: 7) refers to them as iconic symbolic signs. In the following paragraphs, both aspects of their nature are described in more detail.

Onomatopoeic words are iconic because it is possible to compare the acoustic characteristic of various phonemes with the acoustic characteristics of natural sounds. For example, plosives /p/ or /b/ are often connected with onomatopoetic words representing "intense natural sounds of short duration", whereas long vowels are used to imitate prolonged tones (Flaksman 2018: 4). Based on the comparison of oscillogram recordings of speech sounds with the sounds of the natural world, S.V. Voronin (as cited in Flaksman 2018) defines five major sub-classes of onomatopoeia as they are realised in English: a) instants imitate pulse-like sounds via the plosives (*tap, tick or clap*), b) continuants imitate prolonged tones via long vowels (e.g. *hoot, peep*) or prolonged noises via fricatives and sibilants (e.g. *sizzle, hiss*), c) frequentatives imitate vibratory via trills (e.g. *purr, chirr*), d) instant-continuants imitate sounds where pulses and tones are combined (e.g. *clash, plump*), and e) frequentative-instant-continuants combines vibratory, pulse-like and tone-like elements to create onomatopoeic words like *crash* or *thrum.*

Different phonotypes and their iconic use in onomatopoeia formation may be universal, but individual phonemes, which are a part of those phonotypes, are not. And since the sets of phonemes differ from language to language, the resulting

onomatopoeic words differ as well. As a result, they need to be conventionalised, which results in the arbitrary nature of onomatopoeia – i.e., conventionalisation of phonetically identical onomatopoeic words which relate to several different meanings. As was indicated by Fischer (1999: 124), if the onomatopoeic words were truly iconic only, we could not "expect to find any of the features which are characteristic of the arbitrary and conventional vocabulary of a language: ambiguity, polysemy, homonymy, synonymy and so on". As he claims, if *whoosh* was truly iconic, it would not *represent* the sound of rushing wind, it would *be* the sound of rushing wind, only produced by a different source. The problem is, the rushing wind can be expressed by other onomatopoeic words, such as *shoo*, *swoosh*, or even *shshsh*, which results in synonymy. Moreover, the sound *shshsh* can be used to express not only the rushing wind, but also the sound of waves or the sound of trains, which is homonymy. As a result, Fisher (1999: 125) claims that "the context…, coupled with the speaker's knowledge of certain conventions, is necessary for understanding", hence the arbitrary nature of onomatopoeia.

Conventionalised onomatopoeia may consequently enter the system of a language in a classic manner. As mentioned by Körtvélyessy (2020: 15), "arbitrariness puts these words on the same level with the dominant part of the vocabulary". Onomatopoeic words may, therefore, serve as the derivational bases for new lexemes and, as a result, their iconic nature may be gradually lost. The onomatopoeic word *miaow*, for example, is often "extended in meaning to denote the action of making the sound – *to miaow*" (Feist 2013: 107). Thus, the verb *to miaow* is not a direct imitation of sound anymore, it is a feline activity. Moreover, it can even become a complex word composed of an iconic base and fully arbitrary affixes. If the onomatopoeic words are to be understood as imitations of natural sounds, can these derivatives then, still be considered onomatopoeic words?

As an answer, Körtvélyessy (2020) suggests distinguishing between two types of sound-imitating words, based on the function of the sound imitation. She divides onomatopoeia into primary, and secondary onomatopoeia, where the former term is used for the cases where "sound imitation both motivates and defines the word" (Körtvélyessy 2020: 35), and the latter is used when the sound imitation has only a motivating function. Therefore, *miaow* is a primary onomatopoeic word, whereas the motivated *to miaow* is of secondary nature.

Derivational Networks of Onomatopoeia

The research is focused on the productivity of primary onomatopoeic bases in creating secondary onomatopoeia. I use a sample of 40 primary onomatopoeic bases from English and 40 from Slovak. The samples are divided into 2 different

types, where onomatopoeia from Sound Type #1 imitate the sounds of animals, and Sound Type #2 imitates the sounds produces by various falls or bursts. They are listed in the Tables 4 and 5.

Table 4: Onomatopoeic Words from Type #1 - Animal Sounds

	English	Imitated Sound	Slovak	Imitated Sound
1	*howl*	long cry of dog or wolf	*mé*	of a goat
2	*miaow*	cry of cat	*bú*	of a cow
3	*purr*	vibratory sound of cat	*mú*	of a cow
4	*grunt*	of a pig	*kroch*	of a pig
5	*oink*	of a pig	*kvik*	of a pig
6	*baa*	of sheep/lamb	*hav*	of a dog
7	*bow-wow*	of a dog	*mňau*	of a cat
8	*ruff*	of a dog	*brum*	of a bear
9	*woof*	of a dog	*kvak*	of a frog
10	*cluck*	of a hen	*cvrk*	of a cricket
11	*cheep*	of a young bird	*čip*	of a little bird
12	*chirp*	of a small bird	*čiri*	of a swallow
13	*pip*	of a small bird	*hú*	of an owl
14	*peep*	of a young bird/mouse	*kuku*	of a cuckoo
15	*tweet*	of a bird	*čvirik*	of a sparrow
16	*trill*	vibratory sound of bird	*čimčara*	of a sparrow
17	*squawk*	harsh sound of bird	*krá*	of a crow/raven
18	*crow*	of a crow/raven	*kŕk*	of a frog
19	*quack*	of a duck	*hrkú*	of a pigeon
20	*cuckoo*	of a cuckoo	*cukrú*	of a pigeon
21	*koax*	of a frog	*kikirikí*	of a cock
22	*ribbit*	of a frog	*kotkodák*	of a hen
23	*buzz*	low humming of insect	*kvok*	of a hen
24	*hiss*	of a snake	*gá*	of goose
25	*croak*	of a frog	*vŕr*	dog's growl

Table 5: Onomatopoeic Words from Type #2 - Falls, Strokes, Bursts

	English	Imitated Sound	Slovak	Imitated Sound
1	*2*	*3*	*4*	*5*
1	*bong*	low-pitched resonant	*hrk*	jolting
2	*clap*	explosive, as of thunder	*buch*	of strike, gun-shot or fall
3	*knock*	regular thumping noise	*bác*	of strike, gun-shot or fall
4	*plonk*	of sth. being heavily set down	*puk*	short sharp

1	*2*	*3*	*4*	*5*
5	*pop*	light explosive	*pác*	of strike, gun-shot or fall
6	*pow*	blow or explosion	*prásk*	of strike, gun-shot, fall or breaking
7	*zing*	vibrating or buzzing noise	*klap*	impact of hard objects
8	*whomp*	dull, heavy	*šťuk*	of a sharp hard impact
9	*boom*	loud, deep, resonant	*lup*	of a stroke, impact
10	*wham*	of a forcible impact	*plesk*	of lashing
11	*kaboom*	of a loud explosion	*ťuk*	of tapping
12	*blam*	of an explosion	*šuch*	fast motion over the surface
13	*bang*	sudden loud, sharp noise	*vrzg*	of scrooping
14	*thud*	dull, heavy	*klop*	of knocking
15	*snap*	sharp cracking	*ďob*	of rapid pricking, pecking etc.

For each base I then created its derivational network. In the Slovak language, I used the Dictionary Portal of the Ľudovít Štúr Institute of Linguistics (Slovníkový portál Jazykovedného ústavu Ľ. Štúra SAV), a website allowing one to search through all the major Slovak dictionaries, and the Slovak National Corpus (Slovenský národný korpus). For the English language, I used the online dictionaries LEXICO, Collins Dictionary and Merriam-Webster Dictionary, accompanied by Corpus of Contemporary American English.

After compiling the networks, it was time to gather the data they offered. Table 6 provides an example, representing the 2nd order of derivation of the Type #2 words. As can be seen, this table provides several pieces of information. Firstly, I can see the actual number of all derivatives for the selected order of derivation. For example, the most productive word in the 2nd order was the word snap with 6 derivatives in total. Counting it together with the rest of the orders would answer the question of the largest derivational network in Type #2 of English onomatopoeia. Secondly, it tells me the highest possible number of derivatives for each semantic category (e.g. the Type #2 words can create at max 2 derivatives in semantic category QUALITY), as well as the maximum number of derivatives possible for the 2nd order (the Type #2 words can create at max 9 derivatives in the 2nd order).

Table 6: Second Order of Derivation of the English Type #2

	Action	**Quality**	**Instrument**	**Diminutive**	**Agent**	**Reversative**	**Privative**	**Total**	**Saturation (%)**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
bong	1	1	1					3	**33.33**
clap	1	1	1					3	**33.33**
knock	1	1	2					4	**44.44**
plonk								0	**0**

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
pop								0	**0**
pow								0	**0**
zing	1	1						2	**22.22**
whomp	1	1						2	**22.22**
boom		2		1				3	**33.33**
wham	1							1	**11.11**
kaboom								0	**0**
blam								0	**0.00**
bang	1	1	1					3	**33.33**
thud	1							1	**11.11**
snap	1	2			1	1	1	6	**66.67**
Maximum Possible Number of Derivatives	**1**	**2**	**2**	**1**	**1**	**1**	**1**	**9**	
Average Saturation									**20.74**

From these two values, I can acquire the saturation value for each derivational base. Dividing the sum of derivatives (e.g. 6 derivatives for *snap*) by the maximum possible number (9) gives the percentage value of how much the derivational network of a selected base is saturated as compared to the rest of the derivational order (e.g. *snap* has 66.67% saturation value in the 2nd order of derivation). This can then be transposed to the whole network. Finally, I can also see that the average saturation value in the 2nd order of the Type #2 is 20.74%. I carried out the same process for all 40 onomatopoeic words from my sample.

The data acquired then provided the following results. Firstly, it became obvious that the Slovak onomatopoeic words are much more productive in word-formation than their English counterparts. These results are taken from Tables 7–9. For example, while the average size of a Slovak network was 13.43 derivatives, an average English network was only 4.35 derivatives. The difference is even more striking when the maximum values are compared: the largest Slovak network had 37 derivatives; the largest English network only 9 derivatives. The value of Maximum Derivational Network was 119 potential derivatives in Slovak, and only 22 in English. In short, the Slovak onomatopoeic networks were always significantly larger.

Table 7: The Average Size of Derivational Networks

	Type #1	**Type #2**	**Combined**
SK	9.72	19.6	13.43
EN	4.68	3.8	4.35

Table 8: Words with the Highest Number of Derivatives

Order of Derivation		1st	2nd	3rd	4th	5th	Full Network
SK	Type #1	4	14	6	3	1	**24**
		cvrk, vŕŕ	*kvik*	*kvik*	*mé*	*mé, gá*	***kvik***
	Type #2	3	18	13	9	2	**37**
		hrk, šuch	*plesk*	*prásk*	*buch*	*hrk, klop*	***prásk***
	Combined	**4**	**18**	**13**	**9**	**2**	**37**
		cvrk, vŕŕ	***plesk***	***prásk***	***buch***	***hrk***	***prásk***
EN	Type #1	3	5	1	–	–	**8**
		cuckoo	quack	howl			**howl**
	Type #2	3	6	1	–	–	**9**
		bong	snap	snap			**snap**
	Combined	**3**	**6**	**1**	–	–	**9**
		cuckoo, bong	***snap***	***howl, snap***			***snap***

Table 9: Maximum Derivational Network

		1st	2nd	3rd	4th	5th	Maximum Derivational Network
SK	Type #1	6	28	14	6	1	**55**
	Type #2	6	35	38	16	4	**99**
	Combined	**8**	**46**	**41**	**19**	**5**	**119**
EN	Type #1	3	11	3			**17**
	Type #2	4	9	1			**14**
	Combined	**5**	**14**	**3**			**22**

However, the truth is that the primary onomatopoeic words themselves created very little immediate derivatives in Slovak, as suggested by the small 1st order. It was their persistent derivation into verbs, a derivationally very rich category, which resulted in such large networks. As indicated by Ivanová (2020: 102), who conducted research into Slovak derivational networks in the Derivational Networks Across Languages, "there is a rich set of prefixes with different spatial and aspectual meanings that can be added to a verb", and therefore "[t]he richest derivational networks are typical of Slovak verbs". As a result, the derivational networks of onomatopoeia became rich as well.

The frequent derivation into verbs in Slovak had an impact on the distribution of semantic categories as well. The most productive semantic categories were either those reflecting verbs, or derivatives of verbs, such as ACTION, DURATIVE, INCEPTIVE, or REFLEXIVE. The largest number of derivatives belonging to one category was 89 derivatives in the category ACTION. In English, the situation was different, since the most productive semantic categories were

RESULTATIVE and QUALITY. These two categories accounted for 37 derivatives each. The English onomatopoeic networks thus consisted mostly of nouns and adjectives, with verbs being only in the 1st order with the meaning 'to make sound of', and rarely anything else, unlike in Slovak. The data is presented in Table 10.

Table 10: Most Productive Semantic Category

Order of Derivation		**1st**	**2nd**	**3rd**	**4th**	**5th**	**Full Networks**
SK	Type #1	Durative	Inceptive	Manner	Inceptive, Quality	Manner	
		40	49	9	2	2	
	Type #2	Durative	Action	Reflexive	Reflexive, Quality	Reciprocal	
		18	26	24	5	2	
	Combined	**Durative**	**Action**	**Reflexive**	**Quality**	**Manner Reciprocal**	**Action**
		58	**67**	**25**	**7**	**2**	**89**
EN	Type #1	Durative Resultative	Quality	Manner	–	–	
		23	27	3			
	Type #2	Resultative	Quality	Manner	–	–	
		14	10	1			
	Combined	**Resultative**	**Quality**	**Manner**	**–**	**–**	**Resultative, Quality**
		37	**37**	**4**			**37**

Another interesting conclusion can be drawn regarding the systematicity of networks. As already mentioned, the size of English derivational networks could not be compared with Slovak, but the small English networks opened the way for higher saturation and more similar, and therefore more predictable, derivational networks. For example, an average English derivational network was saturated up to nearly 20% of MDN value. The number was even higher when the two semantic types of onomatopoeia were distinguished. An average Slovak network, on the other hand, was saturated only up to 11%. The strong systematicity of English networks can be seen especially in the 1st order of derivation, where the saturation was more than 60% for Type #1 onomatopoeia, and nearly 50% for Type #2. To compare, an average network of the same category in Slovak was saturated up to 31% in Type #1 and 25% in Type #2. To conclude, even though smaller, the English derivational networks of onomatopoeia seem to have better systematicity than the large Slovak networks. The data are presented in Table 11.

Table 11: Average Saturation Value

		1st (%)	2nd (%)	3rd (%)	4th (%)	5th (%)	Total (%)
SK	Type #1	31.33	22.14	8.86	5.33	8.00	**17.67**
	Type #2	25.56	27.43	17.02	10.83	6.67	**19.80**
	Combined	**21.88**	**16.25**	**7.81**	**4.47**	**3.00**	**11.28**
EN	Type #1	62.67	23.63	6.67			**27.53**
	Type #2	46.67	20.74	6.67			**27.14**
	Combined	**37.50**	**16.61**	**5.00**			**19.77**

Conclusions

Primary onomatopoeic bases are, in fact, productive in word-formation, creating various types of the secondary onomatopoeia. However, there is considerable difference between their productivity in Slovak and in English. While the Slovak onomatopoeia tend to form large networks, English networks are much smaller. However, English networks are more systematic and predictable, which is reflected in their high values of saturation, as compared to Slovak. The high productivity of Slovak onomatopoeia seems to be due to the large derivational capacity of verbs in the Slovak language in general. This is because the first step for all Slovak primary onomatopoeia was to derive into a verb, which created many possibilities for the numerous subsequent derivations. Consequently, the majority of onomatopoeic derivatives in the Slovak samples were either verbs or derivatives of verbs, which is reflected in the productivity of semantic categories like DURATIVE, REFLEXIVE or ACTION. English, on the other hand, formed mostly nouns and adjectives, as can be seen in the productivity of categories QUALITY and RESULTATIVE.

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