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Phonology and morphology and the limits of freedom in an artificial language

Abstrakt (Fonologia i morfologia oraz limity dowolności w języku sztucznym). Sztuczne języki, takie jak esperanto, zostały stworzone na papierze. Wymowa takiego języka nie jest zazwyczaj szczegółowo zaplanowana. W języku natywnym ta kompetencja jest zazwyczaj podstawą nieuświadomionych niuansów takich jak stopień wysokości i otwartości głoski. Artykuł prezentuje analizę fonetyczną samogłosek w esperanto, opracowaną na podstawie wymowy czterech esperantystów, jako przykład przeniesionej umiejętności. Ponadto w esperanto istnieje jeszcze co najmniej jedno zagadnienie, w którym użytkownicy zdają się kierować swoją intuicją: zachowanie końcówki pierwszego członu złożenia. Złożenia te są badane w ramach Teorii Optymalności. Źródła gramatyczne odzwierciedlające generowanie tych złożzeń zostały zaproponowane w celu pełniejszego poznania systemu.

Abstract. Artificial languages like Esperanto were created on paper. The pronunciation of such languages is not ordinarily planned in detail. Competence in one's native language is usually the basis of unconscious nuances such as vowel height or openness. In this paper a phonetic analysis of the Esperanto vowels as pronounced by four Esperantists is produced as an example of displaced competence. Besides this, there exists in Esperanto at least one field in which speakers seem to be left to their will: the maintenance of the ending of the first element in compound words. These compounds are studied within the frame of Optimality Theory, and grammatical resources that reflect the generation of compounds are proposed in order to better understand the system.

Somewhere in Wonderland, Alice talks to the Duchess while holding a flamingo. She underlines the importance for everyone to mind their own business, and the Duchess, who was strongly addicted to idioms, states „Take care of the sense, and the sounds will take care of themselves”. Is this true? It is, at least, an appealing description of a speaker's function: build up your sentences paying attention to what you mean, and leave sounds alone because they rule themselves and they always match up with each other in an automatic way. Of course this is a naïve description of how grammar really works, and a close look at sound processes reveals an intricate system of elisions, epentheses and many other more subtle sound changes. However, the Duchess

was right in the same way as it would be sensible to advise a normal computer user not to dabble with the hardware. It is the linguist who should inspect the core of the phonological component and discover why it works detached from the speaker's awareness. It is not at all rare for a lecturer in phonology or dialectology to discover how hard it is to make students aware of a given pronunciation, even – or especially – if such a pronunciation is both their own and different enough to its corresponding written representation. Learning how to listen to oneself is the most serious challenge to Labov's observer's paradox. The intervention of written language in sound change recognition is a serious matter for a student of phonology, and it can also become a serious handicap for a conlanger. In this paper we shall try to shed light on the latter point by observing the effect of unrestricting choices in a constructed language. The emergence of native language competence when speaking or writing in a constructed language is especially strong when no prescription is at hand for a given option. Two fields will be under survey (i) variation determined by the speaker's linguistic background, and (ii) free variation as (limited) optionality. The phonetics of vowels and the alignment of phonology and morphology in Esperanto are expected to shed light on these aspects of competence. In other words: are sounds really reliable when left alone on the conlanger's workbench?

1. Esperanto and the speaker's linguistic background: an example

Montagut (2003:154-155) points at the difficulty of following Zamenhof's ninth rule, the one ruling relationships between oral and written language¹: „Ĉiu vorto estas legata, kiel ĝi estas skribita» (*Every word is read the way it is written*). Before entering into discussion of the rule, a word should be said on the radical change of perspective that interlinguistics should adopt in comparison with traditional linguistics. Zamenhof's words show the way in which his work differs from that of a linguist trying to codify a language. For a linguist struggling with an outbreak of dialects, the task would be to produce a standardised written form for every word. In the opposite direction, for the conlanger with a view to producing an international auxiliary language in the age of writing, the process would begin with a written word and the effort applied to the need for restricting oral variation. Natural languages are first spoken, and only a small number of them have achieved a written form. Artificial languages grow the other way round. A second factor pushes artificial languages away from language standards: natural languages are meant to be their speakers' main language² and grow as an unconscious

¹ “Posttagmeze la tankoj transsaltos la barilon”: ĉu efektive vi legis post-tagmeze, transsaltos, kun du apartaj t-oj kaj s-oj?” Montagut (2003:154).

² While multilingualism is a common feature, it appears as a result of contacts between historically different communities. Only pidgins could be compared to artificial languages on the basis we wish to underline here.

progression from previous languages, while artificial languages irrupt in the middle of a community already speaking another language. Of course, a substratum could be invoked as a parallel in natural languages. However, their abruptness would still keep artificial languages distinct. In this state of affairs, how can a speaker get rid of the way „sounds take care of themselves”, as the Duchess would say, when he tries to convey sense in the words of the new language? How can we cope with the fact that Zamenhof himself advises French readers to pronounce <ɥ> as they pronounce any /t/ in their own language, and, at the same time, he advises English readers to pronounce <ɥ> the way they pronounce /t/ in *tea*? The fact is that, in general, (European) French /t/ is unaspirated, while aspiration is normal for /t/ in English *tea*. It should be said that confusion with aspiration should not be a problem as long as no word in Esperanto contrasts with any other word on aspiration alone, as Piron already pointed out to dismiss this sort of example³. However, it remains true that confusion can arise in dialogic texts, especially when contrast in voice is restated by one of the speakers in terms of aspiration, as in Mandarin Chinese. In such a case Esp. *duŝi* would collide with *tusi* and the contrast would collapse. Another main field of individual sounds challenging safety distances is the vowel system. Vowels are kept distinct by length, position, nasalisation and lip-roundness. Esperanto has only five vowels. Nasalisation plays no role in the classification of Esperanto vowels, and lip roundness is redundant. As is well known, the first two formants of the acoustic spectrum show height (the higher F1, the lower the vowel) and backness (the higher F2, the more advanced the vowel). Five-vowel systems are the most common worldwide (Crothers 1978), and have the advantage of keeping vowels apart from each other, thus avoiding confusion⁴. This type of vowel system shows three height levels, dismissing the difference between open-mid and close-mid vowels which appears in larger vowel-inventories. It should not represent a problem for Esperanto speakers with a native language with a larger vowel-inventory, as Wells (1989) puts forward. And indeed no confusion should arise in monological speeches. However, comparing vowels as pronounced by speakers with different linguistic backgrounds can make things more puzzling. In the following figure the vowels of four Esperanto speakers are compared: Edmond Privat, Louis-Christophe Zaleski-Zamenhof, Humphrey Tonkin, and Mark Fettes. Their vowels appear on the graph following the initial letter of their surname:

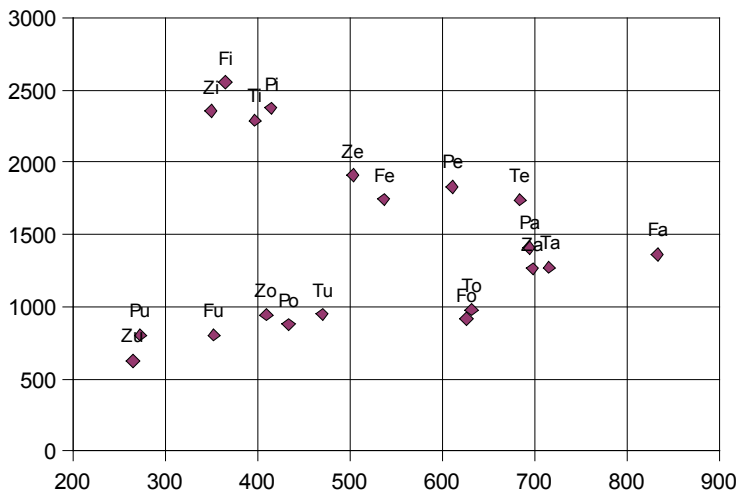
There seems to be no problem when each speaker is analysed: vowels are kept distinctly apart. The problems arise when they are compared⁵. The area of the two round vowels /o, u/ intersect along both formant values. This could clearly complicate comprehension... were comprehension to rely only on acoustic cues, which is not the case.

³ <http://claudepiron.free.fr/articlesenesperanto/lingvistoj2.htm>

⁴ See Koutny (2001) for this matter applied to speech synthesis in Esperanto.

⁵ „Ĉiu emas percepti ĉiun lingvon tra la fonema kribilo de la propra gepatra lingvo” (Wells 1989:20).

(1) Vowel chart ((X=F1, Y=F2)) (single occurrences)



Does every one of these speakers adhere to Zamenhof’s ninth rule? Where phonetic nuances are left unregulated, doors remain open to the influence of native language as long as miscomprehension does not spoil communication. This is the key to Wennergren’s (2008) comment on aspiration⁶, and Wennergren (2010) on vowel place⁷, and it recalls the strategy proposed by Zamenhof in his *lingva respondo 56* on nasal lenition and vowel nasalisation in VnjV groups and other problems⁸. It is interesting to study the way in which Zamenhof states the problem: the aim of proposed pronunciation is to avoid miscomprehension, while real (or natural, cf. “natura emo”) pronunciation is perceived as “more elegant”. Of course, the terms of the problem stated in such a way are no more than an instantiation of markedness, as defined in terms of the Prague School and later running through every single phonological theory up to the present. Not far from that standpoint are Kalocsay & Waringhien’s views on consonant assimi-

⁶ „En kelkaj lingvoj oni elparolas la sonojn P, T, K, C kaj Ĉ kun forta elspiro, kvazaŭ kun malforta H poste. En Esperanto tiuj konsonantoj estas normale sen tia elspiro, sed pri tio ne ekzistas regulo. Oni povas do elparoli kun elspiro, se oni volas, sed oni atentu, ke la elspiro ne sonu kiel plena H” (Wennergren 2008:25).

⁷ „La elparola loko de vokalo povas libere varii inter certaj limoj. Gravas nur, ke ĉiu vokalo ne tro proksimiĝu al iu alia el la kvin vokaloj” (Wennergren 2010:19).

⁸ „Batali kontraŭ tia natura emo en la elparolado ŝajnas al mi afero tute sencela kaj senbezona, ĉar tia elparolado (kiu estas iom pli eleganta, ol la elparolado pure teoria) donas nenian malkompreniĝon aŭ praktikan maloportunaĵon; sed *rekomendi* tian elparoladon (aŭ nomi ĝin “la sole ĝusta”) ni ankaŭ ne devas, ĉar laŭ la teoria vidpunkto (kiu en Esperanto ofte povas esti ne severe observata, sed neniam povas esti rigardata kiel “erara”) ni devas elparoli ĉiun sonon severe aparte; sekve se ni deziras paroli severe regule, ni devas elparoli “pan-jo”, “san-go”, “mi-a”, (Zamenhof 1911:222).

lations⁹. The *Plena analizo gramatiko* holds a position favouring natural evolution of Esperanto phonology, as in the analysis of vowel height and length¹⁰, and, by doing so, Esperanto falls under the same light required to study any natural language. The corollary of this position is a strong reluctance to adhere to Zamenhof's *severe aparte* recommended pronunciation.

2. Free variation: aligning phonology and morphology in Esperanto

Severe aparte managing of sounds clearly conflicts with other requirements expected to be met by the international language, the first of which clearly consists of the need to rely on a huge diversity of speakers' competences. Sapir's (1921) reflexions on accent as based on unnoticed features of one's own pronunciation¹¹ would find among the mass of Esperanto speakers a fertile source of examples, as pointed out above for vowel acoustics or in Dols (2009) for Voice Onset Timing in plosives. A system-internal source of conflict is consonant clusters. It should be borne in mind that we use 'conflict' in the way Optimality Theory circulated the term after Prince & Smolensky (1993): the grammar of any language consists of a set of conflicting universal constraints, with the final shape of specific language forms depending on the exact, specific hierarchy imposed upon those constraints¹². Instances of heterosyllabic chains of consonants disagreeing in voicedness like those cited by Kalocsay & Waringhien ("absolute", "okdek", etc.) offer a typical constraint conflict: agreement in voicedness is favoured by the need to

⁹ „Rilate al *konsonantoj*, la fonetikeco estas pli obeata, almenaŭ ĉe perfekta prononco. Sed ankaŭ tie ĉi, precipe dum rapida parolo, ekzistas diverĝoj: ĉe senpera sinsekvo de konsonantoj voĉa kaj senvoĉa, neevitebla estas la sonkonformiĝo de unu el ili. Tiel oni prononcas proksimume: *absolute* (absolute), *ogdek* (okdek), *egzisti* (ekzisti), *lonktempe* (longtempe), *glafsonoro* (glavsonoro) ktp. Ĉar tiu asimilado de unu konsonanto al la sekvanto (t. n. regresiva) estas konata de tre multaj lingvoj, ĝi estas tolerebla ankaŭ en E-o” (Kalocsay & Waringhien 1935=1985:39-40).

¹⁰ „La ĵus skizita prononcmankon de vokaloj estas iom komplika. Sed ties kaŭzo estas, ke ĝi estas rezulto de libera evoluo. Tiu evoluo, malobeante la regulojn pri la ĉama “meza kaj mezlonga” prononco de la vokaloj, iris siajn proprajn vojojn. Por la hodiaŭa esploranto restis nur konstati la rezultojn” (Kalocsay & Waringhien 1935=1985:43-45).

¹¹ „The feeling that the average speaker has of his language is that it is built up, acoustically speaking, of a comparatively small number of distinct sounds, each of which is rather accurately provided for in the current alphabet by one letter or, in a few cases, by two or more alternative letters. As for the languages of foreigners, he generally feels that, aside from a few striking differences that cannot escape even the uncritical ear, the sounds they use are the same as those he is familiar with but that there is a mysterious “accent” to these foreign languages, a certain unanalyzed phonetic character, apart from the sounds as such, that gives them their air of strangeness. This naïve feeling is largely illusory on both scores. Phonetic analysis convinces one that the number of clearly distinguishable sounds and nuances of sounds that are habitually employed by the speakers of a language is far greater than they themselves recognize” (Sapir 1921:43-44).

¹² See Dols (2009) for an optimality theoretical analysis of the syllable in Esperanto.

decrease articulatory effort, while adherence to lexical distinctness of units is favoured by the need to ensure their matching to their inventory shapes¹³. In Zamenhof's terms we would now be talking about *severa aparteco vs. natura emo* in the pronunciation of consonant clusters. A fair amount of consonant clusters (and thus, a source of conflict) arise from the explicit intention of facilitating the learning of vocabulary. It is in Zamenhof's words that we read how a rich lexical morphology improves the system's economy¹⁴. It is a clear intention to make things easier. However, by doing this with no strategy designed to prevent or repair some clearly marked sound chains, the easy way to learn words can become an obstacle to pronouncing them. It is clear that economy of language cannot always be balanced everywhere: if wordmaking is easy, then some other part of the grammar must pay the price. In this case it turns out to be phonology. The analysis of Zamenhof's texts included in the corpus of Esperanto texts *tekstaro.com* gives the following plosive clusters:

- (2) (Searches on 987,006 words, shaded cells showing clash in voicing, (!) = coincidence between both charts).

		Plosive-final prefixes ¹			
		sub-	post-	apud-	ek-
Root-initial consonant	-p	3(!)	2	0	505
	-b	/	0	0	210
	-t	142 ²	11 ³	0	334
	-d	0	1	3(!) ⁴	75 ⁵
	-k	0	62 ⁶	0	566 ⁷
	-g	/	0	0	13(!)

¹ „prefixes” not used as in the Esperanto grammar.

² including 87 instances of ‘subten...’

³ they all include ‘posttagmez...’

⁴ they all are ‘apuddiga’ from *Fabelo de Andersen*, 3.

⁵ including 45 instances of ‘ekdorm...’

⁶ including 59 instances of ‘postkur...’

⁷ including 353 instances of ‘ekkri...’

¹³ Lombardi's (1999) analysis of voicedness assimilation in obstruent clusters is built on two constraints: „AGREE: Obstruent clusters should agree in voicing” (p.272) and „IDLaryngeal (IDL): Consonants should be faithful to underlying laryngeal specification” (p.270): the hierarchy AGREE >> IDL gives assimilation (precise direction of assimilation depending on other more specific constraints) as a result, while IDL >> AGREE precludes it and sticks to the shape of lexical forms. AGREE belongs to the set of „Markedness” constraints, which militate against articulatory effort, while IDL belong to the set of „Faithfulness” constraints, aiming to preserve the shapes of lexical units.

¹⁴ „I established rules for the formation of new words, and at the same time, reduced to a very small compass the list of words absolutely necessary to be learned, without, however, depriving the language of the means of becoming a rich one. On the contrary, thanks to the possibility of forming from one root-word any number of compounds, expressive of every conceivable shade of idea, I made it the richest of the rich amongst modern tongues. This I accomplished by the introduction of numerous prefixes and suffixes, by whose aid the student is enabled to create new words for himself, without the necessity of having previously to learn them” (Zamenhof 1889=2006).

(3)

Second consonant	First consonant					
		p	b	t	d	k
p	0	3	34	56	531	4
b	3	0	5	8	211	6
t	>1000	179	16	1	>1000	7
d	98	1	8	3	144	14
k	12	4	199	35	611	2
g	1	0	3	1	13	0

There is a certain agreement on the need to avoid *contra natura* consonant clusters inside the word: they are impossible to avoid in prefixation, for Esperanto does not allow epenthesis, but they can trigger the more articulatory-friendly way to add inflectional affixes in compound words. Compare *nigrahara* vs. *nigrokula*, the only reason to alternate a word (*nigra*) with a root (*nigr*) in the first position of the compound being syllabification constraints. After Kalocsay & Waringhien (1985) and Kawasaki (1936-1953), van Oostendorp (1999:77) refers to the rule apparently followed by Zamenhof on this aspect of compounding¹⁵. In fact, the rule is not always adhered to by Zamenhof (at least in written): *ŝtipbatilo* (2), *kapbalancis* (1), *kapdoloro(n)* (5)¹⁶, *ŝipgvidisto* (1), *skribtablo(n)* (14)¹⁷, *skribtabulo* (1), *skribkovrita* (1), *skribkajero* (1), *skribkaraktero* (1), *ŝvitbanejon* (1), *stratbaron* (1), *plektbarilo* (1)¹⁸, *litbenko(n)* (2), *altgrade* (1), *piedprem[...]* (30), *profundpensa(n)* (4), *malgrandpeca(n)* (2), *rapidpieda(j)* (5), *landpeco* (2), *nudpieda(jn)* (4), *posedpreni* (1), *viandpoton* (1), *ludkart[...]* (5), *laŭdkant[...]* (5), *pordkurteno* (1)¹⁹, *mondkorpojn* (1), *vidkapablo* (1), *ŝildknabino* (1), *ludkamarado(n)* (2), *grandkreska[...]* (3), *grandkorpaj* (1), *sidkesto(j)* (1), *sidkusenon* (1), *klakbekon* (1), *flankkurtenoj* (1), *flikkudrita(n)* (2), *vezikkovritan* (1), *rokkrutaĵo* (1), *dikkapaj* (1), *antaŭlongtempan* (1), *longtrunketa* (1).

¹⁵ „oni plurfoje konservas la finaĵojn de la flankelemento. Tio povas okazi el tri motivoj:

- 1) por belsoneco, se la ellaso de la finaĵo estigus malfacile prononceblajn konsonantkarambolojn; ekzemple: *majstroverko*, *arbobranĉo*, *kudromaŝino*. Zamenhof ordinare konservis la finaĵojn, kiam ties forigo okazigus renkonton de nur du konsonantojn, se ilia kunprononco estus iom konfuza – precipe en la du jenaj okazoj:
 - a) kiam la unua estas voĉa kaj la dua senvoĉa (aŭ reciproke): bp (skriboportanta), fb (kaŝobabilan), vf (vivoŝonto, ŝafoviro), dt (ludotablo), bs, vs, ds, zs (pizosilikvoj), zk (rozokolora) ktp.
 - b) kiam la du konsonantoj estas samaj: pp (kapoparto), [bb] (rabobirdo), vv (vivovespero), ss (ĉasoservisto) ktp.” (Kalocsay & Waringhien 1985:419).

¹⁶ Cfr. *kapoklinon* (1)

¹⁷ Cfr. *skribotablo* (3)

¹⁸ but *plektobariloj* (2).

¹⁹ but *pordokurteno(n)* (6).

In all these examples there is consonantal contact placing together either equal stops or stops with different voicing, although an alternative existed by means of a first-element ending. Also, among these examples, sonority sequencing has been violated at least once (*plektbarilo*), and there are complex rhymes not aligned with the word end (*profundpensa, malgrandpeca, landpeco, viandpoton, pordkurteno, mondkorpoj, ŝildknabino, grandkreska, grandkorpaj, antaŭlongtempan, longtrunketa*). It is not that this type of sequence is forbidden worldwide: the point is that they are possible, but marked. If „belsoneco” as in Kalocsay & Waringhien stands for anything in objective terms, it should be phonological markedness.

The use of morphemes in compound words (in all words, in fact), seems to be limited by a principle of economy: something like “save your morphemes”. However, when stated in absolute terms, the principle is needs be a violable one. The limit to this violability is the attainment of a sufficient degree of explicitness. Stated in this way, the system is typically a problem of optimality, and, interestingly enough, it is the way it appears in the Esperanto grammar tradition. *Principo de neceso* and *principo de sufiĉo* seem to stand on equal terms with optimality-oriented constraints REALIZE-MORPHEME and *STRUC²⁰:

- (4) REALIZE-MORPHEME (RM): Let α be a morphological form, β be a morpho-syntactic category, and $F(\alpha)$ be the phonological form from which $F(\alpha+\beta)$ is derived to express a morphosyntactic category β . Then RM is satisfied with respect to β iff $F(\alpha+\beta) \neq F(\alpha)$ phonologically” (Kurusu 2001:39).
- (5) *STRUC: Structure is constructed minimally (Prince & Smolensky 1993=2002:25).

Let us now examine the *neceso* and *sufiĉo* constraints:

- (6) „*Principo de neceso*. Por konstrui vorton kunmetitan, oni kunigas ĉiujn vortojn simplajn, kiuj estas *necesaj* por klare elvoki la ideon esprimotan de tiu kunmetita vorto (sen aŭ kun helpo de kunteksto).
Principo de sufiĉo. En la vorto konstruata oni devas eviti la *neutilajn* pleonasmojn kaj la ideojn *fremdajn* je la ideo esprimota” (Saussure 1905=2003:12).

But what are *vortoj*? Nude stems? Stems plus a categorising affix? The report of *Akademio de Esperanto* on word compounding concluded with a similar set of constraints, now applying not to „simple words”, but to „elements”:

²⁰ See Russell (1997) and de Lacy (1999) for a similar use of *STRUC. Alternatively, MAX-M(F) and DEP-M(F) as stated in McCarthy (2011) (after Wolf 2008) could do the job, at the price of proposing inputs like /[skrib]+[tabl]+[o]/ instead of /[skrib+o]+[tabl+o]/. If the input is [[/skrib+/o]/[tabl+/o/]], *STRUC can be replaced by an alignment constraint punishing inflectional affixes in the middle of the word. See below.

- (7) „En la konstruo de la vorto oni devas enkonduki ĉiujn elementojn, kiuj necesas, sed ne pli ol kiom sufiĉas, por elvoki klare kaj plene la ideon reprezentotan” (*Akademio de Esperanto*, 1965).

If we compare two possible forms of a compound word on a constraint evaluation tableau with *neceso* (REALIZE-MORPHEME) and *sufiĉo* (*STRUC) not ranked, we get no selection:

(8)

/[skrib+o][tabl+o]/	RM	*STRUC
<i>skribtablo</i>	*	
<i>skribotablo</i>		*1

¹ Only exceeding segments in comparison with the other candidates.

This analysis takes into account that there are two categorising morphemes (*finajoj*) for one word. Somehow, the input representation recalls a postlexical cycle, as if the rules of the game were derivational. However, *nigrahara* and the like show that the first [o] in *skribotablo* is not just epenthetic, and that /skrib+tabl+o/ is a problematic input. If the problem is stated in terms of allomorphy, the exact form (and function) of the inflectional affix would depend on context and we would end up with lexical entries like /skrib+{o>Ø}/_N, /skrib+{a>Ø}/_{Adj}, /skrib+{i>Ø}/_V²¹ which, in the case of Esperanto, seem to challenge the economy of the system.

If the input is /[skrib+o][tabl+o]/, *STRUC can be replaced by a more specific alignment constraint penalising inflectional affixes in the middle of the word. The system prefers them to appear at the right of a stem:

(9) ALIGN (INFLECT, L, STEM, R)

Every inflectional affix must stand at the right of a stem.

(Remember that a stem may contain more than one root).

And if OCP can apply not only to segments but also to morphemes, and the need for adjacency is replaced by a distance gradient in the evaluation of candidates producing identical morphemes, then OCP as in Yip (1998)²² can rule out **bonfartoo* and penalise up to some point **skribotablo*. In this case, Kalocsay’s (1931) analysis of *-o* ending as a third element when added to an already formed double root would be prevented from emerging with a double *-o* ending: /[bon+fart]+o/ → *bonfarto*, **bonfartoo*²³. It is

²¹ See Bonet (2004).

²² „OCP: Output must not contain two identical elements” (Yip 1998:5).

²³ *metroo* is a different case: OCP is only offended in *metroo sub specie* OCP(SEG), but not in the relevant version for the cases under study here, a version that can be stated as

not our aim to revise the full system of word compounding in Esperanto here, we shall now stick to the Align constraint, which seems a more intuitive tool for a case at the interface between phonology and morphology.

If the observation by Kawasaki, and Kalocsay & Waringhien is to be followed as a rule, then the reason to choose *skribotablo* is the relative low ranking of ALIGN-IS compared to that of the constraint in charge of preventing agreement in voice:

(10)²⁴

/[skrib+o][tabl+o]/	AGREE	ALIGN-IS	RM
☞ <i>skribotablo</i>		1	
<i>skribtablo</i>	₁ W	₀ L	₁ W

In the absence of AGREE violations, constraint ranking predicts preference for uninterrupted lexical compounds, as in *skribmaŝino*.

Without leaving Kalocsay & Waringhien's observation, there still remain two „belsoneca” (markedness) requirements to be met: the ruling out of complex consonant clusters (**majstrverko*, **kudрмаŝino*) and the ruling out of couples of identical consonants (**kapparto*, **ĉasservisto*). The former are outranked by candidates observing the right sonority sequencing²⁵, and the latter by those not violating OCP[seg]²⁶.

- (11) SONORITY SEQUENCING GENERALIZATION: sonority rises during the onset and falls over the rhyme (Goldsmith 2009:13).
- (12) OBLIGATORY CONTOUR PRINCIPLE: at the melodic level, adjacent identical elements are prohibited (McCarthy 1986:208).

OCP(Morpheme=categorising affix). Although Kalocsay considers this type of compound a case of three lexical elements, the independent o-ending still plays its original role, and it certainly has no function other than asserting that the whole compound is a substantive.

²⁴ Tableaux conventions as in Prince (2002).

²⁵ Esperanto allows only vowels in the syllable nucleus: „In the rhyme, vowels are the only possible governing elements; sonorant consonants and glides the only possible governees” (van Oostendorp 1999:70). Therefore *majs.tr.ver.ko* is not an acceptable syllabification.

²⁶ See van Oostendorp for a detailed and sound analysis of sonority and syllabification in Esperanto.

(13) Evaluation tableau for morpheme elision according to Kalocsay & Waringhien's condition 1

	AGREE	SSG	OCP[seg]	ALIGN-IS	RM
☞ skribmaŝino					1
skribomaŝino				₁ W	₀ L
☞ kudromaŝino				1	
kudromaŝino		₁ W		₀ L	₁ W
☞ kapoparto				1	
kapparto			₁ W	₀ L	₁ W
☞ skribotablo				1	
skribotablo	₁ W			L	₁ W

As can be seen in (13) when the contest is between two constraints pro and contra the emergence (ALIGN-IS and RM) of the ending of the first element, the system would prefer its absence for the sake of economy or positional congruence. However, when these criteria would force the violation of prosodic constraints, the first final /o/ appears.

If Kalocsay & Waringhien's observations are to be followed further, two more aspects (2 and 3 in their list) should be borne in mind:

- (14) a. For reasons of clarity in case the side element would result difficult to recognise (*diosimila*, *luodomo*)
 b. If the meaning of the compound would be ambiguous (*feokanto*, *konkoludo*)²⁷.

Despite the fact that in the first category *ludomo* might be split as in *lud-om* (a bizarre analysis, in any case), or understood as a haplologic (and illegal) pronunciation of *ludo-domo*, and *diosimila* might be processed as *dis-simila* (?), it seems that "clarity reasons" point at the length of both first elements. If this interpretation is accepted, then the key constraint should be an instantiation of MINIMALWORD (McCarthy & Prince 1990, Prince & Smolensky 1993), either adapted to first elements in compound words or to all words (clitics, pronouns, prepositions and the like not contemplated)²⁸.

Ambiguity can be ruled out by the action of a constraint requiring underlying contrasts to be preserved in the output. Stated thus, attention turns towards Correspondence

²⁷ "2) por klareco, se la flankemento estus malfacile rekonebla en senfinaĵa formo; ekzemple: *diosimila*, *luodomo*; 3) se la kunmeto ŝajnus havi alian sencon; ekzemple: *feokanto* (*fe-kanto*); *konkoludo* (*konkludo*); *viro-temo*: *virtemo*; *inoformo*: *informo*" (Kalocsay & Waringhien 1985:419)."

²⁸ A better option would be to apply minimality not in the usual foot-parsing way, but directly on words, as in Garrett (1999).

Theory (McCarthy & Prince 1995). However, the constraint best suited in this case, MORPHEME_{DISJOINTNESS}²⁹, seems to be put in action mainly to discard haplology and other cases of coalescence of concomitant morphemes. PRESERVE_{CONTRAST}, proposed in Łubowicz (2003),³⁰ seems to better fit our needs, especially as used in Ketner (2006).

- (15) BE(VX)_{LONG}
Words must be longer than VX (where X is any segmental sequence)
(after Garrett 1999)³¹.

- (16) PRESERVE_{CONTRAST}
„PCIN(P)

For each pair of inputs contrasting in P that map onto the same output in a scenario, assign a violation mark. Formally, assign one mark for every pair of inputs, in_a and in_b , if in_a has P and in_b lacks P, $in_a \rightarrow out_k$, and $in_b \rightarrow out_k$ (Łubowicz 2003:18)³².

- (17) Evaluation tableau for morpheme elision and preservation according to Kalocsay & Waringhien conditions 2 and 3

	BE(VX) _{LONG}	PRESERVE _{CONTRAST}	ALIGN-IS	RM
☞ [dio][simila]			1	
[di][simila]	₁ W		₀ L	₁ W
☞ [konko][ludo]			1	
[konk][ludo]		₁ W	₀ L	₁ W

For vowel final roots adding an -o ending to surface as nouns (*firmao*, *metroo*, *teo*, *dio*, *ŝuo*), the constraint ranking should contemplate the behaviour of onsetless syllables in this morphological environment: other things being equal, *firmadungita* is better than *firmaodungita*³³ because of the onsetless syllable in the latter, and even

²⁹ “Distinct instances of morphemes have distinct contents, tokenwise” (McCarthy & Prince 1995:62).

³⁰ “PCIN(P). For each pair of inputs contrasting in P that map onto the same output in a scenario, assign a violation mark. Formally, assign one mark for every pair of inputs, in_a and in_b , if in_a has P and in_b lacks P, $in_a \rightarrow out_k$, and $in_b \rightarrow out_k$

“If inputs are distinct in P, they need to remain distinct.”” (Łubowicz 2003:18).

³¹ V.V, CV.V, CVC, ... > VX, but C(C)V is not because it has nothing following V.

³² Clearly used for a purpose as ours in Ketner (2006:52): „Deletion is blocked when the morpheme would be pared down to such an extent that distinctive meaning is lost. This morphological preservation is represented here with the constraint PRESERVE_{CONTRAST}”

³³ As in „En februaro 2008 la firmao aĉetis modelon de 2005 Cirrus SR20 lumon unu-motora-jn piŝtaviadilojn por esti utiligita kiel firmadungita flugadoklubo aviadilo” („Historio de Eklipso-Aviado”, http://epo.wikitrans.net/History_of_Eclipse_Aviation, visited 6th Oct 2012), and „kiam

ONS³⁴ should be expected to conspire with *STRUC to outrule the -o ending. However, the real fact is that both solutions are possible. And the same can be said when the problem doubles: both *scioarbo* and *sciarbo*³⁵. The point is not a special status of ONS, but a given level of blurry competence that opens the door to hesitation in the phonological assembling of compounds. It is not only that Esperanto-speaking communities around the world have broken up into multiple dialects: the fact is that the same speaker hesitates at adding the ending to the first element in compounds. It seems to be a case of a partially unordered set of constraints, or, to better match probability theory terms, a case study for Stochastic Optimality Theory (Boersma 1997, Boersma & Hayes 2001). In this model constraints are not ordered in absolute terms, but on a scale, and they receive a value used to measure the distance between them. The real distance between two constraints is allowed to vary according to a level of „noise” every time the set of candidates is evaluated: if two constraints are five points away, v. gr. their values (mean) are 100 for constraint A and 105 for constraint B and the value for noise (standard deviation) is 2, then the two constraints can meet and the originally lower constraint may even overtake the previously dominant one. Reversion is possible because the constraint values vary on a range (variance) that equals the square of the standard deviation (4). As an example, we shall give the constraints in tableau (12) the following values:

(18)

AGREE	105
SSG	105
OCP	105
ALIGN-IS	100
RM	95

and set the level of noise at 2.0. Using the program Praat, one million evaluations would give the following results (for the sake of evaluation, the results of two different evaluations are given):

ili estas elspuritaj de la firmaodungita murdisto Wyatt, Sara eskapas kun Mikaelo” (Sara Tancredi: http://epo.wikitrans.net/Sara_Tancredi, 6th Oct 2012).

³⁴ „ONSET. A syllable must have an onset” (Prince & Smolensky 1993=2002:93”.

³⁵ And infact they do: „Pentraĵo reprezentanta la biblian miton de la Scioarbo” (Scio: <http://eo.wikipedia.org/wiki/Scio>, 6th Oct 2012), „Similaj mitoj ekzistas en aliaj kulturoj priskribante la kreadon de multoblaj lingvoj kiel agon de dio, kiel ekzemple la detruo de „sciarbo” de Bramo” (http://epo.wikitrans.net/Universal_language, 6th Oct 2012).

(19) Results of the first 1,000,000 evaluations of 4 inputs with 2 candidates each by a constraint ranking as in (18)

Input	Output	Evaluation #1	Evaluation #2
/[skrib+o][maŝin+o]/	skribmaŝino	962,425	961,244
	skribomaŝino	37,575	38,756
/[kudr+o][maŝin+o]/	kudromaŝino	961,282	961,555
	kudrmaŝino	38,718	38,445
/[kap+o][part+o]/	kapoparto	961,449	961,590
	kapparto	38,551	38,410
/[skrib+o][tabl+o]/	skribotablo	961,558	961,364
	skribtablo	38,442	38,636

A sound statistical knowledge of variation would give the key to adjusting the constraint and noise values and, therefore, would provide us with a closer predictive model. If our aim is to comprehend the internal functioning of phonology up to the point where we are able to reproduce it, then variation must have a role in the play. If real life speakers' productions show a given level of variation, then that level of variation must show also in our grammar's results. Phonology is about predicting the way in which the smallest units of grammar behave. When that behaviour is not completely regular, then the model must allow a range of random functioning within the limits of the probabilities observed in the speaker's usage of the system.

Perhaps the sounds „will take care of themselves”, but even when they behave with freedom, limits do exist, and the search for those limits is the linguist's job... if they have not been prescribed by the language designer.

3. Conclusions and further considerations

Esperanto shows cases of variation and free variation (optionality). The natural evolution of a language tends towards dispersion. It is by means of language planning that variability can be kept under control. Classic approaches to language planning have called „codification” (Haugen 1966, Neustupny 1970) or „standardisation” (Ferguson 1972) the stage at which general norms of linguistic correctness are proposed in order to overcome the risk of disintegration. Language planning has been seen as a part of a more general process of modernisation, that „merely implies both the widespread sharing of a new supra-local membership and identity and a geometric increase in (easily bridged) infra-local memberships and identities” (Fishman 1973:32-33). In the age of secondary orality (Ong 1977, 1982), the same effort that once gave us a language meant to connect people across borders might be exerted in the field of sounds.

Phonological theories and applications provide us with powerful tools to comprehend and predict the functioning of languages and their free variations. Further points of interest are the comparison with natural languages on the same grounds and the process of decision making on restricting or respecting variation from a language planning perspective.

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