Putting ‘commas’ at the right place: A note on crucial non-ranking in OT[*]

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Abstract

Two conceptions of crucial non-ranking have been proposed in the literature: i) one that produces variation (Anttila 1997) and ii) that of equal ranking (Crowhurst 2001, Crowhurst and Michael 2005, Topintzi 2005, Rice in press). I show that the former is erroneous in that it predicts unattested variation or fails to account for certain cases altogether. It is also unnecessary since it can be subsumed by the Gradual Learning Algorithm (Boersma and Hayes 2001). I thus conclude that a single notion of crucial non-ranking exists, that of equal ranking. Since alternatives such as constraint conjunction cannot replace equal ranking, I argue that it must be recognised as a genuinely distinct ranking relationship.

1 Introduction

Optimality Theoretic grammars have been long making use of the ‘comma’ in constraint rankings. So the notation C_1, C_2, where C_1 and C_2 are constraints, is taken to indicate a tie between the constraints C_1 and C_2. It is however less clear how exactly this tie is construed. Some discussion on constraint ties has appeared in works such as Anttila (1997), Tesar and Smolensky (1998) and for syntax in Müller (2001). The more common understanding of the ‘comma’ in rankings is either that of an undetermined ranking where C_1 and C_2 are placed next to each other because there is no evidence for a particular ranking between them (non-crucial non-ranking; Prince and Smolensky 1993/2004) or of a crucial non-ranking in the sense of Anttila (1997)[1]. The latter sees C_1, C_2 as the case of a single grammar that corresponds to two tableaux $C_1 >> C_2$ and $C_2 >> C_1$. As we will see later on, this idea has been utilized as one of the ways to model variation.

There is however another understanding of crucial non-ranking dubbed co-ranking (Crowhurst 2001, Crowhurst and Michael 2005) or equal ranking (Topintzi 2005, Rice

[1] Crucial non-ranking is recognised as a possibility in Prince and Smolensky (1993: 55), but it is not explored.

in press). In what follows, I will refer to this type of ranking as *equal ranking*. The idea here is that *C_1, C_2* does not generate two tableaux where either C_1 >> C_2 or C_2 >> C_1 occurs, but rather that both constraints are simultaneously evaluated so that it is crucial that C_1 and C_2 are located in the same position in the ranking. This instance of crucial non-ranking has been developed in analyses of Toba Batak *um*-infixation (Crowhurst 2001), Nanti stress (Crowhurst and Michael 2005) and independently for Arabela stress (Topintzi 2005) and gender assignment (Rice in press).

The current paper aims at discussing these two notions of crucial non-ranking and shows that their predictions are quite different. In the case of crucially non-ranked (henceforth ***CNR***) constraints arising in variation, *C_1, C_2* implies both C_1 >> C_2 and C_2 >> C_1. In contrast, CNR constraints in equal ranking present a real case of a 'comma'. This means that all constraints have to be simultaneously evaluated without any assumption that sometimes C_1 >> C_2 and sometimes C_2 >> C_1 holds. The implication here is that violations of all equally ranked constraints are added and thus are acting as if they were the violations of one constraint. This point will become clearer when we consider Arabela stress shift under equal ranking.

Superficially, it seems as if we need both notions of crucial non-ranking. However, I will attempt to show that while we can dispense with VARIATION CNRs (henceforth ***V-CNRs***), the same is not possible for EQUALLY-RANKED CNRs (henceforth ***E-CNRs***)[2]. I will thus tentatively suggest the elimination of V-CNRs. I argue that there is just one notion of crucial non-ranking and this involves equal ranking. On a more speculative level, it seems that equal ranking is compatible with non-crucial non-ranking. That is, we should be able to construe cases where constraints are separated by a 'comma' without implications for variation, as instances of equal ranking with no apparent negative consequences. All this suggests that the real 'comma' in OT has a single interpretation, that of equal ranking.

I begin the exploration of this issue by examining the way the two CNR approaches differ in a more abstract way. I then provide empirical arguments from Anttila (1997) for the existence of CNR constraints that yield variation in Finnish genitives. Next I consider data from Arabela stress shift which corroborate the existence of equal ranking. Subsequently, I provide arguments against the use of V-CNRs, while I simultaneously show that E-CNRs are not only indispensable, but also compatible with other conceptions of the comma. Having discarded V-CNRs, I focus on equal ranking, which intuitively involves the combined interaction of two or more constraints. As such, equal ranking seems to resemble local conjunction, a mechanism that is not without problems, but still has proven influential in recent years. I show that

[2] Anticipating the clarification of these terms below, 'V/E-CNR(s)' refers to the two types of crucially non-ranked constraints, i.e. VARIATION/EQUALLY RANKED constraints or to the situation that corresponds to them.

local conjunction cannot subsume equal ranking either, therefore this conception of ranking is a genuine one that needs to be theoretically acknowledged.

2 Crucially non-ranked constraints: the basics

Consider a grammar with three constraints C_1, C_2 and C_3 and where $C_1 >> C_3$ and $C_2 >> C_3$. There is no ranking argument between C_1 and C_2, therefore we can assume that these are separated by a comma as shown in (1). One possible way to understand this comma is that there is a single grammar that corresponds to two tableaux as shown in (2).

(1) Grammar considered: $C_1, C_2 >> C_3$

(2) i) Tableau 1: $C_1 >> C_2 >> C_3$

	C_1	C_2	C_3
☞ a. $cand_1$		*	*
b. $cand_2$	*!		

ii) Tableau 2: $C_2 >> C_1 >> C_3$

	C_2	C_1	C_3
a. $cand_1$	*!		*
☞ b. $cand_2$		*	

The first tableau renders (a) as the winner due to $C_1 >> C_2$, while the second tableau has the opposite effect proclaiming (b) as the winner, because of $C_2 >> C_1$. C_3's violations are effectively inactive, since the higher-ranked constraints have selected the winner.

But this is not the only possible understanding of the 'comma'. We could conceptualize the grammar in (1) as indicating that violations of both C_1 and C_2 are simultaneously counted. Tableau (3) illustrates. To distinguish this case from the more standard use of the 'comma', I will use the symbol of equality in rankings and the wavy line in tableaux.

(3) $C_1 = C_2 >> C_3$

	C_1	C_2	C_3
a. $cand_1$		*	*!
☞ b. $cand_2$	*		

Here C_1 and C_2 are simultaneously evaluated. Each incurs one violation, so they tie. No assumption about $C_1 >> C_2$ or $C_2 >> C_1$ holds, thus the decision is passed onto C_3, which favours (b) as the winning candidate.

One major difference of the two notions of CNR constraints is that the former, presented in (2), generates two outputs. We call this kind of constraints "V-CNRs". In contrast, (3) produces a single optimal output. This is what we call "E-CNRs".

It is however possible to produce variation in equal ranking too. Imagine a case where all candidates save two are excluded by a high-ranking constraint C_1. C_2 and C_3 are equally ranked. The former constraint penalises $Cand_2$, whereas the latter penalises $Cand_1$. Since there are no other constraints involved, both candidates should be expected to be optimal. This would look like (4) does. For real-life examples of this type, see for instance tableau (69) on Barasana (Yip 2002: 249) or tableaux (22) and (23) on Estonian (Kager 1996; tableaux as numbered in the electronic version).

(4) $C_1 >> C_2 = C_3$

	C_1	C_2	C_3
☞ a. $cand_1$			*
☞ b. $cand_2$		*	

Such variation is of course only possible when violations of (a) and (b) with respect to the CNR constraints are the same. Had (b) incurred instead two violations of C_2, then (a) would win.

(5) $C_1 >> C_2 = C_3$

	C_1	C_2	C_3
☞ a. $cand_1$			*
b. $cand_2$		**!	

Having introduced the basic way the two types of CNR constraints work, we can proceed into looking how each of them is used in Finnish (V-CNRs) and in Arabela (E-CNRs).

3 Finnish genitives

First a necessary preamble: I will only briefly mention the basic facts about genitive plurals in Finnish. As data are very complex and their analysis would require considerable space, the reader is referred to Anttila (1997) for a full exploration. For current purposes it will merely suffice to present some relevant facts and show how variation emerges in an abstract notation.

On the core of it, genitive plurals either take the Strong (6) or the Weak form (7).

(6) *Strong form:* heavy penult (CVV, CVVC), final syllable onset /t, d/

/puu/	'tree'	**púi.d**en
/potilas/	'patient'	pó.ti.**lai.d**en

(7) *Weak form*: light penult (CV), final syllable onset /j/ or absent

/kala/	'fish'	ká.**lo.j**en
/margariini/	'margarine'	már.ga.rii.**ni**.en

Monosyllabic stems, as well as those whose stem final syllable is underlyingly heavy always take the strong variant. In contrast, all disyllabic stems and most stems with an even number of syllables take the weak form. The interesting facts for our purposes occur with trisyllabic or some longer stems. There, both variants are possible as shown in (8).

(8) *Variation*: stems ≥ 3 syllables emerge with either the Strong or Weak form

		Strong		Weak
/naapuri/	'neighbor'	naa.pu.**rei.d**en	~	naa.pu.**ri.**en
/Reagani/	'Reagan'	Rea.ga.**nei.d**en	~	Rea.ga.**ni**.en
/moskeija/	'mosque'	mos.kei.**joi.d**en	~	mos.kei.**jo.j**en
/ministeri/	'minister'	mi.nis.te.**rei.d**en	~	mi.nis.te.**ri**.en

Anttila shows that this variation is not entirely free. Unlike monosyllabic stems, longer stems are sensitive to the quality of the final stem vowel, so that stems ending in high vowels /i, u, y/ prefer the weak variant, those with low vowels /a, ä/ prefer the strong variant, whereas mid vowels /o, ö/ are compatible with both forms. Moreover, there is a preference that the weight of the antepenult and penult in the genitives alternate, i.e. …HLσ# or LHσ#.

Anttila's explanation of this variation is that some of the constraints active in Finnish phonology are crucially non-ranked. The important point for us is the following. In all the cases that show variation, the constraints that determine the outcome are the CNR ones. But depending on the particular ranking chosen each time, one of the two attested outputs is produced. The following example illustrates this point exactly by considering all possible permutations, i.e. 6, of three CNR constraints. To simplify things, I abbreviate the constraints Anttila uses as C_1, C_2 and C_3 and the relevant candidates as WEAK and STRONG (see Anttila's tableau (51), ROA-63 version for comparison).

(9) Partial grammar: $C_n >> C_1, C_2, C_3 >> C_m$ under *V-CNRs*

i) Tableau 1: $C_1 >> C_2 >> C_3$

	C_n	C_1	C_2	C_3	C_m
a. STRONG		*!	*		
☞ b. WEAK				*	

ii) Tableau 2: $C_3 >> C_1 >> C_2$

	C_n	C_3	C_1	C_2	C_m
☞ a. STRONG			*	*	
b. WEAK		*!			

It is unnecessary to draw the remaining four tableaux; given that (a) violates C_1 and C_2, while (b) only violates C_3, we can infer that the only other case (apart from (9ii) that is) where the STRONG form is the winner is when $C_3 >> C_2 >> C_1$. This means that 4/6 tableaux produce the WEAK form, while the remaining 2/6 favour the STRONG pattern. Anttila observes that this distribution based on the outputs of the tableaux closely matches the actual occurrence of patterns since 63.1% of the genitives surface with the WEAK form, whereas 36.9% present the STRONG variant.

Now consider the same pattern under an equal ranking conception of CNR constraints. This would look like (10) does.

(10) Partial grammar: $C_n >> C_1 = C_2 = C_3 >> C_m$ under *E-CNRs*

	C_n	C_1	C_2	C_3	C_m
a. STRONG		*	*!		
☞ b. WEAK				*	

Since all it matters here is the total violations (after mark cancellation) each candidate incurs, then (a) produces one extra violation of the CNR constraints compared to (b). As a result, (b) will unambiguously and consistently be the winner. Since this misses the variation pattern altogether, there seems to be evidence that the use of V-CNRs is - at least superficially - required. This claim however will be questioned in section 5, but before doing so, let us see why E-CNRs are also needed.

4 Arabela stress shift

Arabela generally presents a rhythmic stress pattern of left-to-right syllabic trochees and allows degenerate monosyllabic feet. The rightmost stress is the primary one [data from Payne and Rich 1988].

(11) a. tènakári 'afternoon'
b. sàmarú 'spirit'
c. hùwahàniyá 'peaceful

In a very specific environment shift of the final stress occurs and moves to the penult.

(12) a. nòwaʃìʃáno *nòwaʃìʃanó 'brightened'
b. sàpohòsáno *sàpohòsanó 'deceived'
c. mwèratìtyénu *mwèratìtyenú 'cause to be seen'

According to Payne and Rich (1988), the description for stress shift is the following: "when the word-final syllable that would have received stress has a *voiced* onset, and the immediately preceding syllable has a *voiceless* onset, then the syllable with the *voiceless* onset is stressed" [emphasis added mine; NT][3]. An analysis along the lines of Topintzi (2005), but not an identical one, attributes stress shift to the fact that voiceless onsets carry moras - indicated by a superscript mora next to the onset consonant that bears it - while voiced ones (including sonorants) do not. At the same time, the W(eight)-(to)-S(tress)-P(rinciple) is quite high-ranked in the language; therefore syllables with voiceless onsets must be stressed. This is not the end of the story though; there is a strong requirement that feet align to the right edge of the word (ALL-FT-R). It is this antagonistic relationship between WSP and ALL-FT-R - reflected in their equal ranking - which sometimes leads to ties between candidates. This means that the evaluation continues and is passed on to the lower-ranked ALL-FT-L which determines the winning output. To see how this works, first consider what happens in stress shift. This is the case that includes a stress-attracting onset in the penult.

(13) Stress shift[4]:
ALL-FT-R = WSP >>ALL-FT-L

[3] Another - possibly better - description of this phenomenon involves reference to sonorant onsets (instead of Payne's and Rich's *voiced*) vs. obstruent onsets (instead of *voiceless* ones). This point is tangential to the issue examined here. For some discussion see Topintzi (2005).

[4] It also holds that PARSE-σ >> ALL-FT-R so that all syllables are parsed into feet, even if this causes worse alignment to the right word-edge.

			ALL-FT-R	WSP	ALL-FT-L
	a.	(nòwa)(ʃ$^{\mu}$ìʃ$^{\mu}$a)(nó)	**** (4)	*	******! (6)
☞	b.	(nòwa)(ʃ$^{\mu}$ì)(ʃ$^{\mu}$áno)	***** (5)		***** (5)

Here, the total number of violations of the equally ranked ALL-FT-R and WSP is the same. The candidates at this point tie, but lower-ranked ALL-FT-L selects the stress-shifted candidate as it presents fewer violations by moving stress a bit further to the left. In contrast, shift fails to occur when the penultimate onset is of the non-stress-attracting type as in (14).

(14) No stress shift[5]
ALL-FT-R = WSP >> ALL-FT-L

			ALL-FT-R	WSP	ALL-FT-L
☞	a.	(s$^{\mu}$àk$^{\mu}$a)(màna)(h$^{\mu}$á)	**** (4)	*	****** (6)
	b.	(s$^{\mu}$à)(k$^{\mu}$àma)(nà)(h$^{\mu}$á)	******!* (7)		******** (8)

The balancing effect that WSP previously exerted is no longer sufficient. (14b), the candidate which not only presents stress shift, but also manages to stress all the syllables with moraic onsets, may satisfy WSP perfectly, but in doing so, it creates extra feet and thus produces massive violations of ALL-FT-R. As a result, the rhythmic candidate is preferred[6].

It should be obvious what the problem now would be had we attempted to understand these data under a V-CNR approach. We would predict variation between the rhythmic and stress-shifted pattern although this does not occur. The truth is that in Arabela, we either get stress shift only or rhythmic stress only, but not both.

To be absolutely certain that equal ranking is really the solution to the problem, we also need to show that apart from the absence of variation in Arabela and thus failure of V-CNRs, it is also the case that no other strict ranking would yield the correct

[5] I am not considering candidates such as (s$^{\mu}$à)(k$^{\mu}$à)(màna)(h$^{\mu}$á) or (s$^{\mu}$à)(k$^{\mu}$àma)(náh$^{\mu}$a), since both fare worse than (14b) and (14a) respectively.

[6] For the full range of patterns and all the combinations see Topintzi (2005). In case the reader wonders whether it is possible to get the rhythmic pattern due to the action of ALL-FT-L (in parallel to the stress shifted pattern in (13)), this occurs too, as shown below.

			ALL-FT-R	WSP	ALL-FT-L
☞	a.	(kòko)(táka)	** (2)	**	** (2)
	b.	(kòko)(tà)(ká)	*** (3)	*	*****! (5)

results. That is, neither ALL-FT-R **>>** WSP >> ALL-FT-L nor WSP >> ALL-FT-R >> ALL-FT-L can work. To prove that, we only need present a case where adopting ALL-FT-R >> WSP >> ALL-FT-L generates the incorrect result, and then do the same for WSP >> ALL-FT-R >> ALL-FT-L. In both instances, it is demonstrated that use of equal ranking settles apparent inconsistencies.

If ALL-FT-R **>>** WSP >> ALL-FT-L (15i) then we can no longer produce the stress shifted pattern. This is because all it matters now is to satisfy ALL-FT-R in the best possible way. Thus (15i.a) is the obvious wrong winner [indicated by 💣]. As shown before, equal ranking gets rid of this discrepancy and correctly picks out (15ii.b) as the winner.

(15) i) ALL-FT-R **>>** WSP >> ALL-FT-L ---- wrong winner

		ALL-FT-R	WSP	ALL-FT-L
💣	a. (nòwa)(ʃìʃa)(nó)	**** (4)	*	****** (6)
☞	b. (nòwa)(ʃì)(ʃáno)	*****! (5)		***** (5)

ii) *equal ranking*: ALL-FT-R = WSP >>ALL-FT-L ---- correct winner

		ALL-FT-R	WSP	ALL-FT-L
	a. (nòwa)(ʃìʃa)(nó)	**** (4)	*	******! (6)
☞	b. (nòwa)(ʃì)(ʃáno)	***** (5)		***** (5)

The same effect arises in the opposite situation. Satisfying WSP is possible, but at a huge cost, namely of a candidate with massive right-foot misalignment. But due to strict domination, if WSP >> ALL-FT-R then this is what we would expect. Nonetheless, the data point us to a different direction, which can only be captured through equal ranking.

(16) i) WSP >> ALL-FT-R >> ALL-FT-L ---- wrong winner

		WSP	ALL-FT-R	ALL-FT-L
☞	a. (s$^{\mu}$àk$^{\mu}$a)(màna)(h$^{\mu}$á)	*!	**** (4)	****** (6)
💣	b. (s$^{\mu}$à)(k$^{\mu}$àma)(nà)(h$^{\mu}$á)		******* (7)	******** (8)

ii) *equal ranking*: ALL-FT-R = WSP >> ALL-FT-L ---- correct winner

		ALL-FT-R	WSP	ALL-FT-L
☞	a. (s$^{\mu}$àk$^{\mu}$a)(màna)(h$^{\mu}$á)	**** (4)	*	****** (6)
	b. (s$^{\mu}$à)(k$^{\mu}$àma)(nà)(h$^{\mu}$á)	******!* (7)		******** (8)

We have thus shown that there is evidence suggesting that equal ranking is indispensable. The problem now is that by accepting two notions of the ‘comma’, we are creating a much powerful system which can lead to over-generation and unrestrictiveness. It is also conceptually undesirable. Suppose there is just one ‘comma’, but this corresponds to two different mechanisms as shown above. How do speakers know how to interpret the ‘comma’? Is it about variation or equal ranking (let alone a third possibility, that of non-crucial non-ranking which we have left out of the discussion)? Alternatively, we can claim that these ranking relationships, namely V-CNRs and E-CNRs, are indeed distinct and independent of one another. But this, as mentioned above, adds more power to the system. One way or another, admitting two types of CNRs also predicts that these should interact with one another, e.g. as in $C_1 >> C_2 = C_3, C_4 >> C_5$ or in more complex ways. I have not found any evidence suggesting such an interaction.

In what follows, I attempt to show that there is at least some evidence, empirical and theoretical, indicating that we can give up V-CNRs, whereas E-CNRs are indeed indispensable.

5 Dispensing with V-CNRs

This section advocates that it is plausible and indeed theoretically possible to dispense with V-CNRs à la Anttila. This suggestion hinges on two major arguments. The first is that not all constraints that are separated by a comma can be interpreted as V-CNRs. Doing so can produce unwelcome results. Secondly, Hayes’ and Boersma’s gradual learning algorithm (GLA; Boersma and Hayes 2001) can account for several cases including the Finnish variation in genitives without making use of the re-ranking mechanism Anttila uses. If the GLA is indeed successful in replacing Anttila’s model, then we can probably make do without V-CNRs.

5.1 Instances where V-CNRs are undesirable

The first empirical argument against CNR variation comes from Arabela examined in section 4. There we had seen that interpreting the ‘comma’ as variable ranking fails to account for the facts properly. This then implies either that indeed there are two conceptions of crucial non-ranking or that one of them is misguided. I will try to pursue the second option.

As a start, consider cases of undetermined ranking between constraints. In most instances[7], only one of the candidates manages to satisfy all of the constraints separated by commas, and thus is the rightful winner. Schematically this looks like:

(17) Undetermined ranking: $C_1, C_2, C_3, C_4 >> C_5$

	C_1	C_2	C_3	C_4	C_5
a. $cand_1$	*!				*
b. $cand_2$		*!			
c. $cand_3$			*!		
d. $cand_4$				*!	
☞ e. $cand_5$					*

In these instances, no ranking argument can be formed between the constraints, other than that they need to dominate C_5. An approach that sees 'comma' as CNR variation has no trouble in accounting for these cases. It will correctly produce C_5 as the winner, without any variation. The same holds for equal ranking.

Less frequently, but still quite commonly, one can find analyses where the undetermined ranking can be interpreted by means of equal ranking but not of V-CNRs. The cases I present here are by no means exhaustive. One would virtually need to scan all analyses that involve 'comma' to establish that. However, what follows should serve as a useful starting point. For instance, a good example of an analysis along these lines is illustrated in the tableau (19) below mentioned in Yip (2002: 238, data in de Lacy (1999))[8]. This refers to Huajuapan Mixtec, where there is an interaction between stress and tone. The overwhelming generalisation is that stressed syllables prefer more prominent tones i.e. H, whereas the reverse holds for stressless syllables which favour the less prominent L. As a result, the existence of tonal feet is proposed. More concretely, it is shown that only HM, ML and HL tonal feet are allowed. The following constraints - along with a few more which are currently of no interest to us - capture the facts.

(18) *NONHD/H: Stressless syllables do not have H tone
OCP(FOOT): No identical tones within a foot

[7] As in e.g. the majority of tableaux in Kager (1999); for instance see his tableau (49), p. 73 with respect to the various strategies of avoiding clusters of nasals-plus-voiceless-obstruents.

[8] Another example is from Nakanai reduplication in Carlson (1998). Tableau (22) - in the ROA version - depicts the constraints L-ANCH, *LHDIPH and ONSET separated by 'commas'. There are six possible permutations and as the reader can confirm by consulting the original, 4/6 generate the correct output, but 2/6 - that is, when ONSET is top-ranked - select a wrong winner. This issue does not arise under equal-ranking.

ALIGN-L(σ́-PRWD): Align the left edge of a stressed syllable with the left edge of the prosodic word

Several inputs are considered, but the one which is important for us is /MMH/ [stressed syllable indicated by underlining; brackets denote footing].

(19) *Stress and tone for /MMH/ in Huajuapan Mixtec*

	*NONHD/H	OCP(FOOT)	ALIGN-L(σ́-PRWD)
a. M(MH)	*		*!
☞ b. (MM)H		*	

The two first constraints are separated by a ‘comma’ since no ranking argument exists between them. As both candidates incur one violation of each of the higher-ranked constraints, they tie. Low-ranked ALIGN-L(σ́-PRWD) resolves the tie by favouring (b).

Now here is the problem. Suppose we were to interpret the ‘comma’ in this instance as a case of V-CNR - there is no reason why we should not be able to - and consider the consequences. It should be obvious that this would now look like the grammar in (1) and consequently should be able to produce two tableaux as in (2). Adapting this to the case under consideration we would thus get:

(20) *NONHD/H, OCP(FOOT) >> ALIGN-L(σ́-PRWD) (cf. (1))

(21) i) *NONHD/H >> OCP(FOOT) >> ALIGN-L(σ́-PRWD)

	*NONHD/H	OCP(FOOT)	ALIGN-L(σ́-PRWD)
a. M(MH)	*!		*!
☞ b. (MM)H		*	

ii) OCP(FOOT) >> *NONHD/H >> ALIGN-L(σ́-PRWD)

	OCP(FOOT)	*NONHD/H	ALIGN-L(σ́-PRWD)
💣 a. M(MH)		*	*!
☞ b. (MM)H	*!		

In other words, interpreting the ‘comma’ as V-CNR à la Anttila generates variation in a case that presents none. Equal ranking on the other hand correctly produces the right result.

Of course there is one way we could save Anttila's proposal, namely by arguing that there is no 'comma' in this particular ranking. More specifically, *NONHD/H >> OCP(FOOT) >> ALIGN-L(σ́-PRWD) indeed produces the optimal winner as shown in (21i). But this is not flawless either. The only reason we were forced to do this modification was to rescue a particular theoretical mechanism, i.e. V-CNR. No empirical evidence backs up this move. At the same time, our theory, as it stands and with only E-CNR present, is consistent with the empirical facts. Consequently, the existence of V-CNR is significantly weakened.

But there is another way to show the weakness of V-CNRs. As mentioned above, for some of the analyses that make implicit use of E-CNRs, it is actually possible to impose a strict ranking between the constraints involved without any further consequences. Nevertheless, there are other instances in the literature which elucidate that only equal ranking between C_1 and C_2 can work. Either ranking C_1 >> C_2 or C_2 >> C_1 simply produces the wrong outcome.

I have actually presented such a case already in Arabela (cf. (15)-(16)). For concreteness, let us however provide an additional example, this time from morphology (Rice in press). Rice considers some languages and observes that nouns tend to be of a particular gender depending on the morpho-phonological affix attached and the semantics involved. For instance, in German, nouns ending in *-e* tend to be feminine, e.g. *die Blume* 'flower', *die Schule* 'school', while those prefixed by *Ge-* tend to be neuter, e.g. *das Getränk* 'drink', *das Gesicht* 'face'. A conflict arises when a noun includes both affixes, that is, it starts with *Ge-* and ends in *-e*. These are actually feminine, e.g. *die Geschichte* 'story, history', *die Gerade* 'straight line', because the feminine gender is more unmarked than the neuter one, and thus in cases of conflict, it is the preferred gender. A similar relationship is argued for feminine and masculine, with the latter being more unmarked. Thus, Rice proposes the following general markedness gender hierarchy in German.

(22) *NEUTER >> *FEMININE >> *MASCULINE, i.e. *das >> *die >> *der

Several nouns however do not acquire the masculine default gender as (22) predicts, implying that the hierarchy can be overridden by some other factor. Additional constraints - shown in (23) - specific to morpho-phonological or semantic properties of these nouns are used for this reason and dominate the hierarchy in (22). Rice proposes that the three constraints below are equally ranked. The proposed ranking for German nouns follows in (24).

(23) *-*e* / MASCULINE, NEUTER: A noun ending in schwa is assigned neither masculine nor neuter gender.

*ge- / MASCULINE, FEMININE: A noun beginning in the morpheme *ge-* is assigned neither masculine nor feminine gender.
*SUPERORDINATE / MASCULINE, FEMININE: A noun denoting a superordinate[9] is assigned neither masculine nor feminine gender.

(24) *-*e* / MSL, NTR = *ge- / MSL, FMN = *SUPERORDINATE / MSL, FMN >> *NTR >> *FMN >> *MSL

To see how this works, consider the superordinate noun *die Pflanze* 'plant'. Obviously, since the word ends in *-e* and denotes a superordinate, the property-specific constraints relevant for its evaluation are *-*e* / MSL, NTR and *SUPERORDINATE / MSL, FMN.

(25) *die Pflanze* --- correct winner under equal ranking

	*-*e* / MSL, NTR	*ge- / MSL, FMN	*SUP / MSL, FMN	*NTR	*FMN	*MSL
a. der Pflanze	*		*!			*
☞ b. die Pflanze			*		*	
c. das Pflanze	*			*!		

The masculine loses early on because it violates two of the highest equally ranked constraints. Between the two remaining candidate genders, the feminine wins as it less marked than the neuter. At this stage, all that the ranking above tells us is that we could not have *SUP / MSL, FMN >> *-*e* / MSL, NTR, because it would select the neuter (c) as the winner. While a fixed ranking *-*e* / MSL, NTR **>>** *SUP / MSL, FMN would work just as well in this instance, this is refuted by the examples below that highlight the necessity of equal ranking.

(26) *das Gemüse* --- correct winner under equal ranking

	*-*e* / MSL, NTR	*ge- / MSL, FMN	*SUP / MSL, FMN	*NTR	*FMN	*MSL
a. der Gemüse	*	*!	*			*
b. die Gemüse		*	*!		*	
☞ c. das Gemüse	*			*		

[9] Very roughly, superordinates can be understood as words denoting generic, natural categories.

We now consider the neuter noun *das Gemüse* 'vegetable', which is subject to all the top-ranked E-CNR constraints. It is evident that the masculine incurs the most violations, the neuter the least, while the feminine is somewhere in between. Since E-CNRs act as a block of constraints, cumulative violations exclude (a) and (b) and render (c) as the sole winner. Therefore, the evaluation never reaches the gender markedness hierarchy, which would otherwise penalise the neuter candidate.

In (25) we had established that *SUP / MSL, FMN >> *-*e* / MSL, NTR is impossible. Our only chance to get the winner right in (26) by strict domination rather than by equal ranking is thus by having *-*e* / MSL, NTR **>>** *SUP / MSL, FMN. It is also imperative that **ge*- / MSL, FMN dominates these two constraints since otherwise the feminine (b) would win. So far, so good. Perhaps, no need for equal ranking arises after all with the ranking **ge*- / MSL, FMN >> *-*e* / MSL, NTR **>>** *SUP / MSL, FMN. Nonetheless, this grammar fails when a word like *die Gemeinde* 'congregation, community' is considered. For this word, only the constraints with respect to the affixes are relevant. The noun does not denote a superordinate. Evidently, the neuter is the erroneously chosen winner.

(27) *die Gemeinde* --- wrong winner chosen under strict domination

			**ge*- / MSL, FMN	*-*e* / MSL, NTR	*SUP / MSL, FMN
	a.	der Gemeinde	*!	*	
☞	b.	die Gemeinde	*!		
💣	c.	das Gemeinde		*	

This problem can only be avoided by allowing the property-specific constraints to be equally ranked. As we have seen, this is consistent with the previous data and as is motivated in (28), it is the solution to the ranking paradox in (27).

(28) *die Gemeinde* --- correct winner chosen under equal ranking

			*-*e* / MSL, NTR	**ge*- / MSL, FMN	*SUP / MSL, FMN	*NTR	*FMN	*MSL
	a.	der Gemeinde	*	*!				*
☞	b.	die Gemeinde		*			*	
	c.	das Gemeinde	*			*!		

The masculine is ruled out quickly since it presents more violations than the other two candidates with respect to the dominant constraints. The tie between the latter two is resolved by lower-ranked *NTR which now comes into play and correctly chooses the feminine gender for *die Gemeinde*.

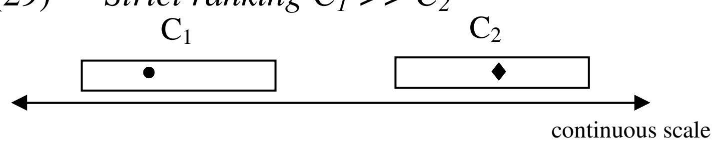
All in all then, in this section we have shown that if Anttila's proposal about the 'comma' is applied to numerous other examples, a huge amount of variation is predicted that does not actually occur. Strict domination can be chosen as an alternative strategy, but while this seems consistent with some cases, there are others such as Arabela stress, German gender assignment (Rice in press) or Nanti stress (Crowhurst and Michael 2005) which convincingly show that any re-analysis along these lines is impossible. Equal ranking must be employed. While final confirmation is required through an exhaustive check of analyses that make use of the 'comma', I suggest that there is after all just a single interpretation of the 'comma' and this is equal ranking. This can be applied to both non-crucial and crucial non-rankings, hence the distinction between the two is merely superficial.

The next section reviews the major alternative to Anttila's variation analysis. This is the Gradual Learning Algorithm (GLA) developed by Boersma and Hayes (2001). It is shown that the GLA can account equally well for the Finnish genitive data presented in Anttila. At the same time, it offers a broader empirical coverage. I show that since GLA can replace Anttila's account, there is no longer much reason to preserve V-CNRs.

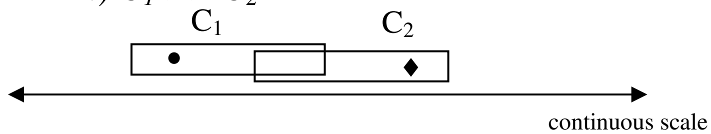
5.2 The Gradual Learning Algorithm (Boersma and Hayes 2001)

The GLA is an error driven algorithm, which seeks to account for variation and intermediate well-formedness. Its basic hypothesis is that constraint ranking is not strict but continuous. Each constraint has a range (Hayes 2000). At any point in time, a particular selection point within this range is chosen as the location of the constraint in hand. When constraints are placed far apart so that their ranges do not overlap, then strict ranking occurs (29). Variation can occur when constraints have overlapping ranges (30) [N.B: dot=the selection point of C_1; diamond=selection point for C_2).

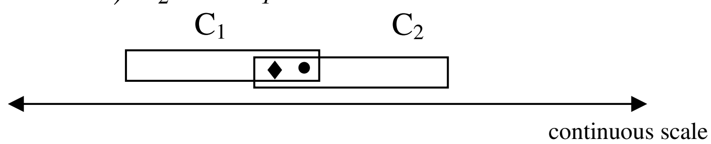
(29) *Strict ranking $C_1 >> C_2$*



(30) *Variable ranking:*
i) $C_1 >> C_2$



ii) $C_2 >> C_1$



In the first case, the selection point of C_1 indicates that it outranks the one of C_2. But in the second case, the selection points for C_1 and C_2 are placed within their overlapping range, with C_2 located above C_1, thus $C_2 >> C_1$ is produced. For detailed information on how these ranges - modelled as probability distributions - are achieved, the reader is referred to Boersma and Hayes (2001).

For the time being, it suffices to mention that the variation captured by the ‘comma’ in Anttila is now expressed through the range overlap and the selection points chosen each time. The GLA seems to suggest a more ‘fluid’ system in which selection points are placed within constraint ranges depending on the data the learner is exposed to. Moderate adjustments of rankings occur until the right grammar is achieved. In the case of variation, the learner is exposed to variants causing slight ranking modifications each time. The grammar eventually stabilizes so that the ranking achieved generates outputs whose frequency is reflected in the frequency of the actual data.

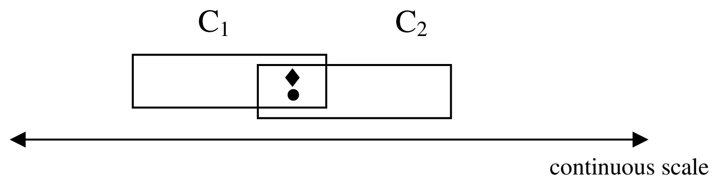
The crucial point however for our purposes is the following: “When one sorts all the constraints in the grammar by their selection points, one obtains a ***total***[10] ranking to be employed for a particular evaluation time (Boersma and Hayes 2001: 48)”. Effectively this eliminates the need for a ‘comma’, since at any point in time, the learner singles out one ranking based on the chosen selection points. Thus, while it may be notationally convenient to use the ‘comma’ for such cases, there should not be any expectation that the frequency of the variants depends on the outcomes of the possible constraint permutations.

As a matter of fact, this is consistent with a point made in van Oostendorp (2004), where it is argued that since Anttila derives frequency effects from constraint ranking, he needs to impose a certain number of constraints each time depending on the statistics he tries to capture. Simply put, if the frequency of the variants is 50%-50%, then two constraints are needed; if 66%-33%, three are required; if 75%-25% four and so on. In the GLA however, variation is a result of the probability distributions of individual constraints and their interactions. Thus the same effects can be achieved with only two constraints C_1 and C_2 that generate different outcomes by placing them at such a distance so that $Cand_1$ wins in e.g. 66% of the cases and $Cand_2$ in the remaining 33%.

[10] Emphasis added mine, NT.

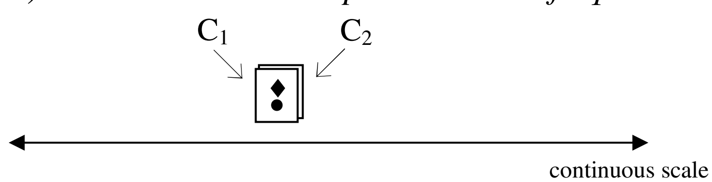
There is a further repercussion of constraints in ranges; although this is not discussed by Boersma and Hayes, the option for equal ranking is in fact predicted in their system. It just mirrors the case where the same selection points are chosen for constraints, as illustrated in (31).

(31) *A possible way to model equal ranking following Boersma and Hayes (2001)*



Of course, one could question the validity of this representation, since it implies that apart from equal ranking, variable ranking should also be possible as it occurs in (30). But this can be resolved if one takes into account the fact that ranges themselves can differ in size (as already suggested in the diagram of the GLA on p. 50). Thus, it is possible that some constraints totally overlap and also have a miniscule range, so that the only possible configuration they can occur in is that of equal ranking.

(32) *More accurate representation of equal ranking*



This amendment then leaves us with three options regarding (basic) constraint relationships: i) C_1 and C_2 are too far apart to permit any constraint reversal, therefore C_1 always dominates C_2, ii) C_1 and C_2 present overlapping ranges, thus total rankings of $C_1 >> C_2$ and $C_2 >> C_1$ may occur, and iii) C_1 and C_2 totally share their ranges which happen to be so tiny that in effect C_1 and C_2 are placed at the same position, i.e. are equally ranked.

5.3. Summary of arguments against V-CNRs

This section has centred around two main arguments: the first exemplified that there are several instances where the 'comma' has been employed in the literature, but its interpretation as a case of V-CNR predicts the wrong results, because it suggests emergence of variation at places that this is missing. A handful of analyses also highlight that strict domination is not a solution either, because it can be shown that no single strict ranking yields the right results. Ranking paradoxes can only be resolved by equal ranking under which constraints are simultaneously evaluated. Additionally, there is a theoretical argument available against V-CNR resulting from the GLA. The GLA puts forward a framework where the variable ranking suggested by Anttila is no longer required. If there is no other motivation for variable ranking then it is plausible that the only conception of crucial non-ranking is equal ranking.

6. Alternatives to equal ranking: Local conjunction

Local conjunction (Smolensky 1993, Moreton and Smolensky 2002, Crowhurst and Hewitt 1997, among others) is basically the idea that the combined interaction of constraints through conjunction may rule out a candidate, but not their independent application. Equal ranking too involves the combined interaction of constraints, thus it seems reasonable to consider local conjunction as a possible alternative to it.

There are two ways that constraint conjunction has been understood in the literature. More commonly it is taken to refer to the case dubbed ‘worst of the worst’ (WOW), in which a candidate *fails* a conjunction iff it fails every conjunct (Smolensky 1993, Moreton and Smolensky 2002). The other conception of local conjunction is that of ‘best of the best’ (BOB), where a candidate *passes* a conjunction iff it passes every conjunct (Crowhurst and Hewitt 1997)[11]. The differences between the two are schematized below[12]:

(33) i) **WOW**

(i)	C_1	$C_1 \wedge C_2$	C_2
$Cand_1$			
$Cand_2$			*
$Cand_3$	*		
$Cand_4$	*	*!	*

ii) **BOB**

(ii)	C_1	$C_1 \wedge C_2$	C_2
$Cand_1$			
$Cand_2$		*!	*
$Cand_3$	*	*!	
$Cand_4$	*	*!	*

[11] As Crowhurst and Hewitt (1997) observe, WOW and BOB essentially correspond to logical conjunction and disjunction. From Smolensky’s point of view, WOW is conjunction, and BOB is disjunction. From Crowhurst’s and Hewitt’s, it is the reverse. This difference is due to whether the conjunctive constraint is formulated as ‘violation’ or ‘satisfaction’. For Smolensky, a conjunctive constraint is *violated* only when both conjuncts are *violated*, hence WOW is the conjunction, whereas BOB corresponds to disjunction because it is violated when either conjunct is violated. For Crowhurst and Hewitt (1997), a conjunctive constraint is *satisfied* only when both conjuncts are *satisfied*, hence BOB is considered the conjunction with WOW being the disjunction.

[12] It is important to mention that at this point I choose to present the conjoined constraint between its conjuncts as Crowhurst and Hewitt do. This is *not* the appropriate location in Smolensky (1993) or Moreton and Smolensky (2002). I will address this issue at the end of this section and in fn. 13.

Conjunction under WOW is violated only in $Cand_4$, because that's the only case where both conjuncts are violated. Conjunction under BOB is violated in all instances with the exception of $Cand_1$ where both conjuncts are satisfied.

With this much in mind, we can proceed in considering whether local conjunction can subsume equal ranking. Crowhurst and Hewitt (1997) show that the nature of these two ideas is different. More specifically, while E-CNRs act as a single cell in the hierarchy, the violations incurred by each of the constraints count individually. On the contrary, in conjunction, violations of the conjuncts imply just a single violation of the complex constraint.

The most significant point however refers to the inability of any of the conjunction constraints to account for the Arabela data previously discussed in section 4. Recall that Arabela uses equal ranking so that it derives stress shift in one specific environment only. In all the remaining cases, rhythmic rightward stress occurs. The constraints that result in the attested patterns are WSP and ALL-FT-R. We thus need to see whether their conjunction could produce the same results. I will first investigate WOW conjunction, followed by BOB conjunction.

(34) Stress shift under WOW
ALL-FT-R >> ALL-FT-R ∧ WSP >> WSP >> ALL-FT-L

		ALL-FT-R	ALL-FT-R ∧ WSP	WSP	ALL-FT-L
	a. (nò)(wàʃ^{μ}i)(ʃ^{μ}áno)	****** (6)	*!	*	**** (4)
	b. (nò)(wà)(ʃ^{μ}ì)(ʃ^{μ}áno)	********* (9)			******! (6)
	c. (nòwa)(ʃ^{μ}ìʃ^{μ}a)(nó)	**** (4)	*!	*	****** (6)
☞	d. (nòwa)(ʃ^{μ}ì)(ʃ^{μ}áno)	***** (5)			***** (5)

It is evident that given the high-ranking of PARSE-σ and FTBIN-MAX (not shown here), it is never possible to satisfy ALL-FT-R perfectly. But recall that in WOW, the conjoined constraint is only violated when both conjuncts are violated. This indicates that we should expect candidates that pass ALL-FT-R ∧ WSP, because they perfectly satisfy WSP by stressing all syllables with voiceless onsets. This is exactly what happens in (34b) and (34d). These are thus the sole rivals. ALL-FT-L is now taken into account and correctly rules out (34b). While this may look like a promising analysis, things fail once the rhythmic pattern is explored as in (35).

(35) Rhythmic stress under WOW
ALL-FT-R >> ALL-FT-R ∧ WSP >> WSP >> ALL-FT-L

		ALL-FT-R	ALL-FT-R ∧ WSP	WSP	ALL-FT-L
☞	a. (s$^{\mu}$àk$^{\mu}$a)(màna)(h$^{\mu}$á)	**** (4)	*!	*	****** (6)
💣	b. (s$^{\mu}$à)(k$^{\mu}$àma)(nà)(h$^{\mu}$á)	******* (7)			******** (8)

Unlike previously, this time the candidate that perfectly satisfies WSP, i.e. (35b) is wrongly chosen as the winner. Its contender, and actual output (35a), fails because it violates the conjoined constraint. Thus, WOW conjunction is not an alternative for the equal ranking approach since it only accounts for some of the data. Let us see whether BOB conjunction fares better.

(36) Stress shift under BOB
ALL-FT-R >> ALL-FT-R ∧ WSP >> WSP >> ALL-FT-L

		ALL-FT-R	ALL-FT-R ∧ WSP	WSP	ALL-FT-L
	a. (nò)(wàʃ$^{\mu}$i)(ʃ$^{\mu}$áno)	****** (6)	*!	*	**** (4)
	b. (nò)(wà)(ʃ$^{\mu}$i)(ʃ$^{\mu}$áno)	********* (9)	*!		******! (6)
	c. (nòwa)(ʃ$^{\mu}$ìʃ$^{\mu}$a)(nó)	**** (4)	*	*	******! (6)
☞	d. (nòwa)(ʃ$^{\mu}$ì)(ʃ$^{\mu}$áno)	***** (5)	*		***** (5)

Things are a bit more complicated in a BOB account, because Crowhurst and Hewitt (1997: 8 in ROA-229 version) assume that when a conjoined constraint is violated, the individual violations of the conjuncts still matter, particularly if these involve gradient constraints (such as ALL-FT-R)[13]. To illustrate, in (36) all candidates are bound to violate the conjoined ALL-FT-R ∧ WSP simply because no candidate can simultaneously satisfy both. Nonetheless, (a) and (b) present more severe violations of ALL-FT-R, thus they are excluded. We are now left with (c) and (d) which tie, as they assign the same total number of violations with respect to the conjuncts. ALL-FT-L is thus decisive and picks out (d) as the winner. This is correct, since it is the attested output. However, the analysis stumbles when it encounters the rhythmic stress data.

[13] I believe this is a weak point in the BOB analysis. Constraint conjunction is by its nature some kind of filter only penalising candidates that fit a certain profile. By also assessing the violations of the conjunct constraints, it is like inserting a further filter to that. If this observation is valid, we would need to assume that all candidates in (36) violate ALL-FT-R ∧ WSP to the same extent. But then things would only get worse, since all of them would be equally bad. As a result, the decision would be passed onto ALL-FT-L which would be better satisfied by (36a)! This is obviously the wrong result.

(37) Rhythmic stress under BOB
ALL-FT-R >> ALL-FT-R ∧ WSP >> WSP >> ALL-FT-L

	ALL-FT-R	ALL-FT-R ∧ WSP	WSP	ALL-FT-L
? ☞ a. (s^{μ}àk$^{\mu}$a)(màna)(h^{μ}á)	**** (4)	*	*	****** (6)
? b. (s^{μ}à)(k^{μ}àma)(nà)(h^{μ}á)	******* (7)	*		******** (8)
? c. (s^{μ}à)(k^{μ}àma)(náh$^{\mu}$a)	****** (6)	*	*	**** (4)

I deliberately avoid assigning exclamation marks to indicate fatal violations as it is quite unclear how the incurred violations are to be computed. The way Crowhurst and Hewitt (1997) count violations is at the very least perplexing, at worst contradictory. To illustrate, I present part of their tableau (56) where they discuss H-tone alignment in Zezuru:

(38) Crowhurst and Hewitt (1997, tabl. 56, C_1=AlignL-H, C_2=OCP, C_3=AlignR-H)
H-toned stems

	C_1	$C_1 \wedge C_2$	C_2	C_3
☞ a. $Cand_1$	***	*		
b. $Cand_2$	**	*		*!
c. $Cand_3$	*	*	*	**!

As illustrated, all candidates violate the conjoined constraint because each of them violates at least one of the conjunct constraints. C_3 will thus select $Cand_1$ because it is not offended at all, contrary to the other candidates. The computation of violations seems to be categorical (McCarthy 2003) and ignores the individual violations of C_1. However, given the gradiency mentioned above, we would have expected instead that $Cand_1$ should be ruled out before it reaches C_3, because unlike the other two contenders, it presents an extra violation of the conjunct constraint C_1. The remaining candidates would then tie, but only temporarily, as C_3 would decide in favour of $Cand_2$. The next tableau depicts an instance where gradiency seems to be assumed.

(39) Crowhurst and Hewitt (1997, tabl. 57, C_1=AlignL-H, C_2=OCP, C_3=AlignR-H)
Toneless stems

	C_1	$C_1 \wedge C_2$	C_2	C_3
☞ a. $Cand_1$	*			***
b. $Cand_2$	**!*	*		**
c. $Cand_3$	**!**	*		

This time, the individual violations of C_1 are important. Due to a gradient calculation of these violations, $Cand_1$ fares better than all candidates and manages to pass the conjunction, although it is really unclear why this should be the case given what we have seen in (38). By doing so however, it is rendered the winner. Had categorical evaluation applied here instead, then presumably $Cand_1$ would also violate the conjoined constraint, so that all candidates would tie at this point. The evaluation would then move on, picking out $Cand_3$ as the winner, since it would be the least penalised by C_3.

Numerous questions then arise, all of which have effects on the example considered in (37): First, is gradiency applicable? If it is not, then the winner should be (37c), as it would be favoured by ALL-FT-L. If gradiency matters, then (37a) would be correctly chosen, but this creates a new lot of questions and problems relating to the general understanding of Crowhurst's and Hewitt's BOB conjunction, such as the ones pointed out in (38) and (39).

Moreover, there is an issue relating to the location of the conjoined constraint. As Padgett (2002) observes, local conjunction in Smolensky's sense is characterised by the universal property: $C_1 \wedge C_2 >> C_1, C_2$ implying that the conjoined constraint is blind to what happens in each of its conjuncts and is always placed above them. This is not the position taken up by Crowhurst and Hewitt (1997), who, as we have seen throughout this exposition, always place the conjoined constraint between its conjuncts and allow it to have access to the performance and violations of the conjuncts. As we have mentioned in fn. 13, this is rather underhanded, because it introduces an extra filter to the conjoined constraint.

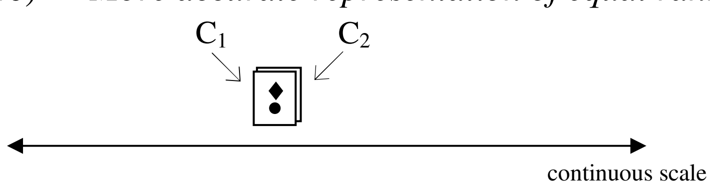
Constraint conjunction - in any of its senses - has been heavily criticised (see Padgett 2002 for some arguments), since it seems to be unconstrained and too powerful a mechanism. It then makes sense that local conjunction - and even this, only under a BOB conception - is a hardly appealing alternative to equal ranking. Although it cannot be excluded overall, it carries along numerous flaws, which make the equal ranking approach a much preferred solution for Arabela and similar cases mentioned in the literature.

The Arabela data invoke an additional challenge. If BOB conjunction is indeed the suitable account, then one central premise of that model, which aims at restricting the range of possible conjunctions among constraints, is violated. In BOB, constraints can only be conjoined if they share an argument that designates the same linguistic object (for discussion see Crowhurst and Hewitt 1997: section 2.2). This argument is the one that is universally quantified in constraint definitions. In the case at hand, ALL-FT-R's definition requires that ***every foot*** needs to be aligned with the right edge of the word, therefore its argument is *every foot*, while for WSP where ***every heavy syllable*** needs to have stress, it is *every heavy syllable*. Evidently, these constraints do not share the same argument, hence it should not be possible to conjoin them at all. Use of BOB conjunction then in Arabela comes at a grave cost, that of discarding the mechanism which makes the model more restrictive.

A similar idea, but less explicitly stated appears in Rice (in press: 17 in manuscript), who treats equal ranking as constraint disjunction in the sense that "the relative optimality of competing candidates is determined by considering the aggregate violations of some set of constraints functioning disjunctively as a block". While this seems a reasonable statement, the way Rice attempts to restrict the equal ranking model next is less persuasive. He wishes to limit "constraint disjunction to kindred constraints". Recall from section 5.1 that in German there are property-specific constraints responsible for gender assignment. According to Rice these are merely disjunctive elements of a single constraint responsible for gender features. This looks very much like the 'shared argument' of Crowhurst and Hewitt, so that only constraints which belong to the same family - an exact definition of 'family' would need to be worked out - can be equally ranked. But, as we have seen, this is not true in Arabela or in Crowhurst (2001: 578) who treats Ident(F) and affix-size constraints as equally ranked.

In fact, given the current proposal, there is no expectation that E-CNRs should be constrained in such a manner. To illustrate, consider (32), the representation of E-CNR under a GLA-based conception. This is repeated here as (40).

(40) *More accurate representation of equal ranking*



GLA imposes no restrictions on the constraints which can interact with one another, and there is no reason why equal ranking should a priori be an exception to this. Languages such as Arabela (Topintzi 2005) or Toba Batak (Crowhurst 2001) merely exemplify this point. One objection that will surely come up against this is the potential proliferation of rankings. While this may indeed be a problem, it is by no means inherent to equal ranking, but pertinent to standard conceptions of strict domination too, e.g. not all possible ranking permutations are actually attested. Constraint and ranking restriction is thus a challenge for the whole OT enterprise. Any solution proposed for it should hopefully be applicable to equal ranking too.

7. Concluding remarks

This paper has discussed several instances of the 'comma' in Optimality Theoretic analyses. There are basically two manifestations of the 'comma': i) non-crucial non-ranking or undetermined ranking (Prince and Smolensky 1993/2004) and ii) crucial non-ranking with two further distinctions: α) VARIATION CNR (Anttila 1997) and β) EQUAL RANKING CNR (Crowhurst 2001, Crowhurst and Michael 2005, Topintzi 2005, Rice in press). I have investigated several problems that V-CNR runs into and I have suggested that the GLA can replace Anttila's approach and along with it the V-CNRs. I have attempted a converging approach that unifies instances of 'comma' under the tag of equal ranking and have shown that this is a mechanism that needs to be recognised in OT, since possible alternatives such as local conjunction cannot capture its effects.

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