Paninian Relations

Alan Prince
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(1) **Logic of Scales, Hierarchies, and Multiplicities**

-*Scales*: if you fall 150 ft, you have fallen 100 ft.
•if you can carry 20 kg, you can carry/have carried 10kg.
•maintain voicing for a 200msec closure,& you have done/can do so for 100msec.

-*Hierarchies:*
•if an event occurs in a subordinate clause, it has also occured in a whole sentence.
•if a Foot contains a stressed high vowel, so does a Prosodic Word.

-*Multiplicities*
•if a word contains 2 *r*'s, it contains an *r*.

In every case we can imagine a nested set of *intervals* anchored at 0: ((((0) 1) 2)....) .

(2) Banning such sets generates a stringency hierarchy:

a. *{0,1} is more stringent (*more general — rules out more things*) than *{0}.
b. *{0−m} is more stringent than *{0−k}, for m>k.
c. *In particular*: Violating *{0−k} *entails* violating *{0−m}.

Quantitatively, for any form f

d. $|*\{0-k\}|_f \leq |*\{0-m\}|_f$ $\qquad$ $|C|_f$ = the number of violations in f of C.

(3) Exx.

a. F(vd)/Ons *vs*. F(vd). (Lombardi, Beckman). If you devoice in Ons, you devoice.
b. $*CC]_\sigma$ *vs*. $*C]_\sigma$. If you have a doubly-closed syllable, you have a closed syllable.
c. *í. *vs*. *V′ . If main stress lodges on (Ci), it lodges on a short vowel.

(4) A stringency hierarchy is a special case/ general case situation.
Panini says: special always takes precedence over general.
So: "Paninian ranking" S >> G.
But OT says (generically): any constraint may take precedence over any other.
•How does free-ranking fit with stringency-related constraints?
(*Answer*: 2 ways, one bad, one good.)

(5) Suppose constraints are defined on such intervals, rather than on the points of the scale.
Aim: derive interaction from nature of representation (scalar, multiple, hierarchical) rather than from from fixing of ranking, retaining free-ranking hypothesis.
[Kiparsky, Green were first to broach this line of attack.]

(6) **Element Stringency vs. Form Stringency**.
Constraints are defined on *elements of structure*.
Evaluation takes place over whole forms, which may contain many elements.

(7) **Stringency**: Boolean (pass, fail; two-valued). *S ⇒ *G, *i.e.* $|S| \leq |G| \leq 1$

	S	G
a		
b		*
c	*	*

• Constraints S and G do not *conflict* — though they disagree on candidate b.

(8) **Ranking Background**: Agreement, Disagreement, Conflict.
Ranking — A, B directly crucially rankable if they conflict on (opt, subopt).
Indirectly rankable by transitivity, though, when ∃ T, A>>**T** and **T**>>B.

(9) Conflict requires this sort of array (where one of a,b is in fact optimal):

/f/	A	B
a	*	
b		*

(10) Or, showing the winners in each column:

/f/	A	B
a	**b**	**a**
b		

In this case, A>>B yields **f↦b**, and B>>A yields **f↦a**.

(11) Observe that for A, B in a stringency relation, as in (6), there is no pair over which the constraints conflict.
(a,b) ↦ a, (a,c) ↦ a, (b,c) ↦ b, no matter what the ranking.

(12) **Form Stringency**: does not follow from Element Stringency.
Multiplicity of violation upsets the apple cart. Consider this abstract situation:

/f/	S = *{a}	G= *{a,b}
bb		**
a	*	*

(13) Or, showing the winners in each column:

/f/	S = *{a}	G= *{a,b}
bb	bb	a
a		

(14) To speak of stringency in evaluation, we must be sure that the constraints stand in the appropriate relation with respect to the actual candidates.

(15) An oddity here. Consider *C]σ *vs.* *CC]σ

	G = *C]σ	S = *CC]σ
map.tik.	**	
maptk.	*	*

	G= *C]σ	S= *CC]σ
map.tik.	maptk.	map.tik.
maptk.		

(16) With G >> S, we actually prefer CvCCC to CvC.CvC !! Empirically dubious, and in violation of a guiding idea behind constraint-domination in OT:

If an element α is universally better — less-marked — than β, then when permitted by faithfulness, we are willing to swap bad β for *any number of* α's, no matter what α's deficiencies are. I.e.

M(β) >> M(α) so any number of violations of M(α) are OK if you improve on M(β).

(17) Similarly, with stringency relations on Faithfulness, as in Positional Faithfulness (Selkirk,Beckman).
Consider Lombardi's F(vd-obstr)/Ons:

/dobmug/	S = F(vd)/Ons	G = F(vd)
do*p*mu*k*		**
*t*obmug	*	*

/dobmug/	S = F(vd)/Ons	G = F(vd)
do*p*mu*k*	do*p*mu*k*	*t*obmug
*t*obmug		

(18) Such forms are not likely to be viable competitors for optimality. But the point is clear.

(19) Possible resolutions:

a. Abandon free-ranked interval constraints for fixed hierarchies a la Prince & Smolensky 1993.

b. Use scalar evaluation, rather than additive lumping, *within* constraints. *C]$_\sigma$ e.g. would still rate CC. as worse than VC., independent of numerosity.

(20) Remark: Fixed Paninian ranking of interval constraints = Fixed ranking of pointwise element constraints.

So with fixed ranking, the difference between the two conceptions is slight.

(Basically, it becomes a matter of how constraints are formulated wrt structure — not trivial, but not a matter that changes the basic predictions of the theory.)

(21) An element hierarchy *a >> *b >> *c .... ≡ *a >> *{a,b} >> *{a, b, c} ...., a Paninian interval hierarchy, so long as $a \cap b = \emptyset$.

Why? Consider *a >> *b vs. *a >> *{a,b}.

	*a	*b	*{a,b}
1. $a^n b^m$	n	m	n+m
2. $a^k b^p$	k	p	k+p

3 cases:

•If n<k, candidate (1) **wins on *a.**

•If n>k, candidate (2) **wins on *a.** *In both these cases, the formulation of *b, *{a,b} is irrelevant.*

‣ If **n=k** then n+**m** > k+**p** is the same as n+**m** > n+**p** and it holds iff m > p (etc.).

I.e. When the decision is passed down the hierarchy by virtue of a tie on *a, the relation of m to p, examined by *b, is the same as the relation of n+m to n+p, since k=n.

Probe Question: why then isn't *{a,b} >> *{a} equivalent to *{a,b} >> *{a,b} ????

(22) **Ranking Properties of Constraints in Stringency Relationship.**

(23) **Satisfaction guaranteed**. Let S, G stand in an Element Stringency relation, so that for any form f, $|S|_f \leq |G|_f$.

Then SAT(G) → SAT(S). (If G is fully satisfied, then so is S, since |G| = 0). A weak property.

From now on, we consider only constraints that stand in a Form Stringency Relation.

(24) **Adjacency in Hierarchy.** $H_1 \mathbf{G}^\frown \mathbf{S} H_2 \equiv H_1 \mathbf{S}^\frown \mathbf{G} H_2$

Pf. G and S do not conflict, so when adjacent, their mutual ranking is not crucial

Note! G and S may still be crucially ranked, by transitivity: G>>T>>S *or* S>>T>>G.

(25) **Activity.** Say that a constraint is *active* on a candidate set if it rejects some candidate.

Observe that one or the other or both may be active on different candidate sets. E.g on the above (6),

{a,b} - only G active **f↦a**

{b,c} - only S active **f↦b**

{a,b,c} - if S>>G, then both **f↦a,** S eliminates c, G eliminates b.

(26) **Activity Inhibition** (Analog of "Panini's Theorem" P&S 1993.)

If G>>S, then $G^+ \Rightarrow S^-$. Equivalently $S^+ \Rightarrow G^-$ in the same situation (G>>S).

(27) Observations about activity:

1. If G>>S , S can still be active!! Namely, on some candidate set where G is not active.
2. If S>>G, both can be active. Though when $S^\frown G$, S's activity is inessential, by Properties I and II above, since $S^\frown G \equiv G^\frown S$ and $G^+ \Rightarrow S^-$. So $S^{+\frown} G^+ \equiv G$. But when S>>T>>G, both can be active and essential. (Construct a case!).

(28) **Utility of the Paninian Ranking Scheme**. (Paninian intervention).

a. **F**/E >> **M** >> **F** : In E, preserve more structure. Simplify in U−E.

Ex. F(vd)/Ons >> M(+vd) >> F(vd). {ba, pa, ap} (Lombardi).

b. **M**/E >> **F** >> **M** : In E, eliminate complexity. Retain in U−E.

Ex. $*CC]_\sigma$ >> F(C,Ø) >> $*C]_\sigma$

Markedness: implications.
F/E, M, F: if L has α in U−E, then L has α generally. (If a language has voiced codas, it has vd onsets.)
M/E, F, M: if L has α in E, then L has α generally. (If a language has CVCC, it has CVC)

(29) **AntiPaninian Ranking**. Say that a ranking is **crucially Anti-Paninian** (AntiPaninian for short), if G crucially dominates S. This can only happen, by the *Adjacency Property*, in ....G>>**T**>>S .

(30) Suppose G sits atop the hierarchy. Surely, Gen is such that for every candidate set, there is something in it that completely satisfies G.

Then, by the *Satisfaction Guaranteed* property, S is also satisfied on every candidate set!

S, then, cannot be crucially subordinated.

So, S and G cannot be crucially ranked, even by an intervening T, and this can only be a Paninian situation.

(31) For AP, then, there must be a dominating D above G. The simplest AP ranking is this:

D >> G >> T >> S

(32) To rank **T** and **S**, we must have that S is potentially active on some input /f/ (at the level of the hierarchy where T,S are encountered). But if G were active, S could not be. (*Activity Inhibition* Property). So G is **not active** on /f/.
•G cannot be satisfied either!, by the Satisfaction Guaranteed property. So we have:

/f/	D	G	T	S
☞ a		*		*
b		*	* !	

(33) **AP in syllable structure.**

a. Markedness.

i. * C] - "NoCoda"

ii. *CC] - "No Double Coda"

iii. FtBin - "Feet are bimoraic"

b. Faithfulness

F(C, Ø) - Max: don't delete a C in the IO map.

(34) The systems:

a. Faithful. {**F** >> NoDoubleCoda, NoCoda} || FtBin

b. Paninian Intervention. {NoDoubleCoda >> **F** >> NoCoda } || FtBin . CVC**C** ↦ CVC**Ø**; CVC ↦ CVC.

c. Totally Simplifying. {NoCoda >> **F**, FtBin} || NoDouble Coda. CV(C)(C) ↦ CV.

d. Monosyllable Paninian, CV otherwise. {FtBin>>NoCoda>>**F**}, and {NoDoubleCoda >> **F** }

e. AntiPaninian. FtBin>>NoCoda>>**F** >> NoDoubleCoda.

(35) Anti-Paninian System. Preserve in Monosyllables, simplify maximally elsewhere.

In	Out	FtBin	*C]	Max-C	*CC]
CVCC	☞ CVCC		*		*
	CVC-		*	* !	
	CV--	*!		* ! *	
CVC	☞ CVC		*		
	CV-	* !		*	
CVCCta	CVCCta		* !		*
	CVC - ta		* !	*	
	☞ CV- - ta			**	
CVCta	CVCta		* !		
	☞ CV- ta			*	

Ranking IV

FtBin
|
*C] (General)
|
Max-C
|
*CC] (Special)

Maps:

#CVCC# ↦ CVCC
#CVC# ↦ CVC (cf.34a)

Otherwise —
CV**CC** ↦ CV
CV**C** ↦ CV (cf. 34c)

(36) D defines a class of forms in which a more marked system prevails. (Ergo DFTF defines a class of forms where a less-marked system prevails.) Harmonic completeness is observed, but a rather gamy walk-on-the-wild side takes place.

(37) **Paninian and AP interactions with scales.** Ex. Asheninca Campa main-stress. (J. P ayne, B. Hayes)
Fundamentally, LR iambic, Heavy = VV, last syllable never stressed.

Main stress falls on the head of one of the last two feet. When last foot is iambic, we have:

a. Nothing special going on: rightmost

sà: **sá:** ti ‘type of partridge’
not**ò**N **kaméN** to ‘my gun’
nawì saw**è** **taná** ka ‘I went in vain’
iŋkìŋ kis^{j}i retà ko**tà** **waké** ri ‘he thought about it for a while’

b. Stress avoids .Ci. in favor of CiN., Ca, Ce, Co.

n^{j}à: w^{j}à: **tawá** ka**rì** ri ‘what he saw in a vision’

c. VV-head beats short V-head:

má: ki**rì** ti ‘type of bee’

(38) Analysis:

*í. >> *V́. >> Rightmost

(39) Observe that Ca., Ce., Co, CaN, CeN, CoN, CiN. is just the complement class of Ci. within the set of short-vowelled syllables. Ergo utility of domination hierarchy in defining.

(40) Observe further that when the last foot is not bisyllabic-iambic, stress avoids the final foot — unless this leads to í.

nokò **wawé** taka (*...wawetáka)
pà: **tiká** keri (* ...tikakéri)

a. *í. causes stress to appear to the right:

opi náta (* opí nata)
ipi **tsó**ka (ipí tsoka is also possible)

b. When there’s a tie on *í., stress may avoid the rightmost position:

kawí niri (but kawi níri is also possible).

So *í. >> NonFin(F′) >> Rightmost. (putting aside the noted variants).

(41) **Question:** how do you get rid of *í. once you have it in grammar?

(42)Consider the interaction between Align-Peak-L (main stress on first syllable) and a peak prominence hierarchy:
1′ ≺ ***2′** ≺ ***3′**≺ ... where 1, 2, 3,... name degrees of intrinsic prominence of syllables from **weakest (1)** to **stronger**..., as e.g. $|\sigma_{\mu}| < |\sigma_{\mu\mu}| < |\sigma_{\mu\mu\mu}| <$ .... (Cf Hayes 1995 for extensive discussion, Prince & Smolensky 1993, Walker 1996, Baković 1996, 1997 for disc.)

(43) The conflict is between initial stress (Pk-L) and stressing the weightiest syllable, which need not be initial.
(Isomorphic to K. Carlson's discussion of Nakanai reduplication, where the conflict is between copying the first vowel and copying the most prominent vowel.)

(44) The crucial cases: those with weight contrast, with heavier element in noninitial position.
Limiting ourselves to bisyllables, and a 3-way scale:

12 ↦ **1′** 2 *or* 1 **2′**
23 ↦ **2′** 3 *or* 2 **3′**
23 ↦ **2′** 3 *or* 2 **3′**

(45) **The Paninian Rankings**

(46) Pk-L >> *{1′} , *{1′, 2′} . Clearly Stress is always initial.

(47) *{1′} >> Pk-L >> *{1′, 2′}. Stress flees from initial 1 to heavier σ if such there is, else initial.

	*{1′}	Pk-L	*{1′, 2′}
1′ 2	* !		*
☞ 1 **2′**		*	*
1′ 3	* !		
☞ 1 **3′**			
☞ **2′** 3			*
2 **3′**		* !	

(48) *{1′}, *{1′, 2′} >> Pk-L. Both 1 and 2 yield stress to stronger σ, else initial.

	*{1′}	*{1′, 2′}	Pk-L
1′ 2	* !	*	
☞ 1 **2′**		*	*
1′ 3	* !	*	
☞ 1 **3′**			*
2′ 3		* !	
☞ 2 **3′**			*

(49) **Anti-Paninian Ranking.** 3 beats 1 and 2. Else initial.

	*{1′, 2′}	Pk-L	*{1′}
☞ **1′** 2	*		*
1 **2′**	*	* !	
1′ 3	* !		
☞ 1 **3′**		*	
2′ 3	* !		
☞ 2 **3′**		*	

(50) Paninian: 1 2 3

```
3   2          3
 \ /           |
  1            2
               |
               1
```

(51) Anti-Paninian:

```
  3
 / \
2   1
```

(52) Extended to 4-scale.

a.Paninian: 1 2 3 4

```
2 3 4        3   4        4
 \|/          \ /         |
  1            2          3
               |          |
               1          2
                          |
                          1
```

b. Anti-P

```
(i)   4        (ii)  4       (iii) 4        (iv)  4   3
     /|\            / \            |               \ /
    2 3 1          2   3           3               / \
                    \ /           / \             2   1
                     1           2   1
```

(i). *{1′-3′} >> Leftmost >>*{1′}, *{1′- 2′}

(ii). *{1′}, *{1′- 3′} >> Leftmost >> *{1′- 2′}

(iii). *{1′- 2′}, *{1′- 3′}>> Leftmost >> *{1′}

(iv). *{1′- 2′} >> Leftmost >>*{1′}, *{1′- 3′}

(53) Non pathology of AP rankings. All rankings **respect the basic > scale**. — in this sense:

if k *beats* j, then n > k ⇒ n *beats* j. E.g **2** ▹1 → **3**▹1, **4**▹1 *cf.* AP (ii)

if k *beats* j , then m < j ⇒ k *beats* m. E.g 3▹**2** → 3▹**1** *cf.* AP (iii), (iv)

(54) Thus, strict domination and inclusion hierarchies fit rather well together. Though free ranking increases the number of predicted systems (= variant implementations of the same underlying scale), they all have the desirable basic property

of preserving the basic sense of the scale.

(55) AP ranking effectively joins high-markedness classes, allowing a solution of the *í. problem. Cf. Standard weight scale: CVV > CVC > CV. Paninian collapse: CVV, CVC > CV. AntiPaninian Collapse: CVV> CVC, CV.

(56) The AP diagram for the syllable structure case:

```
        CV
       /   \
    CVC   CVCC
```

Where FtBin removes CV, we have both CVC and CVCC both preserved — neither better than the other vis a vis Max.

(57) **Conclusion**. The possibility of AP ranking induces a classification on linguistic scales — those which collapse accordingly (prominence), and those which must absolutely be prevented from such (e.g. syllable structure). Many broad avenues are opened.

Appendix.

An example in which the subordinated Special constraint is active.

In	Out	FtBin	*C]$_\sigma$	$\mathscr{F}$(p)	*CC]$_\sigma$	$\mathscr{F}$(q)	Comments
fa**p**ta	fap.ta		* !				p↦Ø to avoid C]$_\sigma$
	☞ fa.ta			*			
fa**pp**ta	fapp.ta		* !		*		p↦Ø to avoid C]$_\sigma$
	fap.ta		* !	*			
	☞ fa.ta			**			
fa**pp**	☞ fá**pp**.		*		*		p↦p
	fáp.		*	* !			
	fá.	* !					
fa**qq**	fáqq.		*		* !		q↦Ø
	☞ fá**q**.		*			*	
	fá.	* !					