

# The Phonology of Anatolian Reduplication

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## §1 Introduction

**§1.1 Reduplication in Anatolian:** Despite recent interest in the formal phonological aspects of verbal reduplication in Proto-Indo-European (PIE) and its oldest daughter languages, the Anatolian evidence has received relatively little attention, largely because the basic facts had yet to be established.

- The Anatolian data has now been comprehensively gathered and philologically assessed by Dempsey (2015), allowing for further phonological investigation, which we take up in this paper.

• Recent phonological analyses (of aspects) of IE reduplication include Fleischhacker (2005); Keydana (2006, 2012); Sandell (2011, 2013); DeLisi (2015); Zukoff (2014, 2015a, to appear); Zukoff and Sandell (2015); see also Steriade (1982, 1988).

- Based on the data in Dempsey (2015), plus additional philological analysis, we argue in §2 that Hittite and Luwian had the partial reduplication patterns in (1), separated by base shape, which we further use to reconstruct the reduplicative patterns of Proto-Anatolian (PA).

(1)	Base Shape	Hittite	Luwian	Proto-Anatolian	PIE
	<i>CVX-</i>	<u>CV</u> - <i>CVX-</i>	<u>CV</u> - <i>CVX-</i>	* <u>CV</u> - <i>CVX-</i>	* <u>CV</u> - <i>CVX-</i>
	<i>TRVX-</i>	<u>TRV</u> - <i>TRVX-</i>	<u>TV</u> - <i>TRVX-</i>	* <u>TV</u> - <i>TRVX-</i>	* <u>TV</u> - <i>TRVX-</i>
	<i>STVX-</i>	<u>iSTV</u> - <i>STVX-</i>	( <u>TV</u> - <i>STVX-</i> )	* <u>STV</u> - <i>STVX-</i>	* <u>SV</u> - <i>STVX-</i> (?)
	<i>VCX-</i>	<u>VC</u> - <i>VCX-</i>	<u>VC</u> - <i>VCX-</i>	n/a?	n/a?

• *C* = any consonant, *T* = obstruent, *R* = sonorant consonant, *S* = [s], *V* = vowel, *X* = an optional string of additional segments.

• The data from Lycian is minimal, but seems in all respects to accord with what is attested for Luwian. We argue in §2.4 that TV-*STVX-* is not synchronically generated in Luwian.

**§1.2 THE POORLY-CUED REPETITIONS PRINCIPLE in PIE?** Anatolian cluster-initial bases in (1) show some variability — this feature is characteristic of the ancient IE languages, which frequently display differences between *TRVX-* and *STVX-* bases in reduplication, e.g. (2):

(2)	<i>CVX-</i>	<i>TRVX-</i>	<i>STVX-</i>	Non-default strategy
Sanskrit	<u>ja</u> - <i>gam-</i>	<u>pa</u> - <i>prac<sup>h</sup>-</i>	<u>ta</u> - <i>st<sup>h</sup>a-</i>	<i>C</i> <sub>2</sub> -copying
Greek	<u>le</u> - <i>lu-</i>	<u>ke</u> - <i>kri-</i>	<u>e</u> - <i>stal-</i>	Non-copying
Gothic	<u>hai</u> - <i>hait</i>	<u>gai</u> - <i>grot</i>	<u>stai</u> - <i>stald</i>	Cluster-copying

- *TRVX-* bases show the same default *C*<sub>1</sub>*V* copying pattern as *CVX-* bases.
- *STVX-* bases — in some cases, along with a subset of other initial-cluster types — show a different, non-default copying pattern.

- Zukoff (2015a,b) develops an analysis of these non-default patterns based on the “POORLY-CUED REPETITIONS PRINCIPLE” (PCR), which ties the licensing of local consonant repetitions to facts about the distribution of phonetic cues. PCR is defined in (3) (per Zukoff 2015a:2):

(3) “A CVC sequence containing identical consonants ( $C_\alpha VC_\alpha$ ) is dispreferred, due to repetition blindness; it is especially dispreferred if one or both of the consonants lack phonetic cues which are important for the perception of its presence (in contrast to zero) in the speech signal.”

- Under the PCR approach, the recurring distinction between *TRVX*- and *STVX*-bases comes down to the fact that TR and ST clusters have very different phonetic properties: TR clusters contain robust phonetic cues such as *release burst* and *intensity rise* (cf. Wright 2004), while ST clusters contain no such cues.

⇒ PCR allows us to understand why TRV and STV clusters are treated differently across IE:

- (i) When  $C_1$ -copying applies to *TRVX*-bases, the output is *TV-TRVX*- — the base cluster TR contains robust phonetic cues, so the consonant repetition is licensed.
  - (ii) If  $C_1$ -copying were to apply to *STVX*-bases, the output would be <sup>x</sup>*SV-STVX*- — yet the base cluster ST lacks the necessary phonetic cues, so the consonant repetition is not licensed; instead, some other copying pattern must apply.
- Given its observable effects in (2), PCR appears to be a feature of Proto-Nuclear-Indo-European (PNIE) — **but is there any evidence in Anatolian?** We argue that:

- (i) Synchronic phonological analysis of Hittite and Luwian reduplication reveals no PCR effects.
- (ii) However, the reduplicative patterns reconstructed for PA provide crucial evidence for PCR.

- In fact, the PA system is almost entirely identical to Gothic, i.e. (4):

(4)	TRVX-	STVX-	Non-default strategy (induced by PCR)
Gothic	<i>gai-grot</i>	<i>stai-stald</i>	Cluster-copying
Proto-Anatolian	* <i>bV-brV-</i>	* <i>stu-stu-</i>	Cluster-copying

⇒ The PA evidence supports the reconstruction of PCR for PIE.

⇒ In addition, reconstructing PCR for PIE opens the door to explaining other vexed Anatolian forms — e.g. Hitt. *šipand-* ‘libate’ (Melchert 2015) — via the prehistoric operation of this principle.

### §1.3 Roadmap:

- (i) Review and categorize the data on partial reduplication in Anatolian, especially with respect to reduplicant shape (determined by base shape); use the combined evidence of Hittite, Luwian, and Lycian to reconstruct Proto-Anatolian surface patterns (§2)
- (ii) Lay out the basics of an Optimality Theoretic (OT) (Prince and Smolensky 1993/2004) grammar that generates the reduplicative patterns reconstructed for PA (§3)
- (iii) Assess the implications of PA for PIE phonological reconstruction — in particular, for the POORLY-CUED REPETITION PRINCIPLE (PCR) (Zukoff 2015a); diagnose archaisms and discuss possible motivations for Hittite and Luwian changes (§4)

- Appendix I contains a complete list of reduplicative stems that are securely paired with attested bases in Anatolian (§5)
- Appendix II provides synchronic analyses of the Hittite and Luwian reduplicative grammars (§6)

## §2 Reduplication in Anatolian and PA

**§2.1 An overview of Anatolian reduplication:** Anatolian verbal stems formed by *partial* reduplication show four distinct copy patterns, which depend on the phonological shape of the base stem: (i) CVX–; (ii) VCX–; (iii) STVX–; (iv) TRVX–.

- These same four patterns are observed across reduplicated forms with three different patterns of reduplicant vocalism: (i) [i]-reduplication; (ii) [e]-reduplication; and (iii) copy reduplication (COPY).
- Reduplicated stems attested beside a synchronic base generally have iterative/durative function with respect to their base (see Dempsey 2015: esp. 331–2) — these paired stems constitute the primary data for synchronic analysis.
  - We treat here *only* partial reduplication; Anatolian examples of “intensive” reduplication, which must be determined by (slightly) different aspects of the phonological grammar, are therefore not considered (see Dempsey 2015 on this type).
  - Since many forms whose reduplicant displays a surface i also contain an *i* in the root, it is not always possible to distinguish between [i]- and copy reduplication.

**§2.2 CVX– bases:** Reduplicative stems to CV-initial bases copy just the initial consonant (plus the reduplicative vowel), e.g. (5):

(5)	GLOSS	BASE	REDUPLICATED STEM	RED. VOCALISM	
Hitt.	‘happen’	<i>kiš–</i>	<i>kikkiš–</i>	[ki-k:is-]	COPY/[i]
	‘wipe’	<i>warš–</i>	<i>wawarš–</i>	[wa-wars:-]	COPY
	‘demand’	<i>wēk–</i>	<i>wewakk–</i>	[wé(:)-wak:-]	[e]
CLuw.	‘take’	<i>la–</i>	<i>lala–</i>	[la-la-]	COPY
	‘give’	<i>pī(ya)–</i>	<i>pipišša–</i>	[pi-pi-]	COPY/[i]
HLuw.	“	<i>*pa–</i>	<i>pi-pa-sa–</i>	[pi-pa-]	[i]
Lyc.	“	<i>pīje–</i>	<i>pibije–</i>	[pi-βi-]	COPY/[i]

**§2.3 VCX– bases:** Vowel-initial bases in the Anatolian languages show a VC-VCX reduplicative pattern; at least two clear examples in (6):

(6)	GLOSS	BASE	REDUPLICATED STEM	RED. VOCALISM	
Hitt.	‘mount’	<i>ark–</i>	<i>ararkiške–</i>	[ar-ark-]	COPY
CLuw.	‘wash’	<i>īlha–</i>	<i>ililha–</i>	[il-ilχa-]	COPY/[i]

- Yet there are several reasons to doubt the antiquity of this reduplicative pattern:
  - The (complicated) developments required to explain CLuw. *īlha–* — the only Luwian evidence for this pattern — are likely to be inner-Luwian.
  - Vowel-initial roots would have been rare or absent in (at least early) PA; most arise only after the loss of prevocalic initial *\*h<sub>1</sub>*, which is — at the very earliest — a development of late PA (cf. Yates 2014b).
    - On CLuw. ‘wash’, see Dempsey (2015:263) (cf. Melchert 2011:127–8). For concise arguments that PIE roots of the shape *\*h<sub>x</sub>CVX–* originally reduplicated *\*h<sub>x</sub>V-h<sub>x</sub>CVX–* with laryngeal-copy, see Byrd (2015:120–1) with references.
    - Moreover, at least one type of VC-VCX– reduplication — specifically, the VR-VRT– patterns attested in Hittite and Luwian — are incompatible with the PA grammar that generates the other three reconstructible consonant copy patterns; see §6.1 in Appendix II for further discussion.

⇒ We therefore assume that this pattern had not yet emerged in PA.

**§2.4 STVX– bases:** Reduplication in PIE roots of shape *\*STVX–* is a major locus of phonological variation across the IE languages (see, e.g., Niepokuj 1997; Keydana 2012; Zukoff 2015a; cf. §3.3 below).

- For Anatolian, two relevant lexical items are attested:
  - Hitt. *išdušduške–*, the reduplicated stem to Hitt. *ištu–* ‘become evident’; this corresponds with Luw. *dušdu–\**, attested in CLuw. *dušdumali–* ‘manifest; voucher’.
  - CLuw. *hišhi(ya)–* is a reduplicated stem (historically) formed to the base attested in Hitt. *išh(a)i–* ‘bind’.
    - The same reduplicated stem for ‘bind’ is likely attested in HLuw. participal forms (PUGNUS+PUGNUS)*hi-sà-hi-mi-na* (CEKKE §13, 16).
- Hittite ([i]STV–STVX–) and Luwian ([TV–STVX–]) look like a phonological mismatch, but this may just be superficial: in inherited *\*#ST–* clusters, Hittite shows regular prothesis, and Luwian shows regular *\*s*-deletion, as illustrated in (7) (cf. Melchert 1994:30–2, 271; Yates 2014a):

(7)	PIE <i>*#ST–</i>	CLuw. <i>T–</i>	Hitt. <i>išT–</i>
	<i>*spor–</i> ‘spread’	<i>parritti</i>	<i>išpāri</i>
	<i>*st(e)h<sub>3</sub>men–</i> ‘ear’	<i>tummān</i>	<i>ištāmanan</i>

- Consequently, Hittite and Luwian reduplicated forms can be the phonologically regular outcome of PA *\*STV–STVX–*, i.e. (8).

(8)		<b>*s-Deletion</b>	<b>Prothesis</b>
	PA <i>*stu-stu–</i>	> Luw. <i>dusdu–*</i> (⇒ CLuw. <i>dušdu-mali–</i> )	Hitt. <i>išdušdu–</i>
	PA <i>*sh<sub>2</sub>i-sh<sub>2</sub>i–</i>	> CLuw. <i>hišhi(ya)–</i>	

- An alternative view (e.g. Dempsey 2015:335) would take the Luwian forms as evidence of synchronic *TV–STVX–* reduplication in Luwian (and perhaps also Proto-Anatolian), as found in Sanskrit (e.g. Vedic *tī-ṣtha-ti* ‘stands’) — however, at least three (interrelated) issues make this hypothesis unlikely:

- The reduplicative pattern is clearly an innovation against PIE. Since it is otherwise unparalleled in Anatolian, it has to be an inner-Luwian innovation.
- Neither reduplicated stem has a corresponding base attested in Luwian, which should immediately cast doubt on their synchronic status.
- More generally, there are no *#ST–* initial clusters in Luwian due to regular sound change (cf. (7)).

⇒ Reduplication in accordance with this new pattern would have had to occur “just in time,” i.e. in Pre-Luwian prior to the regular deletion of the initial *\*s* of the base.

- It is now clear that *\*TV–STVX–* reduplication cannot be an archaism (e.g. Kobayashi 2004:43–4; Byrd 2015:119–20).
- While there is in fact no direct evidence (yet) for the outcome of PA *\*#sh<sub>2</sub>–*, the fact that all obstruents pattern together with respect to other Anatolian epenthesis/deletion processes strongly argues for Luw. *#h- < \*#sh<sub>2</sub>–* in parallel to initial *\*s*-stop clusters; the expected Luwian cognate of Hitt. *išh(a)i–* is then CLuw. *\*ha(i)–*.
- Provided with enough evidence from paired stems, it is *possible* that the original /s/ of such a root could be recovered by Luwian speakers from inherited reduplicated forms and used to synchronically generate reduplicated stems like *hišhi–*; however, the lack of Luwian evidence for paired stems in this type speaks against this possibility.

⇒ Luwian *\*TV–STVX–* forms are better analyzed as lexicalized stems — i.e. the *lautgesetzlich* development of PA *\*STV–STVX–* rather than the result of productive Luwian reduplication.

- While accident of attestation cannot be excluded, the semantic equivalence of CLuw. *hišhiyanti* and simplex Hitt. *išhiyanteš* in the corresponding versions of the Zariya ritual (CTH 757.A/B) might be explained by assuming that the original iterative semantics of the reduplicated form were bleached after the historical loss of the base verb in Luwian. In a similar vein, the total absence of attested verbal forms for either simple *\*stu–* or reduplicated *\*stu-stu–* may point to historical loss of these stems in (Pre-)Luwian.

- Further support for this analysis comes from the grammar itself: the attested Luwian copy patterns that are clearly synchronic (*CV-CVX-*, *TV-TRVX-*, *VC-VCX-*) require a ranking of phonological constraints that does not generate *TV-STV-* reduplication; for details, see §6.1 in Appendix II.

⇒ Hittite and Luwian thus converge in the reconstruction of *\*STV-STVX-* reduplication for PA, e.g. (9):

(9)	GLOSS	BASE	REDUPLICATED STEM		RED. VOCALISM
PA	'become evident'	<i>*stu-</i>	<i>*stu-stu-</i>	<i>*[stu-stu-]</i>	COPY
	'bind'	<i>*sh<sub>2</sub>(o)i-</i>	<i>*sh<sub>2</sub>i-sh<sub>2</sub>i-</i>	<i>*[sχi-sχi-]</i>	COPY/[i]

**§2.5 TRVX–bases:** The limited evidence suggests that the Anatolian languages diverge with respect to their treatment of *TRVX–* bases:

- CLuw. *par(a)-* 'carry off' is paired with a reduplicated stem *papra-* [pa-pra-] (see Melchert to appear b), which argues for copying of just the initial obstruent to bases with initial *obstruent-sonorant* clusters, i.e. *TV-TRVX-*.
- The Lycian verbs *pabra-* and *pabla-* — although of unknown meaning — are also consistent with *TV-TRVX-* reduplication.
  - Per Melchert (to appear b), CLuw. *par(a)-* continues PIE *\*b<sup>h</sup>er-* 'bear', and must be separated from Hitt. (*arha*) *parh-* 'chase/drive (away)' = HLuw. *ARHA* \*501+*RAlI-ha-* [parχ(a)-] 'id.', both of which reflect PIE *\*b<sup>h</sup>erh<sub>2</sub>-* 'rush'. On Lyc. *pabra-* and the (problematic) equation with CLuw. *papra-*, see Dempsey (2015:273–4).
- However, two Hittite forms — if rightly partial reduplication (e.g. Kloekhorst 2008:273–4, 631–2) — would show instead *TRV-TRVX-* reduplication, i.e. (10):

(10)	GLOSS	BASE	REDUPLICATED STEM		RED. VOCALISM
Hitt.	'blow'	<i>par(a)i-</i>	<i>parip(p)ar(a)i-</i>	<i>[pri-p:r(a)i-]</i>	COPY/[i]
	'kneel'	<i>hal(a)i-</i>	<i>halihal(a)i-</i>	<i>[χli-χ(:)lai-]</i>	COPY/[i]

- Due to orthographic limitations, the Hittite forms are ambiguous — they can reflect either partial reduplication or "intensive" reduplication (e.g. Hitt. *wariwar* 'burn up': *war-\** 'burn' (*urāni* / *warnu-*)). Dempsey (2015:275–6, 319–20) argues for "intensive" reduplication in 'kneel', but partial reduplication in 'blow'.

○ Is the Hittite *TRV-TRVX-* cluster-copy pattern an innovation or retention with respect to PA?

- The *TV-TRVX-* partial reduplication pattern attested in Luwian (and Lycian) is found in many of the non-Anatolian IE languages (Greek, Vedic, Gothic, etc.), while *TRV-TRVX-* is attested only in Hittite.
  - While not typologically common, patterns akin to the *TV-TRVX-* pattern are found at least in Klamath, Ilokano, Coast Tshimshian, Khmer, Nuxalk, and Pima (Fleischhacker 2005).
- Moreover, Hittite may preserve traces of *C<sub>1</sub>-copy* — e.g. Hitt. *tatrant-* 'sharp-edged; prone to goring', which may be the lexicalized participle of a reduplicated PA verbal stem *\*dV-dr-* (< PIE *\*der-* 'cut, split'; cf. Melchert 1984:33 n. 68, Kloekhorst 2008:857).
  - We assume that *paprah<sub>2</sub>-/papre(šš)-* 'make/be(come) impure' and *tatrah<sub>2</sub>-* 'incite' are deadjectival in Hittite (≠ *paprant-* 'impure', *tatrant-*) rather than synchronic partial verbal reduplication (to unattested bases) (cf. Dempsey 2015:329). A purely nominal origin for *tatrant-* cannot be ruled out, however.
  - Hitt. *papra-\** is generally compared either to words like Goth. *fairina* 'guilt' (= OHG *firina* 'crime') and CLuw. *paratta-* 'impurity(?)' (Melchert 1984:33 n. 68; cf. Kloekhorst 2008:628–9), or to words like Skt. *babhrú-* 'brown' and Lith. *bēbras/bēbrus* 'beaver' (Puhvel 2011:105–6; cf. Dempsey 2015:329). In either case, it is not connected to a PIE root that clearly makes verbal formations of any kind.

⇒ Especially when viewed in light of the other IE evidence, the *TRV-TRVX-* must be a Hittite innovation, while Luwian *TV-TRVX-* must be a retention.

⇒ Hittite verbal stems exhibiting the *TRV-TRVX-* pattern reduplicated *\*TV-TRVX-* in PA.

**§2.6 Evaluating Anatolian consonant copy:** Summing up §§2.2–2.5, the reduplicative patterns in (11) are the most likely reconstructions for PA:

$$(11) \quad *CVX- : *CV-CVX- \quad *STVX- : *STV-STVX- \quad *TRVX- : *TV-TRVX-$$

**§3 Morphophonology of Proto-Anatolian reduplication**

- In this section, we lay out the synchronic, Optimality Theoretic (Prince and Smolensky 1993/2004) analysis of the copying patterns reconstructed for Proto-Anatolian. This analysis confirms that the motivation for the \**STV-STVX-* pattern indeed **must be PCR**.

**§3.1 CVX– bases:** Reduplication to *CVX-* bases represents the basic case. They very clearly show *C<sub>1</sub>V* reduplication, though there’s little else they could have shown.

- The one other option to rule out (especially when compared with “intensive” reduplication) is the copying of post-nuclear consonants, e.g. *C<sub>1</sub>VC<sub>2-</sub> → <sup>x</sup>C<sub>1</sub>VC<sub>2</sub>-C<sub>1</sub>VC<sub>2-</sub>*.
- The fact that we don’t see this pattern indicates that Anatolian partial reduplication (and indeed IE partial reduplication) is “minimal,” copying as little as possible that can still create a phonotactically licit reduplicant.
  - This can be effected in a number of ways in OT, using various sorts of “size minimizer” constraints (cf., e.g., Spaelti 1999, Hendricks 1999, Gouskova 2004, Riggle 2006; see Zukoff to appear on this in Ancient Greek).

- For present purposes, we can use a markedness constraint disfavoring consonant clusters (\*CC) as our size minimizer constraint:

$$(12) \quad *CC: \textit{Assign one violation for each consonant cluster (i.e. string of two consonants)}.$$

- Since consonant clusters are generally allowed to surface outside of reduplication, \*CC must be dominated by the faithfulness constraints which could repair a cluster, namely *MAXC-IO* and *DEPV-IO*.

- \*CC effectively prohibits copying post-nuclear consonants because it would create an extra consonant cluster for no reason:

$$(13) \quad CVX- \textit{ bases: PA } *CVX- \rightarrow \textit{ PA } *CV-CVX- \quad \textit{ e.g. } \quad \begin{array}{l} \textit{Hitt. } \textit{warš-} \textit{ ‘wipe’} \quad \rightarrow \quad \textit{wa-warš-} \\ \textit{HLuw. } \textit{sarla-} \textit{ ‘praise’} \quad \rightarrow \quad \textit{sa-sarla-} \end{array}$$

/RED, C <sub>1</sub> VC <sub>2</sub> C <sub>3-</sub> /		*CC
a.	$\overline{C_1V-C_1VC_2C_3-}$ ( <i>wa-wars-</i> )	*
b.	$C_1VC_2-C_1VC_2C_3-$ ( <i>war-wars-</i> )	**!
c.	$\overline{C_1VC_2C_3-C_1VC_2C_3-}$ ( <i>wars-wars-</i> )	**!*

**§3.2 TRVX– bases:** We reconstruct *TRVX-* bases in PA as displaying the \**TV-TRVX-* reduplication pattern, as continued in Luwian, and most other IE languages. This essentially embodies the default *C<sub>1</sub>V* pattern found also for the *CVX-* bases.

- However, achieving this pattern for *TRVX-* bases results in *skipping* of the second member of a root-initial cluster (candidate (15b) *TV-TRVX-* >> candidate (15a) <sup>x</sup>*TRV-TRVX-*).
- This skipping effect is an even more straightforward application of the size minimizer constraint \*CC: an extra consonant is not copied even if it results in the copying of discontinuous string.

- Discontiguous copying of this sort violates the Base-Reduplicant (BR) faithfulness constraint CONTIGUITY-BR in (14a). This constraint is basically inactive in the PA system, ranking at the very bottom.
  - It is, however, active in Hittite, and leads to a non-skipping pattern: *TRV-TRVX-*.
- CONTIGUITY-BR and \*CC could be satisfied simultaneously by copying just the second consonant and the root vowel (candidate (15c) <sup>x</sup>*RV-TRVX-*); however, this is not optimal, because the constraint ANCHOR-L-BR (14b), which requires copying from the left edge, outranks CONTIGUITY-BR.
  - ANCHOR-L-BR is consistently high-ranked throughout Anatolian.

- (14) a. CONTIGUITY-BR [CONTIG]  
*Assign one violation mark \* if two segments which are contiguous in the base have correspondents in the reduplicant that are not contiguous.*
- b. ANCHOR-L-BR [ANCHOR]  
*Assign one violation mark \* if the leftmost segment of the reduplicant does not correspond to the leftmost segment of the base.*

- When ANCHOR and \*CC dominate CONTIG, we generate the skipping pattern.

- (15) TRVX- bases: \*TRVX- → \*TV-TRVX- (e.g. PA \*brV- → \*bV-brV- > Luw. *pa-pra-*)

/RED, TRVX-/	ANCHOR	*CC	CONTIG
a. <u>TRV</u> -TRVX- ( <i>pra-pra-</i> )		**!	
b. <u>TV</u> -TRVX- ( <i>pa-pra-</i> )		*	*
c. <u>RV</u> -TRVX- ( <i>ra-pra-</i> )	*!	*	

**§3.3 STVX- bases:** Based on the behavior of the CVX- and TRVX- bases, we can identify C<sub>1</sub>V- copying as the “default” reduplication pattern for PA, in all relevant senses. STVX- bases do not follow this default pattern; instead, they copy the entire initial cluster: \*STV-STVX-.

- As discussed in §1.2, this distribution is entirely parallel to what is found in Gothic (see, e.g., Keydana 2006, 2012, Zukoff and Sandell 2015):

- (16) 

Proto-Anatolian	* <u>gi</u> -gis-	* <u>bV</u> -brV-	*stu-stu-
Gothic	<u>hai</u> -hait	<u>gai</u> -grot	<u>stai</u> -stald

- If we adopt the PCR strategy for PA, and have the PCR constraint — defined in (17) (simplifying slightly for present purposes) — rank above \*CC (the constraint which is normally responsible for preventing cluster-copying), we generate the pattern in a way consistent with the \*TV-TRVX- pattern.

- (17) PCR: *Assign one violation mark \* for each sequence of repeated identical consonants (C<sub>α</sub>VC<sub>α</sub>) that surfaces in pre-obstruent position.*

- The default C<sub>1</sub>V- candidate (18b) cannot surface here because it violates PCR.
- Based on the relative ranking of ANCHOR and \*CC, the next best option is the cluster-copying candidate (18a).

- (18) STVX bases: \*STVX- → \*STV-STVX- (e.g. PA \*stu- → \*stu-stu- > Hitt. *ištu-štu-*)

/RED, STVX-/	ANCHOR	PCR	*CC	CONTIG
a. <u>STV</u> -STVX- ( <i>stu-stu-</i> )			**	
b. <u>SV</u> -STVX- ( <i>su-stu-</i> )		*!	*	*
c. <u>TV</u> -STVX- ( <i>tu-stu-</i> )	*!		*	

### §3.4 Local Summary:

- We have now developed an internally consistent grammar that generates the reduplicative patterns of reconstructed Proto-Anatolian.
- The default  $C_1V$ - copying pattern, which applies to both  $CVX$ - and  $TRVX$ - roots/bases falls out from the activity of essentially just two constraints: ANCHOR and \*CC; both must dominate CONTIG, which in PA is effectively inactive.
- To generate the divergent \* $STV$ - $STVX$ - pattern on top of this, all that is required is a high-ranking PCR constraint. This has the effect of forcing extra copying just in case the default pattern would have yielded a poorly-cued consonant repetition.

· Total ranking for PA: ANCHOR-L-BR, PCR  $\gg$  \*CC  $\gg$  CONTIGUITY-BR

⇒ This demonstrates that PCR does indeed affect Proto-Anatolian, even though it is not active in the attested daughter languages. Anatolian reduplication thus falls fully in line with the other reduplicative systems attested in the IE daughter languages.

## §4 Diachrony of Anatolian reduplication

**§4.1 PCR in PIE:** According to the analysis developed in §§2–3, PA reduplication shows a clear phonological split between the treatment of  $TRVX$ - roots and  $STVX$ - roots.

- As in the other IE languages, this split is motivated by PCR (cf. Zukoff 2015a,b).

⇒ This convergence between PA and PNIE strongly argues that PCR played a role in the grammar of PIE.

**§4.2 Reduplicative archaisms in Anatolian?** Assuming that PCR was active throughout the development of PIE into PA potentially allows for an explanation of some difficult forms like those in (19):

- (19) a. PIE/Early PA \*/se – spónd – ei/ → \*sēpóndei > Hitt. *šipandi* ‘libates’ (per Melchert 2015)  
 b. PIE/Early PA \*/wé – wĕk – ti/ → \*wēk-ti > Hitt. *wēkzi* ‘demands’ (per Sandell 2014)

- Several IE languages (incl. Sanskrit, Gothic, Old Irish) attest long-vowel (weak) perfect/preterite stems which can potentially be analyzed as default  $C_1V$ - reduplicative copying followed by medial consonant deletion + compensatory lengthening (Schumacher 2005) as a repair for PCR (Zukoff 2015a,b): e.g., Sanskrit *bejur* as if from \*ba-bj-*ur*.

⇒ The same process could have applied in early PA to generate these forms.

- If correct, such examples would constitute **archaisms** already in PA — that is to say, forms that cannot be generated by the synchronic grammar of that stage.
- In this sense, PA would pattern with other ancient IE languages, nearly all of which attest archaisms in reduplication beside synchronically productive patterns, e.g. (20):

(20)	ARCHAISM	PRODUCTIVE PATTERN	GLOSS
Latin	<u>sistō</u>	<u>stetī</u>	‘stand’
Greek	ἵστανμι (< * <u>sistāmi</u> )	ἕσταλχα	‘stand’ / ‘prepare’
Vedic	<u>paptúr</u>	<u>petúr</u>	‘fly’



### §4.3 Constraint re-ranking and the demise of PCR in Anatolian:

- The reconstructed PA reduplicative patterns differ from the daughter languages in several ways, and thus so too must its grammar.

· For reasons of time, we will not discuss at length the grammars of Hittite and Luwian, though discussion and relevant tableaux can be found in Appendix II (§6).

- To generate the set of changes that characterize the daughter languages, all that is required is a re-ranking of a few of the constraints which characterize the PA grammar, as outlined in (21).

(21) Rankings

PA	PCR	>>	*CC	>>	CONTIG
Luwian	*CC	>>	CONTIG	>>	PCR
Hittite	CONTIG	>>	*CC	>>	PCR

· In all of the reduplication patterns observed in Anatolian and reconstructed for Proto-Anatolian, the only one which on the surface appears to violate ANCHOR is the Luwian TV-STVX-pattern. But this pattern cannot be productive in Luwian as argued in §2.4.

- The set of changes can thus largely be characterized by two changes in rankings:
  - (i) For both languages, PCR is rendered inactive, and is demoted to the bottom of the ranking; this allows for the emergence of the VC-VCX-pattern.
  - (ii) CONTIG and \*CC are reversed in Hittite, generating cluster-copying as the default pattern for cluster-initial roots, i.e. the TRV-TRVX-pattern.
- **Why** does PCR cease to be operative between PA and the Anatolian languages?
- We can tentatively point to several factors which are likely to have played a role in the development of new Hittite and Luwian grammars:
  - The emergence of vowel-initial roots after the loss of *\*h<sub>1</sub>*; at least under certain circumstances, such roots cannot be reduplicated without violating PCR.
  - The new allowance of vowel-initial roots conspires with the “vocalization” of syllabic sonorants to create new bases of the shape *VRCX-*; such bases likewise cannot be generated under the PA constraint ranking (cf. §6.1).
  - Changing phonotactics — in particular, the repairs driven by the new prohibition on *\*#ST*, which changed the distribution of surface reduplicative patterns in these languages:
    - The categorical loss of *\*s* in *\*#ST* in Luwian effectively eliminated one distinct surface pattern.
    - Meanwhile, Hittite prothesis gave rise to a new surface pattern.
- Further consideration of the motivations for the loss of PCR in Anatolian, and, relatedly, the details of the operation of PCR at earlier stages, are important questions that we plan to continue pursuing in future research.

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## §5 Appendix I: Paired Reduplicative Stems in Anatolian

- All examples of reduplicative stems paired with attested verbal bases in the Anatolian languages we judge to be secure are given in (22) with philological notes below:

(22)	GLOSS	BASE	REDUPLICATED STEM	RED. VOCALISM	
Hitt.	‘mount’	<i>ark-</i>	<i>ararkiške-</i>	[ar-ark-]	COPY
	‘sit’	<i>ēš-</i>	<i>ašāš-</i>	[as-á:s-]	COPY (?)
	‘kneel’	<i>ḫal(a)i-</i>	<i>ḫalihāl(a)i-</i>	[χli-χ(:)lai-]	COPY/[i]
	‘become evident’	<i>ištu-</i>	<i>išdušdušk[e]-</i>	[istu-stu-]	COPY
	‘happen’	<i>kiš-</i>	<i>kikkiš-</i>	[ki-kris-]	COPY/[i]
	‘cut’	<i>kuwarške-</i>	<i>kuwakuwarške-</i>	[k <sup>w</sup> a-k <sup>w</sup> ar-]	COPY
	‘pour’	<i>lah(h)u-</i>	<i>lilḫuwa-</i>	[li-lχ <sup>w</sup> a-]	[i](*[e])
	‘bend’	<i>lak-</i>	<i>lelakk-</i>	[lé(:)-lak:-]	[e]
	‘chant’	<i>mald-</i>	<i>mammalt-</i>	[ma-malt-]	COPY
	‘fall’	<i>mau(šš)-</i>	<i>mummiye-</i>	[mu-m:-]	COPY
	‘blow’	<i>par(a)i-</i>	<i>parip(p)ar(a)i-</i>	[pri-p:r(a)i-]	COPY/[i]
	‘shoot’	<i>šiye-</i>	<i>šišiye-</i>	[si-si-]	COPY/[i]
	‘place’	<i>d(a)i-</i>	<i>titti-</i>	[ti-ti-]	COPY/[i]
	‘step’	<i>tiya-</i>	<i>titti-</i>	[ti-t:i-]	COPY/[i]
	‘cry out’	<i>wai-</i>	<i>wiw(a)i(ške)-</i>	[wi-w(a)i-]	COPY/[i]
	‘wipe’	<i>warš-</i>	<i>wawarš-</i>	[wa-wars:-]	COPY
	‘demand’	<i>wēk-</i>	<i>wewakk-</i>	[wé(:)-wak:-]	[e]
CLuw.	‘run’	<i>ḫuiya-</i>	<i>ḫuihuiya-</i>	[χ <sup>w</sup> i-χ <sup>w</sup> i-]	COPY/[i]
	‘wash’	<i>ilḫa-</i>	<i>ililḫa-</i>	[il-ilχa-]	COPY/[i]
	‘take’	<i>la-</i>	<i>lala-</i>	[la-la-]	COPY
	‘pour’	<i>lūwa-</i>	<i>lilūwa-</i>	[li-lur-]	[i]
	‘give’	<i>pī(ya)-</i>	<i>pipišša-</i>	[pi-p(:)i-]	COPY/[i]
	‘break’	<i>malḫu- / malwa-</i>	<i>mammalḫu- / mammalwa-</i>	[má-m:alχ <sup>w</sup> -] / [má-m:alwa-]	COPY(*[e])
HLuw.	‘exalt’	<i>sarla-</i>	<i>sasarla-</i>	[sa-sarla-]	COPY
	‘release’	<i>sa-</i>	<i>sasa-</i>	[sa-sa-]	COPY
	‘fill’	<i>su(wa)-</i>	<i>susu-</i>	[su-su-]	COPY
	‘stand’	<i>ta-</i>	<i>tata-</i>	[ta-ta-]	COPY
Lyc.	‘give’	<i>pije-</i>	<i>pibije-</i>	[pi-βi-]	COPY/[i]

- More paired stems are easily reconstructible for PA by Anatolian-internal comparison, e.g. Hitt. *lipp-* ‘lick’ : Luw(o-Hitt). *lilipa(i)-*; Hitt. *pašš-* ‘swallow’ : Luw(o-Hitt.) *pipašša(i)-*; Hitt. *nai-* ‘turn’ : CLuw. *nana-*; Hitt. *tar-* ‘say’ : CLuw. *tatariya-* / HLuw. *ta-ta-rali-ya-* [tatar(i)ya-] ‘curse’; and significantly, Hitt. *išḫ(a)i-* ‘bind’ : CLuw. *hišḫi(ya)-* (on which see §2.4 above).
- The hapax verbal form cited by *CHD* (L–N: 58) as *lilakki*, can also be read *lelakki*, and together with *wewakk-* and *mēm(a)i-* assigned historically to the class of “iterative-intensive” \**h<sub>2</sub>e*-conjugation \**Cé-CoC-*reduplicating presents reconstructed by Jasanoff (to appear).
- The reduplicated stems of Hitt. ‘sit’ and ‘step, assuming a standing position’ are semantically irregular in that they have transitivity semantics with respect to their bases, i.e. ‘cause to sit’ and ‘cause to stand’. On the distinction between the homophonous reduplicated stems *titti-*, see Melchert (to appear a) (cf. Jasanoff 2010).
- Several attested paired reduplicative stems in (22) are — from a synchronic perspective — phonologically opaque with respect to their bases due to prehistoric (morpho)phonological developments:

- For Hitt. ‘demand’ and ‘bend’, the root-final geminate of the reduplicated stem is synchronically irreconcilable with the singleton velar of the base, which surfaces in synchronic derivation — note especially Hitt. imperfective *wekišk-* (with consistent [k]; cf. Melchert 2014).
- For CLuw. ‘break’, the Pre-Luwian operation of Čop’s Law (Čop 1970) would explain the geminate *-mm-* of CLuw. ‘break’, although given the (late and limited) attestation of the reduplicated stem, its linguistic reality is uncertain; if simply orthographic, the verb likely reflects productive copy reduplication (see Dempsey 2015:268–9).
- The reduplicated stems for Hitt. ‘fall’ and Hitt. ‘pour’ — provided that hapax *li-la-ḫu-i* is an alternative spelling for much better attested *li-il-ḫu-* / *le-el-ḫu-* (see *CHD*, L-N:57) — are here assumed to show post-PA historical syncope of the root vowel.
- As shown by Melchert (2011:130), the etymologically related [i]-reduplicated stem CLuw. *li-lūwa-* is an inner-Luwian creation to the (laryngeal-metathesized) base *lūwa-* ‘pour’ (< PIE *\*luh<sub>3</sub>-* ← *\*lh<sub>3</sub>u-C-*), and thus provides no evidence for a pre-Anatolian reduplicated [i]-present with zero-grade of the root (as argued by Dempsey 2015:294).
- In the strict sense, the function of such reduplicated stems as iteratives to these bases is a type of suppletion.

## §6 Appendix II: Analysis of Hittite and Luwian

**§6.1 Generating VC-VCX- in Hittite and Luwian:** The problem for generating the VC-VCX- pattern for PA is the otherwise necessary high ranking of PCR.

- For a base of shape *\*VRT*, the attested *VR-VRT-* pattern violates PCR; therefore the PA grammar would instead select candidate (c) in (23) with discontinuous copying of the second post-nuclear consonant. There is no evidence of such a pattern anywhere in Anatolian, or indeed anywhere in IE.

(23) (Hypothetical) *\*VRT* bases: *\*VRT-* → *\*VT-VRT-* (cf. Hitt. *ar-ark-*, CLuw. *il-ilḫa-*)

/RED, VRT-/	NOHIATUS	ANCHOR	PCR	*CC	CONTIG
a. <u>VRT</u> -VRT-				**!	
b. ☹ <u>VR</u> -VRT-			*!	*	
c. ☹ <u>VT</u> -VRT-				*	*
d. <u>V</u> .-VRT-	*!			*	
e. <u>R</u> -VRT-		*!	*!	*	
f. <u>T</u> -VRT-		*!		*	

- Although a moot point, we nevertheless note that a hypothetical PA base consisting of just *\*VC* is unproblematic under this ranking, which would generate *\*VC-VC-*.
- In Hittite and Luwian, PCR has been demoted to the bottom of the constraint ranking; this re-ranking alone generates the innovative VC-VCX- pattern, no matter the relative rankings of the other constraints:

(24) *VRT* bases: *VRT-* → *VR-VRT-* e.g. Hitt. *ark-* ‘mount’ → *ar-ark-*  
 CLuw. *ilḫa-* ‘pour’ → *il-ilḫa-*

/RED, ark-/ilχ-/	NOHIATUS	ANCHOR	*CC	CONTIG	PCR
a. <u>ark</u> -ark- / <u>ilχ</u> -ilχ-			**!		
b. ☹ <u>ar</u> -ark- / <u>il</u> -ilχ-			*		*
c. <u>ak</u> -ark- / <u>iχ</u> -ilχ-			*	*!	
d. <u>a</u> .-ark- / <u>i</u> .-ilχ-	*!		*		
e. <u>r</u> -ark- / <u>l</u> -ilχ-		*!	*		*
f. <u>k</u> -ark- / <u>χ</u> -ilχ-		*!	*		

**§6.2 Cluster-initial bases in Hittite:** After the necessary re-ranking (i.e. demotion) of PCR discussed in §6.1, generating the *TRV-TRVX-* pattern in Hittite requires positing just one more simple re-ranking, viz. promoting CONTIG over \*CC:

(25) TRVX bases in Hittite: *prai-* ‘blow’ → *pri-prai-*

/RED, pr(a)i-/	ANCHOR	CONTIG	*CC
a. <i>pri-prai-</i>			**
b. <i>pi-prai-</i>		*!	*
c. <i>ri-prai-</i>	*!		*

- The same constraint ranking, augmented with additional constraints that are independently necessary to account for Hittite epenthesis (principally: #ST, MAXC-IO ≫ DEPV-IO), will also yield the attested pattern in Hittite *iSTVX-* bases:

(26) STVX roots: /stu-/ → [istu-stu-]

/RED, stu-/	*#ST	MAXC-IO	ANCHOR-L-BR	CONTIGUITY-BR	ONSET	DEPV-IO	*CC	PCR
a. <i>stu-stu-</i>	*!						**	
b. <i>istu-stu-</i>					*	*	**	
c. <i>su-stu-</i>			*!				*	*
d. <i>tu-stu-</i>			*!				*	
e. <i>su-su-/tu-tu-</i>		*!						

- If Hittite *istu-* were underlying /istu-/ instead of /stu-/, it should follow the pattern observed in *VC-VCX-* bases, which would (wrongly) yield <sup>x</sup>*iš-istu-*; if reduplication in these stems is synchronic, epenthesis must also be synchronic (cf. Yates 2014a).
- It is also crucial to this analysis that the epenthetic [i] vowel does not belong to the reduplicant proper; a surface-identical version of candidate (b) where the epenthetic [i] is parsed as part of the reduplicant would fatally violate ANCHOR-L-BR.

**§6.3 Cluster-initial bases in Luwian:** The only cluster-initial bases in Luwian are of shape *TRVX-*, since *STVX-* bases have been eliminated by regular sound change (cf. §2.4 above).

- Whereas Hittite shows cluster-copying for TRVX roots (*TRV-TRVX-*), Luwian shows the more typical IE pattern of single-consonant copy: *TV-TRVX-*.
- This pattern is generated by taking the ranking proposed for Hittite and reversing the ranking of CONTIGUITY-BR relative to \*CC, i.e. (27):

(27) \*CC ≫ CONTIG ≫ PCR

(28) TRVX roots: *par(a)-* ‘carry off’ → *pa-pra-*

/RED, p<a>ra-/	ANCHOR-L-BR	*CC	CONTIGUITY-BR
a. <i>pa-pra-</i>		**!	
b. <i>pa-pra-</i>		*	*
c. <i>ra-pra-</i>	*!	*	

- This new grammar in fact would prefer *C<sub>l</sub>-copy* in reduplication to an *STVX-* base, although such bases do not exist in Luwian.