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ASYMMETRIC CRISP EDGE[*]

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CRISPEDGE constraints provide a means for limiting harmony by penalizing features that stray beyond a particular domain. Usually this constraint is bidirectional: it penalizes features that cross the relevant domain's left and right edges equally. But harmony in the Romance variety of Tudanca Montañés provides evidence for an asymmetric version of CRISPEDGE. Regressive harmony originates with the final vowel and extends beyond the stressed syllable only under limited circumstances. Asymmetric CRISPEDGE, which penalizes features spreading beyond the stressed syllable's left edge but not its right edge, provides the only satisfactory account of this restriction.

Keywords: CRISPEDGE, Harmonic Grammar, Positional Licensing, Tudanca Montañés

1 Introduction

The observation that the edges of different phonological domains—say, different levels of prosodic or segmental representations—are often aligned is a common theme in the phonological literature. Perhaps the two most obvious domains in which this coordination is asserted are the syntax/phonology interface, where prosodic constituency is determined at least in part by syntactic phrasal boundaries (see Selkirk (2011) for an overview), and prosodic morphology, wherein morpheme shape and placement are often tailored to meet specific prosodic desiderata (e.g. McCarthy and Prince 1993; 1995).

A handful of constraint formalisms exists to enforce this coordination. Ito and Mester (1999) contribute to this body of work by developing the CRISPEDGE family of constraints, which rules out "[m]ultiple linking between prosodic categories" (208): for each prosodic category PCat, there exists a constraint CRISPEDGE[PCat] that is violated if some element is linked to multiple units of type PCat. For example, CRISPEDGE[σ] effectively blocks gemination by prohibiting elements from maintaining membership in two different syllables.

Walker (2001) elaborates on this formalism by positing a second argument in each CRISPEDGE constraint that specifies which particular phonological elements may not have membership in multiple PCats. (Kawahara (2008) makes a similar proposal.) For example, CRISPEDGE([Round], σ) penalizes [Round] features that are linked to multiple syllables; other multiply linked features are not penalized. CRISPEDGE constraints of this sort play a central role in Walker's (2011) theory of licensing-driven vocalic phenomena. In her framework, a Positional Licensing constraint LICENSE(λ, π) compels λ—which might be a feature or set of features—to appear in the position π. Other constraints, including CRISPEDGE, determine the means by which compliance with LICENSE is achieved: do unlicensed features spread to the licensor, or are they eliminated? May a feature appear in non-licensing positions in addition to the licensor? For systems in which the answer to the latter question is "no," that prohibition is enforced by CRISPEDGE. For example, unstressed high vowels delete under certain conditions in northern dialects of Modern Greek (see Walker (2011:208) for details and references). Walker treats this as the combined effects of LICENSE([+high], $\acute{\sigma}$), which requires [+high] to be linked to the stressed syllable, and CRISPEDGE([high], σ), which prohibits linking a [high] feature to multiple syllables. With [+high] unable to spread to the licensor because of CRISPEDGE, deletion is the only way to satisfy LICENSE.

Ito and Mester (1999:208) note another possible elaboration of their formalism that, to my knowledge, has not been explored: "CRISPEDGE remains to be further developed in terms of categories and L/R

edges." That is, building on Walker's formalism, we might employ CRISPEDGE([F], PCat, L/R), which is violated only when [F] has an affiliation with another prosodic unit to PCat's left or right as specified by the L/R argument. I argue here that in Harmonic Grammar (HG; e.g. Legendre, Miyata, and Smolensky 1990), this asymmetric CRISPEDGE is crucial to analyses of Positional Licensing phenomena like those studied by Walker (2011).

Evidence for this asymmetric CRISPEDGE is found in the harmony system of Tudanca Montañés, a Romance variety spoken in Spain and described by Penny (1978) (Hualde (1989) also discusses properties of the language that are of interest here). Harmony originates with a final high vowel, which centralizes (indicated with capitalization, following Hualde) and causes centralization to spread leftward up to and including the stressed syllable:

(1) a. pÍntU   'male calf'   cf. pínta   'female calf'
         sekÁlU   'to dry him' cf. sekálo   'to dry it' (mass)

     b. kÁrAbU   'tawny owl'
         orÉgAnU   'oregano'
         antigwÍsImU 'very old'

Under particular circumstances (see below), harmony also targets a pretonic vowel: [ehpInÁθU] 'spinal cord.' In Kaplan (2018) I argue that accounting for this "overshoot," in which harmony seems to go too far, requires a Positional Licensing formalism that encourages assimilation beyond the licensor; such a formalism must be prevented from triggering pretonic harmony in non-overshoot cases, and I argue here that asymmetric CRISPEDGE is the appropriate vehicle for doing so.

2 Tudanca's Harmony in Harmonic Grammar

This section summarizes the relevant parts of the analysis of Kaplan (2018). As we'll see, asymmetric CRISPEDGE plays a central role. The following section argues that alternatives are inferior.

Positional Licensing drives Tudanca's harmony: centralization (which I assume to be [–ATR], following Hualde (1989)) seeks the prominence of a stressed syllable by spreading to that position. The analysis in Kaplan (2018) builds on Kaplan (to appear), which develops a Positional Licensing formalism that rectifies pathological properties of standard Positional Licensing in HG. Unlike OT, constraints in HG are numerically weighted, and each constraint contributes to a candidate's harmony score; these properties change the relationship between Positional Licensing and faithfulness in ways that lead to unwanted predictions. Correcting this requires Positional Licensing to be a positive and gradient constraint. By way of illustration, the constraint necessary for Tudanca is given in (2). This constraint rewards licensed features instead of penalizing unlicensed ones, and it also assigns +1 for each non-licensor that a licensed feature is associated with. See Kaplan (to appear) for justifications of both properties.[1]

(2) LICENSE([–ATR], σ́): assign +1 for each [–ATR] that coincides with σ́. For each such [–ATR], assign +1 for each additional position it coincides with.

One serendipitous consequence of rewarding harmony on non-licensors is that LICENSE([–ATR], σ́) provides a ready motivation for Tudanca's overshoot. This overshoot occurs just when a pretonic vowel

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[1] As discussed in Kaplan (to appear), this formalism must be implemented in a serial framework to avoid problematic predictions of positive constraints (Kimper, 2011). In the interest of simplicity, I use parallel HG here; the problems arising from positive constraints are tangential to present concerns.

is labial-adjacent.[2] Contrast the examples of overshoot in (3) with (1), where the pretonic vowels are not labial-adjacent.

(3)   pIyÍhkU   'pinch'
           ehpInÁθU   'spinal cord'
           mUr̄ÍyU   'stone'
           bUhÁnU   'worm'
           mAr̄ÁnU   'pig'
           tAmbÚhU   'short and fat person'

Let us set aside the requirement of labial adjacency for the moment and focus on the fact that the possibility of overshoot requires something like LICENSE([–ATR], $\acute{\sigma}$) as defined above while overshoot's absence in (1) demands a constraint that prevents LICENSE from producing overshoot.[3]

First, (4a) shows that LICENSE([–ATR], $\acute{\sigma}$) triggers overshoot: when harmony stops at the stressed syllable, it sacrifices an additional reward from LICENSE. Of course, in cases like (4b) this is not the desired result. ((☞) marks the intended winner, and ☻ marks the incorrect winner. Here and throughout, I assume a constraint *[+ATR, +high]# that motivates centralization of final high vowels, which we might take to be a word-final weakening process (Barnes, 2006). I also assume that *[–ATR] penalizes each [–ATR] vowel, not each [–ATR] feature, contra Beckman (1999), so a single feature associated with two vowels incurs two violations.)

(4)   a.

/piyíhku/	LICENSE([–ATR], $\acute{\sigma}$) 4	*[–ATR] 3	H
a. piyíhkU		−1	−3
b. piyÍhkU	+2	−2	2
☞ c. pIyÍhkU	+3	−3	3

    b.

/oréganu/	LICENSE([–ATR], $\acute{\sigma}$) 4	*[–ATR] 3	H
a. oréganU		−1	−3
(☞) b. orÉgAnU	+3	−3	3
☻ c. OrÉgAnU	+4	−4	4

Kaplan (2018) uses the constraint in (5) to block pretonic harmony in cases like (4b). This is an asymmetric CRISPEDGE constraint, which I abbreviate CRISPEDGE-L to emphasize the property that distinguishes it from symmetrical versions of this constraint. (See section 3 for a demonstration that symmetrical CRISPEDGE does not work in the current context.)

(5)   CRISPEDGE([–ATR], $\acute{\sigma}$, L): The stressed syllable's [–ATR] cannot extend beyond the left edge of that syllable.

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[2]This is related to an independent process in Tudanca whereby mid vowels centralize when adjacent to a labial even when harmony is not present: [bOnúka] 'weasel.' Labials cause non-mid vowels to centralize only as an extension of harmony—that is, as overshoot. See Penny (1978) and Hualde (1989) for discussion and Kaplan (2018) for a constraint-based analysis of the full range of labial-induced centralization.

[3]Interestingly, all examples of overshoot that I am aware of contain penultimate stress, even though antepenultimate stress is also possible in the language; see (1b). Whether this is a coincidence or not I cannot say, though I know of no data with antepenultimate stress that meet the conditions for, but do not exhibit, overshoot. There is thus no clear evidence that overshoot requires penultimate stress, a condition that might point toward a three-syllable window—i.e. a ternary foot—for harmony. Furthermore, forms like [sekÁlU] 'to dry him' (1a) indicate that harmony does not always fill such a ternary domain.

As (6) shows, the analysis now correctly produces [orÉgAnU]. *[–ATR] and CRISPEDGE-L gang up on LICENSE to block pretonic harmony. CRISPEDGE-L penalizes this harmony because it entails [–ATR] spreading beyond the stressed syllable's left edge; in contrast, it does not assign penalties when the stressed syllable shares this feature with a post-tonic vowel—this is the essence of asymmetric CRISPEDGE.[4]

(6)

/oréganu/	LICENSE 4	*[–ATR] 3	CRISPEDGE-L 2	H
a. oréganU		−1		−3
☞ b. orÉgAnU	+3	−3		3
c. OrÉgAnU	+4	−4	−1	2

Because LICENSE outweighs *[–ATR], it can produce harmony when only *[–ATR] is violated—namely in the post-tonic domain. As for the data in (3), where overshoot occurs, Kaplan (2018) posits another constraint, called here *[+lab][+ATR], requiring labial-adjacent vowels to be centralized. (I do not know of any convincing phonetic motivation for this constraint, but see Hualde (1989) for brief discussion of other languages that show similar effects.) This constraint and LICENSE gang up on *[–ATR] and CRISPEDGE-L to produce overshoot on only labial-adjacent vowels; see Kaplan (2018) for justification for, and more complete discussion of, *[+lab][+ATR]. An overshoot example is given (7).

(7)

/piyíhku/	LICENSE 4	*[–ATR] 3	CRISPEDGE-L 2	*[+lab][+ATR] 2	H
a. piyíhkU		−1		−1	−5
b. piyÍhkU	+2	−2		−1	0
☞ c. pIyÍhkU	+3	−3	−1		1

A note on representations: the discussion so far has assumed that a single [–ATR] feature extends to all centralized vowels in a form as in (8a). But what if the first vowel of *[OrÉgAnU] has its own separate [–ATR] feature distinct from the one appearing in the remaining syllables, as in (8b)?

(8)   a.   O r É g A n U
                    \ | /
                  [–ATR]

       b.   O r É g A n U
                   | \ /
                [–ATR] [–ATR]

Because the [–ATR] feature on the stressed vowel does not appear in a syllable to the left of that position in (8b), this configuration does not violate CRISPEDGE-L, unlike (8a). This is potentially worrisome: remove the CRISPEDGE-L violation from (6), and candidate (c), *[OrÉgAnU], wins. But (8a) and (8b) differ in another crucial way: in evading a violation of CRISPEDGE-L, (8b) sacrifices a reward from LICENSE because the [–ATR] feature on the stressed syllable does not appear in the pretonic syllable. Consequently, if candidate (c) from (6) represents (8b), we must also reduce the reward from LICENSE to 3. That candidate's score is reduced to 0, and it loses to candidate (b). This dual-features approach to avoiding CRISPEDGE-L violations is not viable after all, and I set it aside. Apart from CRISPEDGE and LICENSE, the constraints used here and in section 3 do not distinguish (8a) from (8b), so I henceforth assume structures like (8a), which maximize the reward from LICENSE.

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[4]It is not a winning strategy to evade the CRISPEDGE-L violation by harmonizing the pretonic vowel(s) but not the stressed vowel: LICENSE assigns no reward if the licensor does not harmonize.

One final refinement is required: it is insufficient for CRISPEDGE-L to simply assign −1 when the stressed syllable's [–ATR] also appears in the pretonic domain. It must assign one violation for each pretonic vowel that this [–ATR] appears on. The reason is illustrated in (9).

(9)

/ehpináθu/	LICENSE 4	*[–ATR] 3	CRISPEDGE-L 2	*[+lab][+ATR] 2	H
a. ehpináθU		−1		−1	−5
b. ehpinÁθU	+2	−2		−1	0
☞ c. ehpInÁθU	+3	−3	−1		1
d. EhpInÁθU	+4	−4	−2		0

Once LICENSE and *[+lab][+ATR] trigger harmony on the labial-adjacent pretonic vowel, we must stop harmony from extending to the other pretonic vowel. *[–ATR] cannot do this on its own because it is outweighed by LICENSE. We must rely on the same gang effect that blocks pretonic harmony in (6), where *[–ATR] and CRISPEDGE-L combine to block the harmony that LICENSE wants. But this is only possible if harmony on the initial vowel incurs new violations of both *[–ATR] and CRISPEDGE-L. As inspection of (9) shows, were CRISPEDGE-L to assign just one violation no matter how far harmony extends beyond the stressed syllable, candidate (d) would win. We can therefore amend CRISPEDGE-L as follows:

(10) CRISPEDGE([–ATR], σ́, L): The stressed syllable's [–ATR] cannot extend beyond the left edge of that syllable. Assign −1 for each syllable to the left of the stressed syllable that an offending [–ATR] appears in.

This, then, is the core of the analysis of centralization in Tudanca. Normally, *[–ATR] and CRISPEDGE-L gang up on LICENSE to prevent pretonic harmony. In the post-tonic domain, CRISPEDGE-L is inactive, so LICENSE triggers harmony there. And in overshoot contexts, LICENSE and *[+lab][+ATR] gang up on *[–ATR] and CRISPEDGE-L.

Two anonymous reviewers ask about CRISPEDGE-R: does this constraint exist, and if so, what is its function? Because harmony originates at the right edge of the word, a right-edge version of (10) plays no active role in Tudanca, but a version of CRISPEDGE-R that holds for the right edge of the word rather than the right edge of the stressed syllable would prevent harmony from extending rightward from a final vowel to subsequent words. More generally, harmony driven by Positional Licensing typically extends in one direction only (Walker, 2011), and if the positive version of Positional Licensing used here is applicable more broadly, both CRISPEDGE-R and CRISPEDGE-L may be needed to prevent the source of the harmonizing feature from triggering harmony in the wrong direction.

We can now ask the following question: is CRISPEDGE([–ATR], σ́, L) the proper means of curtailing overshoot in Tudanca? In the next section I consider salient plausible alternatives and argue that each is inferior to CRISPEDGE-L. The alternatives I consider are symmetric CRISPEDGE, positional faithfulness for pretonic syllables, *[–ATR], and the positional markedness constraint *[–ATR]-pretonic.

3 Alternatives

It is perhaps most imperative to show that CRISPEDGE-L succeeds where its symmetric cousin fails. The symmetric counterpart of CRISPEDGE-L penalizes any [–ATR] feature that is simultaneously associated with the stressed syllable and some other syllable, whether that other syllable is to the right or the left of the stressed syllable. Essentially, the problem with symmetric CRISPEDGE, which I will call CRISPEDGE-S, is that it cannot distinguish pretonic harmony (which it must block) from post-tonic harmony (which it

must allow). Categorical CRISPEDGE-S assigns −1 if the stressed syllable's [–ATR] is not confined to that syllable regardless of how many other positions [–ATR] appears in. Consequently, once harmony between post-tonic vowels and the stressed syllable is established, there is no cost from CRISPEDGE-S for extending harmony to the pretonic domain. This is illustrated in (11a): all three candidates tie on CRISPEDGE-S, and with LICENSE outweighing *[–ATR], pretonic harmony cannot be stopped. If we change things so that *[–ATR] outweighs LICENSE, as in (11b), post-tonic harmony is blocked along with pretonic harmony. (The discontiguous harmony in *[orÉganU] represents a possible configuration in other licensing-driven systems and so must be allowed as a possible candidate (Walker, 2011), indicating either one [–ATR] linked to vowels in non-adjacent syllables or, as Walker treats it, two [–ATR] features in correspondence with each other. The latter differs from (8b), which did not have this correspondence relationship. In Walker's framework, if the two features in (8b) were in correspondence, the CRISPEDGE-L violation that (8b) is meant to escape would be reintroduced.) The correct form is collectively harmonically bounded (Samek-Lodovici and Prince, 1999; 2002) by *[OrÉgAnU] and *[orÉganU].

(11) a.

/oréganu/	LICENSE 4	*[–ATR] 3	CRISPEDGE([–ATR], $\acute{\sigma}$) 2	H
(☞) a. orÉgAnU	+3	−3	−1	1
💣 b. OrÉgAnU	+4	−4	−1	2
c. orÉganU	+2	−2	−1	0

b.

/oréganu/	*[–ATR] 4	LICENSE 3	CRISPEDGE([–ATR], $\acute{\sigma}$) 2	H
(☞) a. orÉgAnU	−3	+3	−1	−5
b. OrÉgAnU	−4	+4	−1	−6
💣 c. orÉganU	−2	+2	−1	−4

CRISPEDGE-S fares no better if it assigns violations gradiently, comparable to (10). Under this arrangement, CRISPEDGE-S favors [orÉgAnU] over *[OrÉgAnU], but it prefers *[orÉganU] even more. The harmonic bounding problem is exacerbated. As before, LICENSE and *[–ATR] favor *[OrÉgAnU] and *[orÉganU], respectively, over [orÉgAnU]. Additionally, now if CRISPEDGE can prevent harmony on the pretonic vowel, it can also do so for the penultimate vowel (and even the final vowel were we to consider forms like *[orÉganu]).

(12) a.

/oréganu/	LICENSE 4	*[–ATR] 3	CRISPEDGE([–ATR], $\acute{\sigma}$) 2	H
(☞) a. orÉgAnU	+3	−3	−2	−1
b. OrÉgAnU	+4	−4	−3	−2
💣 c. orÉganU	+2	−2	−1	0

b.

/oréganu/	*[–ATR] 4	LICENSE 3	CRISPEDGE([–ATR], $\acute{\sigma}$) 2	H
(☞) a. orÉgAnU	−3	+3	−2	−7
b. OrÉgAnU	−4	+4	−3	−10
💣 c. orÉganU	−2	+2	−1	−4

The same problem plagues *[–ATR], which (like CRISPEDGE-S) cannot distinguish pretonic from post-tonic positions. If it excludes harmony in one of those domains it does so in the other, too. For both CRISPEDGE-S and *[–ATR] it is possible to adopt weights that preclude both pretonic and post-tonic harmony, as in (11b) or (12), and introduce another constraint that disfavors gapped harmony domains, thereby overriding CRISPEDGE-S/*[–ATR]. But in Kaplan (to appear) I show that constraints of this sort interact pathologically with Positional Licensing, and in any case the positive version of Positional Licensing at the heart of the current analysis obviates such constraints. This treatment therefore entails a more complex and less theoretically sound analysis than one that uses asymmetric CRISPEDGE.

On the other hand, IDENT(ATR)-pretonic targets only pretonic syllables and thereby makes the distinction that CRISPEDGE-S cannot. (See Kaplan (2015) for an argument that IDENT(ATR)-pretonic is a well-formed constraint.) At first glance, this appears to do the trick:

(13)

/oréganu/	LICENSE 4	*[–ATR] 3	IDENT([ATR])-pretonic 2	H
a. oréganU		−1		−3
☞ b. orÉgAnU	+3	−3		3
c. OrÉgAnU	+4	−4	−1	2

But Richness of the Base reveals IDENT(ATR)-pretonic's limitations. When the pretonic vowel is underlyingly centralized, IDENT([ATR])-pretonic incorrectly favors retention of that centralization:

(14)

/Oréganu/	LICENSE 4	*[–ATR] 3	IDENT([ATR])-pretonic 2	H
(☞) a. orÉgAnU	+3	−3	−1	1
💣 b. OrÉgAnU	+4	−4		4

Because post-tonic harmony requires LICENSE to outweigh *[–ATR] (as we saw in (11b)), if IDENT(ATR)-pretonic (in conjunction with *[–ATR]) can prevent LICENSE from extending harmony to a pretonic /o/, it can also prevent (with help from LICENSE) *[–ATR] from decentralizing a pretonic /O/. In establishing the former gang effect, we also admit the latter.

Problems do not disappear with IDENT([+ATR])-pretonic, which preserves only [+ATR] and therefore assigns no penalties in (14) while still ruling out overshoot in (13). As long as LICENSE outweighs *[–ATR], candidate (b) in (14) still wins.

Rich-base inputs do not threaten asymmetric CRISPEDGE. Because faithfulness plays no role in the analysis developed in Section 2 (or more accurately, faithfulness is too low-weighted to affect the outcome—see Kaplan (to appear) for faithfulness's role in licensing-driven patterns in HG), input vowels' [ATR] specifications are inconsequential. The outcome in (6), e.g., does not change if the input is /Oréganu/.

Neither CRISPEDGE-S nor IDENT(ATR)-pretonic capture the generalization at hand. The former discourages feature-sharing between the stressed syllable and all other positions, not just pretonic ones, and the latter does not discourage pretonic harmony but instead discourages any unfaithfulness in pretonic positions. In contrast, CRISPEDGE-L hits the nail on the head by militating against feature-sharing between the stressed syllable and pretonic positions.

Like CRISPEDGE-L, the positional markedness constraint *[–ATR]-pretonic captures the intuition that [–ATR] should not (generally) appear to the left of the stressed syllable. Were it to replace CRISPEDGE-L in (7) and (9), the candidates' violation profiles and the outcomes of the tableaux would not change. And like CRISPEDGE-L, *[–ATR]-pretonic deals correctly with inputs containing pretonic centralized vowels. *[–ATR]-pretonic, though, is not a well-formed constraint. Typically, positional markedness bans marked

elements in weak positions; see Walker (2011), e.g., for a defense of this view. Unfortunately, pretonic positions, especially in Romance languages, show signs of strength; for example, they resist vowel reduction in some Romance varieties (Canalis, 2009). (See Crosswhite (2001), e.g., for other similar pretonic/post-tonic asymmetries.) Nor is it obvious that *[–ATR]-pretonic belongs to the family of augmentation constraints (Smith, 2005), which are markedness constraints that enhance a strong position's prominence. I conclude, then, that *[–ATR]-pretonic is illicit because it is not consistent with the typology of position-sensitive markedness constraints.

4 Conclusion

Unlike most assimilation motivated by Positional Licensing, harmony in Tudanca Montañés does not always stop at the licensor. This means two things: first, Positional Licensing must motivate overshoot, a requirement met by positive Positional Licensing. Second, positive Positional Licensing's power must be held in check lest harmony run amok. Only CRISPEDGE-L adequately fills that role. By militating against harmony that extends beyond the stressed syllable's left edge, it protects pretonic syllables while not interfering with harmony in the post-tonic domain. If positive Positional Licensing drives licensing-based harmony more generally, as I argue in Kaplan (to appear), asymmetric CRISPEDGE has a large and central role to play in confining harmony to the proper domain. Conceivable substitutes for asymmetric CRISPEDGE fail to distinguish pretonic harmony from post-tonic harmony, do not properly evaluate certain input configurations, or flout generalizations concerning well-formed markedness constraints.

CRISPEDGE belongs to a category of constraint that regulates the edges of phonological (and other) domains. Other constraints types that belong to this category, such as Alignment (McCarthy and Prince, 1993) and Anchoring (McCarthy and Prince, 1995), distinguish left and right edges, and the argument put forth here extends this functionality to Ito and Mester's own contribution to this literature. That CRISPEDGE warrants the power already granted to other constraints should not be surprising—as Ito and Mester themselves say, "general notions like 'edge,' 'left,' and 'right' are not the exclusive property of Alignment Theory" (1999:209). Perhaps what is surprising is that it has taken so long to find evidence for this.

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