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Fundamental Universals of Language (expanded version)*

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1. Introduction

There is a clear link between the form and content of linguistic universals and basic assumptions about the nature of language. Those who believe that the core properties of language can be captured by generalizations about directly observable features of phonology, morphology, and syntax seek universals couched in those terms. The pioneering work of Greenberg (1963) did just this, proposing universals such as those in (1).

(1) a. In languages with prepositions, the genitive almost always follows the governing noun; in languages with postpositions, the genitive almost always precedes the governing noun. (Universal 2)
b. Languages with dominant VSO order are always prepositional. (Universal 3)
c. In languages with dominant VSO order, an inflected auxiliary always precedes the main verb; in languages with dominant SOV order, an inflected auxiliary always follows the main verb. (Universal 16)

In contrast, those who believe that the properties of language can only be understood with reference to abstract rules and representations whose features are not evident in the physical form of the sentence propose universals that incorporate notions and contrasts of this type. The laws developed within the Principles and Parameters tradition initiated by Chomsky (1981) are prime examples of this.

(2) a. An empty category must be properly governed. (The Empty Category Principle)
b. An anaphor must be bound in its governing category. (Principle A)
c. Movement is only possible from the left edge of a phase. (The Phase Inpenetrability Condition)

As Evans & Levinson (2009) note, the universals put forward in both traditions have in general fared poorly—they have typically either been falsified outright or

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have had to be stated in a weaker form, with reference to statistical tendencies, implicational relationships, or parametric variation.

In what follows, I will propose another possibility: there are genuine linguistic universals, but they are derived not from data about the properties of individual languages but rather from more basic facts about the non-linguistic mechanisms involved in language production, comprehension, and acquisition. I will henceforth call generalizations with this inferential base 'fundamental universals of language.'

I take as my starting point an idea also adopted by E & L (p. 444): commonalities among languages are the product of 'myriad interactions between communicative, cognitive and processing constraints.' This view is a special case of the more general philosophical stance known as *emergentism*, which holds that complex and unexpected facts can arise from the interaction of more basic properties and propensities (Stefan 1997; O'Grady 2005, 2008). From this perspective, language is a second-order phenomenon: there is a language faculty, but it is not made up of linguistic principles of either the Greenbergian or Chomskyan type. Rather, the emergentist language faculty is, in the apt words of Bates & MacWhinney (1988), 'a new machine built out of old parts' that are not themselves linguistic—as E & L also suggest (e.g., p. 446).

But what are these 'old parts,' and do they have effects that are manifested in the same way in all languages? With the help of two examples, one involving phonology and the other syntax, I will argue that the emergentist view of the language faculty supports the formulation of fundamental laws that have exceptionless effects in all languages.

2. Obstruent voicing

It is widely known that stops resist voicing. Of the 706 languages in Ruhlen's (1975) survey, 166 allow only voiceless stops; another 536 languages permit both voiced and voiceless stops. This invites formulation of an implicational universal to the effect that voiced stops entail voiceless stops, but such a generalization is undermined by the existence of four languages in Ruhlen's sample that allow only *voiced* stops—precisely the sort of fact that plagues the quest for linguistic universals, as E & L note. A different type of generalization fares better, however.

Voicing requires a steady flow of air through the vocal folds, which becomes increasingly difficult as air accumulates in the space between the glottis and the consonant's point of articulation. As the pressure difference across the vocal folds decreases, so does air flow in accordance with Pascal's Law.

(3) **Pascal's Law**
Pressure within a system must be equal throughout the system.

Unless measures are taken to increase the size of the supraglottal cavity by lowering the larynx and/or expanding the cheeks, the subglottal air pressure

quickly falls below the threshold necessary to maintain vocal cord vibration and voicing ceases. See Ohala (1995) for discussion.

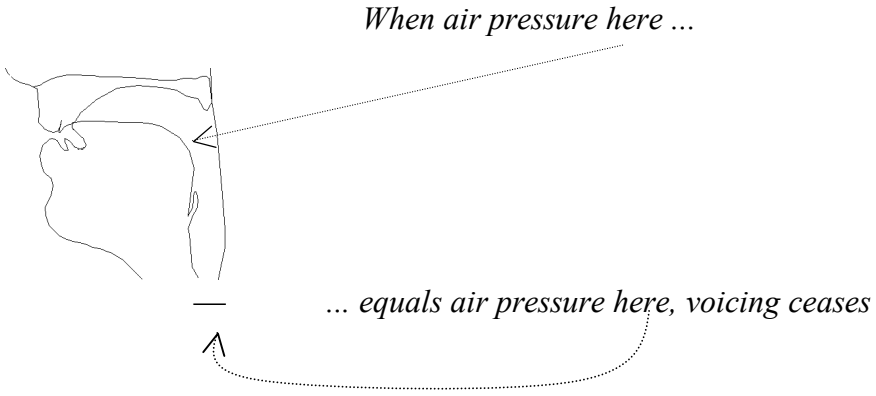

Figure 1. Air pressure and voicing

This observation sets the stage for a putative fundamental linguistic universal—a generalization about language that follows from a more basic non-linguistic fact, in this case Pascal's Law.

(4) **The Voicing Universal (Fundamental Universal 1)**
Voicing is difficult to maintain during the production of a stop.

This universal provides a straightforward explanation for why languages might lack voiced stops altogether, as many of the languages in Ruhlen's sample do. In addition, it explains why voiced stops tend to be shorter than their voiceless counterparts (Ohala 1983:195) and for why velar stops, with their relatively small oral cavity (and correspondingly limited options for expansion), are less likely cross-linguistically to be voiced than are their alveolar and labial counterparts (Ohala 1995:86).

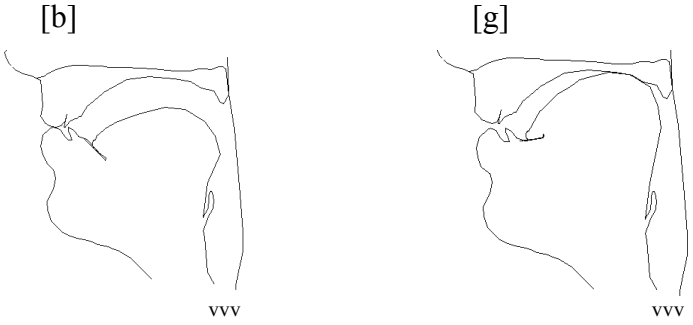

Figure 2. Differences in the size of the oral cavity for [b] and [g]

Crucially, the Voicing Universal is secure even in those few languages that allow only voiced stops. No one's vocal tract escapes the effects of Pascal's Law.

Every attempt to maintain voicing in the face of supra-glottal closure encounters the same physiological obstacles, regardless of whether the language permits only voiced stops (Gudanji, a language of Australia), only voiceless stops (Hawaiian), or both voiced and voiceless stops (English).

There is even a way to test this claim: if in fact speakers of Gudanji feel the effects of Pascal's Law, as surely they must, voiced velar stops in that language should be shorter than voiced labial stops. Given the difference in the size of oral cavity for each sound (see figure 2), supra-glottal pressure should build up more slowly during the production of [b], thereby allowing a longer period of voicing.

If this is on the right track, then cross-linguistic differences in whether languages allow voiced stops reflect how and whether the effects of Pascal's Law are accommodated, not whether those effects are present—they always are. (Berent 2009 independently makes a similar point with respect to the sonority hierarchy and its role in regulating consonant clusters.)

The key point in all of this is simple. The search for universals that hold of *phonological inventories* is indeed highly problematic—the fate of the putative generalization that voiced stops entail voiceless stops is typical in this regard. But the prospects are very different for Pascal's Law and for the fundamental universal that we draw from it: voicing is difficult to maintain during the production of a stop. This generalization is invariant and exceptionless, and its effects are felt by every speaker every time he or she produces a voiced stop in any language.

An example from syntax illustrates the same point.

3. Filler-gap dependencies

A common feature of natural language is the presence of 'filler-gap dependencies,' such as those found in certain types of *wh* questions and relative clauses, among other patterns.[1]

(5) a. What did the dog find _?
b. the book [which Harry recommended _]

It is widely recognized, both in the linguistic literature and in the literature on neuro-cognition, that filler-gap dependencies place a special burden on working memory (e.g., Gibson 1998, Kluender 1998:247, Goodall 2004:102, Hawkins 2004: 173, Phillips et al. 2005).

As of yet, there is no Pascal's Law for working memory—we have no general metric for measuring the costs incurred by the various operations it supports, but

[1] The term 'gap' is intended to be neutral with respect the question of how these sentence types are formed and interpreted; there is no implication that a movement operation is involved.

there is general support within language in particular and within cognition in general (Lewis et al. 2006) for what might be called the Distance Law. [2]

(6) **The Distance Law**
The burden on working memory increases with the time/distance over which information must be maintained.

There is good reason to think that the cost associated with filler-gap dependencies is sensitive to the number of intervening clause boundaries (Frazier & Clifton 1989; Kluender 1998:253) and the number of intervening items with discourse referents (Gibson 1998, Grodner & Gibson 2005, Lewis et al. 2006). Research along these lines supports a generalization that I will dub the Filler-Gap Universal.

(7) **The Filler-Gap Universal (Fundamental Universal 2)**
The difficulty of a filler-gap dependency increases with its length (calculated in terms of the number of intervening clause boundaries and phrases with discourse referents).

One manifestation of this universal is seen in a contrast across languages with respect to whether filler-gap dependencies can extend over a clause boundary. As noted by Hawkins (2004:193ff), languages such as Russian and German permit a filler-gap dependency to extend into an embedded infinitival VP, but not into an embedded clause.

(8) Russian

a. Filler-gap dependency extending into embedded VP
Vot ogurcy [**kotorye** ja obeščal [**Inf** prinesti _]]
Here.are cucumbers which I promised to.bring

b. Filler-gap dependency extending into embedded clause
*Vot ogurcy [**kotorye** ja obeščal [**S** čto prinesu _]]
Here.are cucumbers which I promised that I.bring

In contrast, English permits a filler-gap dependency to extend into either an embedded infinitival phrase or an embedded clause.

[2] As Lewis et al. (2006:452) independently note, the metric may be time-related rather than distance-related, but this does not change the basic point.

(9) English

a. Filler-gap dependency extending into embedded VP
Here are the cucumbers [**which** I promised [**Inf** to bring _]]
|_____|

b. Filler-gap dependency extending into embedded clause
Here are the cucumbers [**which** I promised [**S** that I'd bring _]]
|_____|

Swedish goes one step further, also allowing a filler-gap dependency to extend into an embedded clause that is itself inside an NP.

(10) Swedish
ett ben [**som** jag ser [**NP** en hund [**S** som gnager på _]]]
|_____|
the bone which I see a dog which gnaw on
'the bone which I see a dog which is gnawing on'

This particular manifestation of the effects of the Distance Law appears to be cumulative and asymmetrical—no language permits filler-gap dependencies that extend across a clause boundary while rejecting those that do not.

A less straightforward but perhaps more instructive case involves another phenomenon involving relative clauses. It has long been known that (post-nominal) direct object relative clauses place a greater burden on working memory than do subject relatives (Wanner & Maratsos 1978, Gibson 1998, Caplan & Waters 2002, Levy 2008), arguably because of the greater number of intervening items with discourse referents (NPs and lexical verbs), as Gibson suggests.

(11)a. Subject relative clause
the man [that _ helped the passerby]
|__0__|

b. Direct object relative clause
the man [that the passerby helped _]
|_____1_____2____|

This appears to parallel a quite robust linguistic generalization proposed by Keenan & Comrie (1977): any language that permits a gap-type direct object relative clause also allows the comparable subject relative clause pattern, but not vice versa, in accordance with a general accessibility hierarchy (subj > dir obj > ind obj > ...).

Significantly though, there seem to be genuine counterexamples to this generalization: a relatively small set of syntactically ergative languages, of which the Polynesian language Tongan offers an example, allow filler-gap direct object relatives but not subject relatives in transitive clauses (Otsuka 2001:191-92).

(12)a. *Relativization of the direct object of a transitive clause*:
e fefine [‘oku ‘ofa‘i ‘e Sione _]
the woman Prs love Erg Sione
‘the woman who Sione loves’

b. *Relativization of the subject of a transitive clause*:
*e siana [na‘a langa _ ‘a e fale]
the man Pst build Abs the house
‘the man who built the house’

This undermines the generalization that direct object relatives entail subject relatives, but not the fundamental universal based on the Filler-Gap Law—unless it can be shown that there is an inverse (or no) relationship in Tongan between working memory load and the number of items intervening between filler and gap. This seems unlikely, and there is a way to investigate the issue: if the Filler-Gap Universal holds in Tongan, the processing difficulty of (12a) should increase with the complexity of the subject NP. Hence the filler-gap dependency should be more costly in (13b), with a long intervening subject NP, than in (13a), where the subject is shorter.

(13)a. Direct object relative with a short subject (= (12a)):
e fefine [‘oku ‘ofa‘i ‘e **Sione** _]
the woman Prs love Erg Sione _
|_____1_____2____|
‘the woman who Sione loves’

b. Direct object relative with a long subject:
e fefine [‘oku ‘ofa‘i **‘e he tokoua ‘o Sione**_]
the woman Prs love Erg Ref brother of Sione _
|_____1_____2_____3____|
‘the woman who Sione’s brother loves’

To my knowledge this matter has not been investigated in Tongan, but it is worth noting that Grodner & Gibson (2005) report just such a result for English; see also Lewis et al. (2006:451).

In sum, it seems plausible to suppose that Tongan is not insensitive to distance effects, even though it allows a relatively long dependency while spurning its shorter counterpart. This calls for an explanation of course, perhaps with reference to the semantics of ergativity,[3] but it does not in and of itself undermine the Filler-Gap Universal or the Distance Law on which it is based.

[3] Ergative languages seem to assign special prominence to the direct object in transitive clauses (e.g., Manning 1996:87, Carreiras et al. 2010:90). This may make them more suitable than subjects for relativization, despite the greater burden on working memory.

4. Concluding remarks

In sum, there are two competing views in the literature on universals. On the one hand, there are *occurrence universals*, which predict that certain grammatical properties and patterns must occur in language. Generalizations of this type, characteristic of both the Greenbergian and Chomskyan traditions, have become increasingly imperiled as more information becomes available about the diversity of human language. On the other hand, there are *difficulty universals*, which predict only that particular properties and phenomena are more difficult to instantiate than others for reasons independent of language per se. These are what I call 'fundamental universals,' because their predictions can be traced to foundational mechanisms that underlie language, consistent with the emergentist thesis.

For the purposes of illustration, I have outlined two fundamental universals of language. The Voicing Universal, which follows from Pascal's Law, stipulates that voicing is difficult to maintain during the production of a stop. The Filler-Gap Universal, which is derived from the Distance Law, holds that the difficulty of filler-gap dependencies increases with the number of intervening clause boundaries and lexical items.

Although there is real hope that these generalizations will prove to be exceptionless, it is essential to note that they bear on questions of difficulty, not impossibility. Data about the occurrence of certain phonemic inventories or the acceptability of particular types of relative clauses cannot undermine fundamental universals. All other things being equal, a universal based on Pascal's Law falls only if the vocal tract is not a system in which pressure must be equalized, and a universal derived from the Distance Law is refuted only if working memory is indifferent to the amount and type of material that intervenes between fillers and gaps.

Facts about whether particular languages allow only voiced stops or only direct object relatives bear on a different issue—the question of whether and how the effects associated with fundamental universals 'translate' into typological preferences. If the phenomena considered here are typical (which I think they are), we can expect fundamental universals to have systematic reflexes (see table 1). The vast majority of languages with voiced stops do indeed also have voiceless stops, and most languages with direct object relative clauses also allow subject relatives. As Haspelmath (2009) notes, it is no accident that the best supported generalizations about language make reference to implicational hierarchies defined in terms of the cost of processing, articulation, and so forth.

Table 1. External laws, fundamental universals, and the properties of languages

External law	Fundamental universal	Typological tendencies
Pascal's Law	difficulty of voicing during stops (the Voicing Universal)	preference for voiceless stops over voiced stops; shorter duration for voiced stops than for voiceless stops; voiced labial stops more likely than voiced velar stops
Distance Law	processing cost sensitive to number and type of elements intervening between filler and gap (the Filler-Gap Universal)	preference for intra-clausal dependencies over cross-clausal dependencies; preference for subject relatives over object relatives

If these ideas are on the right track, research into linguistic universals within an emergentist paradigm needs to address two parallel sets of issues:

§What are the non-linguistic principles and propensities (e.g., Pascal's Law, The Distance Law) that make up the human language faculty, and what fundamental universals of language follow from them?

§To what extent do the effects of fundamental universals (the Voicing Universal, the Filler-Gap Universal), which are felt without exception by all speakers of all languages, shape the properties of individual linguistic systems? Can a language have voiced stops without having voiceless stops, even though the former require greater articulatory effort? Can a language permit direct object relatives but not subject relatives, even if the former place a greater burden on working memory? What are the extenuating circumstances in which such 'markedness mismatches' arise?

The guiding principle for this research program is that fundamental universals of language stand or fall independently of generalizations about the typological properties of individual languages. Their validity rests on claims about the foundational mechanisms on which language is built—a particular type of vocal tract, a working memory subject to time- and load-related restrictions, a cognitive system of a certain sort, and so forth. There is real hope that such universals will prove to be exceptionless and that they will shed real light on how language works.

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