An Optimality-Theoretic Typology of Case and Grammatical Voice Systems*

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In this paper we explore the consequences of the hypothesis that Universal Grammar contains formal counterparts of extremely simple constraints like these: agents surface as subjects; low-prominence arguments do not surface as subjects or objects; low-'animacy' arguments surface as objects. Using Optimality Theory (Prince & Smolensky, 1991, 1993) to formally manage the necessary violations of such constraints as they come into mutual conflict, we show that such simple universal principles governing the mapping of semantic roles to surface morphosyntactic roles can provide formal explanation of empirical cross-linguistic typologies of case and grammatical voice systems.

Optimality Theory provides a general means for constructing particular grammars from universal constraints, and of generating theoretical typologies of possible languages from the same constraints; this is summarized in §1. In §2, we present the universal constraints that constitute our proposed theory of case and voice. In this paper, we take a grammatical voice to be a particular mapping of thematic roles to surface abstract cases. In §3, we show how the theory entails three possible intransitive case-marking systems: Nominative/Accusative, Ergative/Absolutive, and Active/Stative. In §4, we illustrate how the theory treats one example language from each of these three systems, including voice as well as intransitive case. In §5, we state a set of implicational universals entailed by the theory and use them to derive analytic typologies of case/voice systems. In §6, we briefly sketch some extensions.

1. Analytic Typology in Optimality Theory

In Optimality Theory, a grammar is taken to be a function mapping each linguistic input (e.g., an underlying phonological string) to its correct structural description, or 'parse', or 'output' (e.g., a prosodic parse: Prince & Smolensky 1993). Universal Grammar (UG) provides the universe of possible outputs available to all languages: the *candidate set*. UG also provides a set of well-formedness constraints on outputs. These constraints are, in general, highly **conflicting**: for many inputs, all possible outputs violate at least one constraint. A grammar is a means of ordering all possible outputs according to how well they satisfy the well-formedness constraints — i.e., how *harmonic* they are (the term 'Harmony' derives from Smolensky 1986). The most harmonic possible ouput for a given input — the *optimal* output — is the structural description which is declared well-formed by the grammar: it is the correct output for that input.

The difficult job of the grammar of a particular language, then, is to determine which possible structural description of an input is most harmonic, when all such possibilities may violate some universal well-formedness constraints. According to Optimality Theory, a grammar does this by ranking the universal constraints in a language-particular *dominance hierarchy*: the grammar declares that satisfying any given constraint is strictly more important than satisfying all lower-ranked constraints. For any input, the output *O* assigned to that input by the grammar is more harmonic than any

alternative structural description *A* of the input, in the following sense: if there are any constaints which *O* violates more strongly than *A*, then there is another, higher-ranked, constraint which *A* violates more strongly than *O*.

When a structural description violates a constraint $\mathbb{C}$, we say that it *incurs the mark* *$\mathbb{C}$. When one constraint $\mathbb{C}_1$ dominates another $\mathbb{C}_2$ in the dominance hierarchy of a language, we write $\mathbb{C}_1 >> \mathbb{C}_2$; this means, in effect, that the mark *$\mathbb{C}_1$ is a 'worse violation' than *$\mathbb{C}_2$: it does more to lower the Harmony of a structure which incurs it. When one structural description *B* is more harmonic than an alternative *W* (when *W* incurs a worse set of marks), we write $B \succ W$; in a sense made precise by Optimality Theory, *B* is 'less marked' than *W*.

The general methodology we deploy runs as follows:

(1) **Analytic Typology in Optimality Theory.**
   a. Hypothesize a universal set of possible structural descriptions.
   b. Hypothesize a universal set of well-formedness constraints governing such structures.
   c. Consider all possible rankings of the constraints into dominance hierarchies; these define the predicted set of possible language-particular grammars.[1]
   d. For each possible hierarchy, determine the well-formed structures of the corresponding language.

The central innovation to grammatical theory provided by Optimality Theory, which we exploit here to the fullest, is this: UG is characterized as a set of highly general constraints which are frequently violated by the licit forms in the language. The theory tightly controls constraint violation, ensuring that licit forms only violate a constraint when doing so is necessary to permit satisfaction of a more highly ranked constraint. Optimality Theory has enabled the formulation and formal analysis of a number of highly general universal constraints in phonology: see Prince & Smolensky (1993) and the two-dozen Optimality Theoretic papers cited therein, especially McCarthy & Prince (1993). To our knowledge, the present paper describes the first systematic application of Optimality Theory outside phonology and morphology.

2. A Minimal Theory of Abstract Case

2.1 Inputs. Here, an input to be assigned a structural description by a grammar is simply a clause or a predicate/argument complex. Each argument in the input is labelled with its thematic role; here we treat only agent and patient[2]. In addition, each argument is labelled with an abstract 'prominence' level, high or low. The voice alternations we treat are driven by prominence demotions in the input: the abstract 'passive' we consider arises from an input consisting of a low-prominence agent and a high-prominence patient. We denote this input '**aP**', using '{a,p}' to denote low- and '{A,P}' high-prominence agents and patients, respectively. Our abstract 'antipassive' arises from the input **Ap**, with prominence-demoted patient. Simple transitives (active voice) derive from the input **AP**. Our two intransitive inputs are **A** and **P**, depending on whether the argument is a thematic agent or patient. (The predicate itself is not made explicit in the input.)

2.2 Outputs. The output assigned by a grammar to an input consists in the input argument themselves, together with a value for each argument of what we will call an 'abstract case'. We take such cases to be realized by overt morphological case on the NPs in some languages, by word order in others, and by verbal cross-referencing in still others. We do not explicitly treat verbal morphology or auxiliaries which may be associated with certain voices.

For our initial work restricted to two thematic roles, we assume only three possible abstract cases: C_1, C_2, and C_4. As shown in §2.4, the theory entails that, in all languages, C_1 and C_2 are the abstract cases respectively assigned to the arguments A and P for the simple transitive input **AP**; therefore, in any given language, we take C_1 and C_2 to be realized through whatever surface means are used to designate the agents and patients in simple transitive sentences. In the simple account here, C_4 subsumes all lower cases, including dative or oblique overt case on NPs, as well as failure of an argument to appear on the surface at all.

We notate outputs by simply subscripting each thematic argument with the number of the case it is assigned; for example, the simple transitive input **AP** is universally assigned the output A_1P_2 (as we show below in §2.4). We assume that the candidate set of possible outputs made available by UG excludes every structure in which two different arguments are assigned the same *core case* C_1 or C_2; thus, e.g., A_1P_1 and a_2P_2 are not possible outputs.[3]

In all languages, intransitive arguments are taken to bear case C_1 or C_2 when they are realized on the surface like the agents or the patients, respectively, in simple transitive sentences. This will permit all languages to be treated using a common set of universal constraints governing the assignment of abstract case.

The traditional names associated with C_1/C_2 vary depending on the intransitive case assignment strategy of the language. 'Nominative/accusive' (NOM/ACC) are the names traditionally used when intransitive arguments are all marked like transitive agents: in our terms, when intransitive arguments are assigned C_1, regardless of whether they are thematic agents or patients. The traditional terms are 'ergative/absolutive' (ERG/ABS) when, in our terms, intransitive arguments are all assigned C_2. Finally, 'active/stative' (ACT/STA) is the traditional terminology when intransitive agents receive C_1 but intransitive patients receive C_2.

Our first result is a derivation of this typology of case marking systems for intransitive clauses: we show that nominative/accusative, ergative/absolutive, and active/stative systems arise from different dominance rankings of a single universal set of constraints. But first we must present these constraints.

2.3 The Universal Constraints. We propose the following set of constraints:[4]

(2) **Universal Constraints Governing Abstract Case**

a. $\mathbf{A \rightarrow C_1}$: Agents receive abstract case C_1.
b. $\mathbf{P \rightarrow C_2}$: Patients receive abstract case C_2.
c. $\mathbf{A \not\rightarrow C_2}$: Agents do not receive abstract case C_2.
d. $\mathbf{P \not\rightarrow C_1}$: Patients do not receive abstract case C_1.
e. $\boldsymbol{\alpha} \not\rightarrow \mathbf{C_4}$: Core arguments (agents and patients) do not receive abstract case C_4.
f. $\boldsymbol{\alpha} \rightarrow \mathbf{C_2}$: Some argument is case-marked C_2.
g. $\mathbf{X \rightarrow C_1}$: High-prominence arguments receive abstract case C_1.
h. $\mathbf{x \not\rightarrow C_{12}}$: Low-prominence arguments are not core case-marked (C_1 or C_2).

Most of these constraints arise from the natural assumption that the mappings between thematic roles and cases which are manifest in simple transitives satisfy the universal mapping constraints: agents receive C_1 and not C_2 or C_4 (a,c,e); patients receive C_2 and not C_1 or C_4 (b,d,e). Some argument is case-marked C_2 (f) (and another is marked C_1; a constraint to that effect is redundant with (g), since in all inputs considered here, at least one argument is of high prominence). The constraints sensitive to abstract prominence (f,g) reflect the fact that prominence-demotion as manifest in passive and antipassive voices is expressed through loss of core case by core arguments (g), and, in the case of passive, the opportunity for a high-prominence patient to be promoted to C_1 (f). These constraints formally capture aspects of the functional correlation between subjecthood and discourse prominence (e.g., Givón 1984, 1989).

It is important to note that these proposed constraints and the input/output representations they presume are neutral with respect to many syntactic assumptions. Our cases might be primitive elements in a syntactic theory (analogous to the 'MAP's of Gerdts 1993, this volume, and references therein). On the other hand, while it is not made explicit in the minimalist notation we employ, constituent structure of considerable complexity is consistent with the theory we explore here; our abstract cases could be taken to encode structural properties, the constraints (2) forming a module of a theory containing other structure-related constraints; the constraints (2) would then presumably serve to license the structural elements or movement required in the optimal structure (e.g., as suggested in another syntactic domain by Grimshaw 1993).

2.4 Active Voice. The means used in a given language to mark the abstract cases C_1 and C_2 are determined by how that language marks the agents and patients in simple transitive sentences. This follows, we asserted, from the fact that our theory of abstract case entails that the input for such sentences, **AP** (high-prominence agent, high-prominence patient), is *always* assigned the output A_1P_2 (i.e., A receives C_1, P receives C_2), regardless of the way the language ranks the universal constraints (2) in its language-particular dominance hierarchy. We now demonstrate this.

The first step is to determine the set of possible outputs for the input **AP**: the candidate set provided by UG. This is: $\{A_1P_2, A_1P_4, A_2P_1, A_2P_4, A_4P_1, A_4P_2, A_4P_4\}$. (As stated in §2.2, assigning both A and P the same core case — A_1P_1 or A_2P_2 — is assumed to be prohibited by UG.) Now since there are two high-prominence arguments and at most one can receive C_1, every candidate must violate constraint (2.g) $\mathbf{X \rightarrow C_1}$ —

only A_1P_1 satisfies this constraint fully, and UG rules out this structure. The output A_1P_2 satisfies all the other constraints, however. All other candidate outputs violate additional constraints; e.g., A_4P_2 also violates $\mathbf{A}\rightarrow\mathbf{C_1}$ and $\boldsymbol{\alpha}\not\rightarrow\mathbf{C_4}$. Thus, no matter how a grammar ranks the universal constraints (2), A_1P_2 is the most harmonic candidate: it incurs only the mark $*\mathbf{X}\rightarrow\mathbf{C_1}$, whereas all the alternatives incur this same mark and others as well. Therefore the theory entails that, in all languages, the structural description assigned to **AP** is A_1P_2.

3. Deducing the Typology of Intransitive Case Systems

Consider the two possible (high-prominence) intransitive inputs: **A**, corresponding to an intransitive predicate taking a thematic agent as argument, and **P**, for a patient-taking predicate. The possible outputs for **A** are just $\{A_1, A_2, A_4\}$; for **P**, $\{P_1, P_2, P_4\}$. The constraints in (2) which bear on these alternatives are given in the following table:

(3) **Intransitive Case Marking Typology**

<table>
<tr><th>Constraint</th><th>Input: P</th><th colspan="2">Input: A</th></tr>
<tr><td>P→C₂</td><td>⇒ choose C_2</td><td colspan="2"></td></tr>
<tr><td>P↛C₁</td><td>⇒ choose C_2</td><td colspan="2"></td></tr>
<tr><td>α→C₂</td><td>⇒ choose C_2</td><td colspan="2">⇒ choose C_2</td></tr>
<tr><td>X→C₁</td><td>⇒ choose C_1</td><td colspan="2">⇒ choose C_1</td></tr>
<tr><td>A→C₁</td><td></td><td colspan="2">⇒ choose C_1</td></tr>
<tr><td>A↛C₂</td><td></td><td colspan="2">⇒ choose C_1</td></tr>
<tr><td>RESULT:</td><td>choose C₂ unless
X→C₁ dominates
P→C₂, P↛C₁ and
α→C₂</td><td colspan="2">choose C₁ unless
α→C₂ dominates
X→C₁, A→C₁ and A↛C₂</td></tr>
<tr><td></td><td></td><td>A_1</td><td>A_2</td></tr>
<tr><td></td><td>P_2</td><td>Active/Stative</td><td>Erg/Abs</td></tr>
<tr><td></td><td>P_1</td><td>Nom/Acc</td><td>IMPOSSIBLE</td></tr>
</table>

Consider first the input **P**, and two of the possible outputs, P_1 and P_2. As the table shows, three of the constraints will be satisfied if and only if P is assigned C_2, i.e., iff the output is P_2. The fourth constraint is satisfied only if the output is P_1. Which output is more harmonic? In Optimality Theory, we do ***not*** answer this by majority vote; rather, we consult the language's dominance hierarchy. If the fourth constraint $\mathbf{X}\rightarrow\mathbf{C_1}$ dominates the other three, it wins, and P_1 is the more harmonic; otherwise, it is P_2. According to the methodology

of Analytic Typology (1), cross-linguistic variation is generated by all possible rankings of universal constraints, so the theory predicts that P will receive case C_1 in some languages (those which rank $\mathbf{X \rightarrow C_1}$ highest) and case C_2 in others. These two possibilities are indicated in the bottom two lines of the table (shaded).

We have ignored the remaining candidate, P_4. Regardless of how the constraints are ranked, this structure can never be more harmonic than P_2: the only mark incurred by P_2 is $*\mathbf{X \rightarrow C_1}$, and P_4 incurs this mark *as well as* the marks $*\mathbf{P \rightarrow C_2}$ and $*\boldsymbol{\alpha} \not\rightarrow \mathbf{C_4}$. Thus P_1 and P_2 are the only two possible optimal structures.

The case of agentive intransitives is analogous: it is treated in the rightmost column of table (3). Again, there are two possibly optimal candidates, A_1 and A_2; the latter will be optimal only in languages which rank $\boldsymbol{\alpha \rightarrow C_2}$ higher than the other three relevant constraints, all of which are violated by A_2.

Analytic typology (1) assuming the universal constraints (2) thus predicts the typology of intransitive case-marking systems given in the shaded lower-right portion of (3). Depending on its ranking of the universal constraints, a given language will fall into one of the three possible cells: the fourth cell, a language systematically assigning intransitive agents C_2 and patients C_1, is predicted impossible because it would require that $\mathbf{X \rightarrow C_1} >> \boldsymbol{\alpha \rightarrow C_2}$ (for P_1) and, in the same dominance hierarchy, that $\boldsymbol{\alpha \rightarrow C_2} >> \mathbf{X \rightarrow C_1}$ (for A_2). The three predicted systems correspond to the traditional active/stative (A_1,P_2), ergative/absolutive (A_2,P_2), and nominative/accusative (A_1,P_1) systems.

4. Treatment of Example Languages

The ranking of the universal constaints (2) by a language's grammar determines the cases assigned to all the possible inputs considered here, not just the intransitive inputs considered in §3. We now illustrate the patterns of case assignment across several different inputs, for three different dominance hierarchies corresponding to three typological language families. Appendix A provides a summary by language of the actual case/voice systems we refer to in the paper; relevant references are marked in the bibliography.

4.1 A Nominative/Accusative Example. The following is an Optimality Theoretic *constraint tableau* for a typological family which includes English:

(4) **Constraint Tableau for English-type Languages**

Input	Output	X→C$_1$	x↛C$_{12}$	α→C$_2$	A↛C$_2$	A→C$_1$	P↛C$_1$	P→C$_2$	α↛C$_4$
A	☞ A$_1$			*					
	A$_2$	*			*	*			
P	☞ P$_1$			*			*	*	
	P$_2$	*							
aP	a$_1$P$_2$	*	*						
	a$_2$P$_1$		*		*	*	*	*	
	☞ a$_4$P$_1$			*		*	*	*	*
	a$_4$P$_2$	*				*			*
Ap	A$_1$p$_2$		*						
	☞ A$_1$p$_4$			*				*	*
	A$_2$p$_4$	*			*	*		*	*

Across the top of (4) is a ranking of the universal constraints (2), with most dominant to the left. (Certain modifications of the ranking would not effect the results.) Comparing the dominance hierarchy against the shaded intransitive typology of (3), we see that the conditions are met for a nominative/accusative system: **X→C$_1$** *does* dominate all three constraints **P→C$_2$**, **P↛C$_1$** and ***α*→C$_2$**, so **P** will be assigned C$_1$; on the other hand, ***α*→C$_2$** does *not* dominate **X→C$_1$** so **A** will also be assigned C$_1$. Both high-prominence intransitive arguments A and P must be assigned C$_1$ in order to satisfy the most dominant constraint, **X→C$_1$**. The constraint tableau shows two candidate outputs for **P** (P$_1$ and P$_2$), and shows the marks each receives. (When any constraint ℂ is violated by a candidate output, a '*' is placed in the column for ℂ; this indicates the mark *ℂ). The most-dominant mark incurred by P$_2$, ***X→C$_1$**, is a higher-ranked violation than that of P$_1$, ****α*→C$_2$**, so P$_1$ is more harmonic than P$_2$; P$_1$ is the optimal candidate, and therefore the output (indicated by ☞). (The candidate P$_4$ is not shown in (4) because, as previously explained, it is universally less harmonic than P2.) Similarly, for input **A**, the optimal candidate is A$_1$. This dominance hierarchy gives rise to a nominative/accusative intransitive system.

The remainder of the tableau (4) concerns the passive input **aP** and the antipassive input **Ap**. The candidate outputs shown are all those which are not universally less harmonic than some competitor (cf. §5). For **aP**, the optimal candidate is a$_4$P$_1$: the highest-ranking mark incurred by this structure, ****α*→C$_2$**, is a less serious violation than the highest-ranking marks of all its competitors. Since the output of **aP** is a$_4$P$_1$, in this language, passive is

realized with an agent demoted to C_4 [in English, either an OBL NP or one that does not surface] and a patient promoted to C_1 [NOM]. This configuration, the traditional passive, we dub 'Passive$_1$', the subscript labelling the case of the high-prominence argument (P). The antipassive input **Ap** produces output A_1p_4 — 'Antipassive$_1$' — in which the patient is demoted to C_4 [in English, realized through absence on the surface; e.g., *john ate*].

The dominance hierarchy shown in (4), therefore, yields a language with nominative/accusative intransitive case marking, and Passive$_1$ and Antipassive$_1$ voices. English is of course just one representative of this large typological class.

4.2 An Ergative/Absolutive Example. If the constraint $\mathbf{X \rightarrow C_1}$ topping the preceding hierarchy (boxed column in (4)) is ranked a bit lower, and all other relative rankings remain unchanged, the typological class changes from one including English to one exemplified by Eskimo. As shown in (5) below, the intransitive case marking system is now ergative/absolutive: intransitive A and P both receive case C_2 [ABS]. The optimal parse of **aP** is now a_4P_2 — 'Passive$_2$': the agent demotes to C_4 [in Eskimo, either an OBL or surface-absent NP] while the patient receives C_2 [ABS], like intransitive arguments. The output for **Ap** is now A_2p_4 — 'Antipassive$_2$': the patient demotes to C_4 [OBL or surface-absent in Eskimo] and the agent receives C_2 [ABS]. This is the traditional antipassive structure.

4.3 An Active/Stative Example. If we modify the English-type ranking (4) by moving the pair of constraints $\mathbf{A \rightarrow C_1}$, $\mathbf{P \not\rightarrow C_1}$ (dashed columns in (4)) to the top of the hierarchy, we move to a typological class incuding Lakhota. Tableau (6) below shows that the intransitive case marking system is now active/stative, with A_1 and P_2 optimal. The output for **aP** is now a_1P_2, the same case assignment as in active voice. That is, whether the agent is high- (**AP**) or low-prominence (**aP**) makes no difference: the optimal parse assigns C_1 to the agent in either case. This is a language *without* a passive voice: the top-ranked constraint $\mathbf{A \rightarrow C_1}$ ensures that agents receive C_1, regardless of their level of prominence. There is, however, an antipassive voice: input **Ap** produces output A_1p_4 — Antipassive$_1$ [C_4 = surface-absence in Lakhota].

(5) **Constraint Tableau for Eskimo-type Languages**

Input	Output	x↛C_{12}	α→C_2	X→C_1	A↛C_2	A→C_1	P↛C_1	P→C_2	α↛C_4
A	A_1		*						
	☞ A_2			*	*	*			
P	P_1		*				*	*	
	☞ P_2			*					
aP	a_1P_2	*		*					
	a_2P_1	*			*	*	*	*	
	a_4P_1		*			*	*	*	*
	☞ a_4P_2			*		*			*
Ap	A_1p_2	*							
	A_1p_4		*					*	*
	☞ A_2p_4			*	*	*		*	*

(6) **Constraint Tableau for Lakhota-type Languages**

Input	Output	A→C_1	P↛C_1	X→C_1	x↛C_{12}	α→C_2	A↛C_2	P→C_2	α↛C_4
A	☞ A_1					*			
	A_2	*		*			*		
P	P_1		*			*		*	
	☞ P_2			*					
aP	☞ a_1P_2			*	*				
	a_2P_1	*	*		*		*	*	
	a_4P_1	*	*			*		*	*
	a_4P_2	*		*					*
Ap	A_1p_2				*				
	☞ A_1p_4					*		*	*
	A_2p_4	*		*			*	*	*

5. General Analysis

In §4 we saw three possible case/voice systems which may arise through appropriate ranking of the universal constraints (2). What are all the possible such case/voice systems?

5.1 A Typology of Passives. The possible structures which can in fact surface as outputs from the low-prominence agent input **aP** are these: a_4P_1 = 'Passive$_1$'; a_4P_2 = 'Passive$_2$'; a_2P_1 = 'Reversal'; and a_1P_2 = No Passive. Only these four can be optimal for some constraint ranking — these are the 'possibly optimal' structures. Examination of all other possible outputs (e.g., a_2P_4, a_4P_4, etc.) reveals that each such output W is universally less harmonic than some other, possibly optimal, alternative B: W incurs all the marks incurred by B, and some others as well, so B $\succ$ W, universally (see Prince & Smolensky 1993 §9.1.1).

Of the four possibly optimal outputs for **aP**, two are surface-intransitive: in a_4P_1 and a_4P_2, only P bears a core case (C_1 or C_2). In a_2P_1, agent and patient reverse the cases they receive compared to active voice; this 'Reversal' form of passive is exhibited in, e.g., Navajo (e.g., Jelinek 1990). When a_1P_2 is optimal, the language lacks a passive, as discussed above for the Lakhota class.[5]

While there are four possibly optimal outputs for **aP**, only one is optimal for a given language (determined by its dominance hierarchy); in the simple form presented here, the present theory provides only one possible input for generating passive structures, and since each input generates only one output, multiple passive constructions in a single language cannot be treated. An extension to a richer input representation capable of distinguishing different inputs would allow for multiple passives within a single language.

For subsequent analysis it is important to identify the exact conditions on a dominance hierarchy which will ensure that a given passive structure is optimal. Here is one such *constraint domination condition*; others can be deduced for Passive$_2$, Reversal, and No Passive.

(7) A language has Passive$_1$ if and only if its constraint ranking obeys the following:
   a. either $\mathbf{X}\rightarrow\mathbf{C_1}$ or $\mathbf{x}\not\rightarrow\mathbf{C_{12}}$ dominates each of: $\boldsymbol{\alpha}\not\rightarrow\mathbf{C_4}$ and $\mathbf{A}\rightarrow\mathbf{C_1}$; and
   b. either $\mathbf{A}\not\rightarrow\mathbf{C_2}$ or $\mathbf{x}\not\rightarrow\mathbf{C_{12}}$ dominates each of: $\boldsymbol{\alpha}\rightarrow\mathbf{C_2}$ and $\boldsymbol{\alpha}\not\rightarrow\mathbf{C_4}$; and
   c. $\mathbf{X}\rightarrow\mathbf{C_1}$ dominates each of: $\boldsymbol{\alpha}\rightarrow\mathbf{C_2}$, $\mathbf{P}\rightarrow\mathbf{C_2}$, and $\mathbf{P}\not\rightarrow\mathbf{C_1}$.

It may be verified that the 'English' hierarchy above (4), but not the 'Eskimo' (5) or 'Lakhota' (6) hierarchy, satisfies this condition; Passive$_1$ occurs only in the English case.

5.3 A Typology of Antipassives. For the input **Ap** there are only three possibly optimal structural descriptions: A_2p_4 = 'Antipassive$_2$'; A_1p_4 = Antipassive$_1$; and A_1p_2 = No Antipassive. The same reasoning used with passives will show that the remaining structures are sub-optimal regardless of the constraint ranking. And again, for each of the three possibly optimal parses of **Ap**, it is possible to derive a constraint domination condition, analogous to (7), under which that Antipassive will be present in a language.

5.4 Implicational Universals of Case and Grammatical Voice Systems. By examining the various constraint domination conditions analogous to (7), it is possible to determine which combinations of passive and antipassive voices and intransitive case systems can simultaneously obtain in a single language (i.e., derive from a single constraint ranking).

The results can be stated as follows ['⇒' = 'implies'; '¬' = 'not']:

(8) **Theorem: Implicational Universals**

1. Reversal ⇒ ¬Antipassive$_{1,2}$
2. Passive$_2$ ⇒ ¬Accusative
3. Antipassive$_1$ ⇒ ¬Ergative
4. Antipassive$_2$ ⇒ Passive$_2$
5. Antipassive$_2$ ⇒ Ergative
6. Passive$_1$ ⇒ ¬Active
7. Passive$_1$ ⇒ ¬Ergative
8. Reversal ⇒ ¬Active

This set of implications is non-redundant (each one rules out a combined voice/case system not ruled out by the rest) and complete (every voice/case system not ruled out by these implications can in fact be realized through some ranking of the constraints (2).

5.5 Compound Typologies. These implicational universals determine the typologies shown below under (10). Each shaded cell is an impossible combination, ruled out by the universal(s) labelled by the indicated number(s). We locate in the typology of (10) a number of languages from a survey of voice systems. The predictions of this extremely simple theory are borne out fairly well empirically: although one of the Dyirbal and one of the Mam passives fall into predicted-impossible (grey) cells, and examples have not yet been found for two systems predicted possible (empty white cells), the great majority of languages examined fall in the predicted-possible (white) cells and nearly all cells are exemplified.

6. Extensions

A number of fairly straightforward extensions of the theory, such as to other thematic and case roles, etc., are clearly needed. We mention two less obvious extensions here.

6.1 Impersonal Constructions. A dummy can be treated as a case-receiving element in the output which is not present in the input — analogous to epenthesis in phonology. Certain kinds of Impersonal Passives can then be analyzed, as, e.g., $\mathbb{a}P \rightarrow \mathbb{a}_1P_2$ = 'Impersonal Passive$_{12}$', where $\mathbb{a}$ denotes a missing agent in the input, and $\mathbb{a}_1$ a dummy[6] assigned C_1. As in the Optimality Theoretic treatment of epenthesis, this would violate a constraint FILL, which says that surface structural positions must be filled by underlying material. Impersonal constructions would appear only in languages with FILL sufficiently low-ranked (Prince & Smolensky 1993:25).

6.2 Split Ergativity and the Ergative/Accusative Asymmetry. As indicated in (3), the constraint $\boldsymbol{\alpha}\rightarrow\mathbf{C_2}$ is necessary for the existence of ergative languages, but not accusative ones. In fact, compared to accusative languages, *pure* ergative languages are relatively rare; they are most often split, typically with nominals high on an 'animacy' hierarchy exhibiting an accusative pattern and lower-animacy nominals exhibiting the ergative pattern. This suggests that a more accurate version of the constraint $\boldsymbol{\alpha}\rightarrow\mathbf{C_2}$ might be:

(9) **[–An]→C_2**: Some low-'animacy' argument should recieve abstract case C_2.

The ergativity we have seen resulting from **α→C_2** (when sufficiently highly ranked) would then appear only with low-'animacy' arguments, providing an explanation of why for ergative, but not accusative, systems, splitting seems to be the unmarked case. Similar treatment may be possible for aspect- or tense-based splits.

(10) **The Combined Case/Voice Typology**[5]

Accusative	Antipassive$_1$	Antipassive$_2$	No Antipassive
Passive$_1$	Arabic English Saramaccan	4 5	Bambara Finnish
Passive$_2$	2 Dyirbal(1st/2nd)	2 5	2
Reversal	1	1 4 5	Navajo
No Passive	Ewe Mojave	4 5	Ute

Ergative	Antipassive$_1$	Antipassive$_2$	No Antipassive
Passive$_1$	3 7	4 7 Mam	7
Passive$_2$	3	Dyirbal(3rd) Chamorro Eskimo Mam	Burushaski
Reversal	1 3	1 4	
No Passive	3	4	Enga

Active	Antipassive$_1$	Antipassive$_2$	No Antipassive
Passive$_1$	6	4 5 6	6
Passive$_2$	Lezgian	5	
Reversal	1 8	1 4 5 8	8
No Passive	Lakhota	4 5	Choctaw

Appendix A

Language	Passive (V-morph)	Antipassive	Impersonal: ∅P
Arabic N Acc Palestinian	1 (*ʔin-*) A:0 P:NOM	1 (-0) A:NOM P:0	
Bambara N Acc Mande	1 (*-ra*) A:0,OBL P:ACC	—	
Burushaski N[7] Erg S. Asian isolate	2 (-0/*d-*) A:0/0,OBL P:ABS	—	
Chamorro N Erg Austronesian	2 (*-ma*;*-in*) A:OBL P:ABS	2 (*-man*;*-fan*) A:ABS P:0,OBL	
Choctaw V Act Muskogean	—	—	
Dyirbal N Erg* Pama- (3rd) Nyungan Acc* (1st,2nd)	2 (-0) A:0 P:ABS 2 (-0) A:0 P:ACC	2 (*-ŋay*) A:ABS P:0,OBL 1 (*-ŋay*) A:NOM P:0,OBL	
Enga N Erg* New Guinea	—	—	
English N Acc	1 (periphr. *be*) A:0,OBL P:NOM	1 (-0) A:NOM P:0	
Eskimo NV Erg Greenland	2 (*-(g)au-*) A:0,OBL P:ABS	2 (-0;*-i-*) A:ABS P:0,OBL	
Ewe N Acc Kwa	—	1 (-0) A:NOM P:0	
Finnish N Acc	1 (*-(t)AAn*) A:0,OBL P:NOM	—	12 (*-(t)AAn*) [∅:NOM] P:ACC (pronoun only)
Lakhota V Act* Siouan	—	1 (*wa-*) A:ACT P:0	12 (-0) ∅:ACT P:STA
Lezgian N Act[8] NE Caucasian	2 (-0) A:0 P:STA	1 (-0) A:ACT P:0	

Language	Passive (V-morph)	Antipassive	Impersonal: ⓐP
Mam V Erg Mayan	2 (-*eet*;-*j*;-*ʔn*) A:0,OBL P:ABS 2 (-*njtz*) A:0,OBL P:ABS (A:3rd, underived V) 1 (-*njtz*) A:0 P:ERG (general truths)	2 (-*n*) A:ABS P:0,OBL	
Mojave V Acc Yuman	—	1 (-0) A:NOM P:0	12 (-*č*) [ⓐ:NOM] P:ACC
Navajo N Acc Athapaskan	Reversal (*bi*-) A:ACC P:NOM	—	
Saramaccan N Acc Creole	1 (-0) A:0 P:ACC	1 (-0) A:NOM P:0	
Ute N Acc Uto-Aztecan	—	—	12 (-*ta*-) [ⓐ:NOM] P:ACC

Notes: 'N'= Case realized by morphology on noun and/or word order, 'V'= verbal cross-referencing; 'Erg' = ergative/absolutive, 'Acc' = nominative/accusative 'Act' = active/stative; 'Erg*', 'Acc*', 'Act*' = split system; OBL includes DAT; '0' = surface-absence; [ⓐ] = silent dummy.

Notes

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1. In this paper, we assume that all rankings of the universal constraints are possible. In other applications, restrictions on possible rankings are also part of UG (Prince & Smolensky 1993, §8.1.2; McCarthy & Prince 1993, §7).

2. A natural extension would decompose the cover terms 'agent' and 'patient' into features, figuring in the universal constraints. This would facilitate extension to a fuller spectrum of thematic roles — case-marking of experiencers being of particular interest.

3. This principle is occasionally violated; one case in Lakhota was given a multistratal Optimality Theoretic analysis in Legendre & Rood 1992.

4. It is possible that this constraint set could be modified without affecting the results established below. However, as we will see, fully exploring the consequences of each alternative constraint set is a lengthy matter, and we have not undertaken extensive investigation of alternatives. Some of the more obvious simplifications of the account, however, are not empirically adequate.

5. 'No Passive' here means no *personal* passive. Impersonal passives are briefly considered in §6.1: they derive not from the personal passive input **aP** but rather from ∅**P**: the agent is *absent* from the input.

6. This dummy may be silent. In Appendix A, this has been indicated in the last column by [∅] — in pro-drop languages offering independent evidence for a silent dummy.

7. We treat the noun-marking system of Burushaski; there is also a verbal cross-referencing system, which is not completely aligned with the noun-marking system.

8. Lezgian is described as ergative/absolutive in Mel'čuk 1988; his discussion, however, clearly shows what in our terms is an active/stative system.

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