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Differential Coding, Partial Blocking, and Bidirectional OT*

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1. Differential coding and partial blocking

PARTIAL BLOCKING – in which two semantically equivalent forms coexist, but with non-overlapping distributions – poses a problem for Optimality Theory. A classic OT evaluation produces one winner, but in partial blocking there are (at least) two. Recent work has proposed WEAK BIDIRECTIONAL OT as one solution to partial blocking (Blutner 1999), but the range of phenomena which motivate this architecture over alternatives remains relatively unexplored. Here I suggest that certain cases of DIFFERENTIAL CODING provide one motivation for Weak bidirectional OT.

I use the term DIFFERENTIAL CODING to refer to morphology or syntax which (a) codes the grammatical function of the core arguments in transitive or passive clauses, and (b) is differential in the sense that it is selective, with its distribution dependent on semantic and pragmatic features of the arguments. Differential coding may involve case marking, agreement, direction, or voice. Well-known examples are subject case marking in many Australian languages (e.g. Dyirbal), where some transitive subjects are case marked but not all, differential object marking (e.g. Spanish, Hindi) where some direct objects are case marked but not all. It includes inverse marking as in the Algonquian languages or Nocte, where the verb may carry a mark depending on semantic and pragmatic properties of both nominal arguments (DeLancey 1981). And in some languages, e.g. Lummi, voice is differential in that the distribution of active and passive is categorically restricted by semantic and pragmatic features of agent and patient (Jelinek and Demers 1983).

There is a relation between differential coding and markedness (or prototypicality). Certain semantic and pragmatic properties are prototypical (statistically more frequent) for grammatical objects, especially low animacy, low definiteness, and low topicality. Transitive subjects, in contrast, are prototypically high in animacy, definiteness, and topicality. Differential coding systems mark

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subjects and/or objects which diverge from the prototype, leaving unmarked those which are more prototypical, a generalization known from typological work:

> …the most natural kind of transitive construction is one where the A (=transitive subject, JA) is high in animacy and definiteness, and the P (=transitive object, JA) is lower in animacy and definiteness; and any deviation from this pattern leads to a more marked construction. (Comrie 1989:128)

Differential coding is simply the kind of more marked construction which marks deviations from the norm.

Some of these norms are listed in (1). The prototypical or unmarked situation is for the transitive subject (henceforth 'S') to be associated with the high end of the dimensions in (1a-e) – to be 1st or 2nd person (i.e. LOCAL PERSON), to be animate, to be definite, to be topical. Conversely, the unmarked situation for the direct object ('O') is to be associated with the low end of the same dimensions – to be 3rd person, inanimate, indefinite, non-topic.

(1) Unmarked alignments

a.	Gram. Function:	S	>	O
		↓		↓
b.	Person:	1st/2nd		3rd
c.	Animacy:	Human		Inanimate
d.	Definiteness:	Definite		Indefinite
e.	Topicality:	High		Low

In Dyirbal, it is 3rd person S's (marked S's) which are case marked, not 1st or 2nd; it Spanish, it is animate and specific O's (marked O's) which are case marked, not inanimate or non-specific ones; in Nocte, it is clauses in which both S and O are marked (3rd person S, local person O), which get inverse marking; and in Lummi, it is active clauses with 3rd person S and local person O which are blocked, requiring instead passive expression. It is possible then to derive from (1) a set of implicational universals regarding the distribution of differential coding (on this, see, among others, (Silverstein 1976, Comrie 1989, Aissen 1999a, 2003).

2. The pragmatic division of labor

Differential coding is an instance of PARTIAL BLOCKING (cf. Horn 1989:194). Partial blocking refers to cases in which two semantically equivalent forms coexist, but have non-overlapping distributions. One form, generally the less complex one, expresses a core or prototypical sense, while the other, usually a more complex form, is relegated to a more peripheral sense. An example from Kiparsky (1982) is the pair *cook*/*cooker*. *Cook* is an unmarked agentive noun expressing what we would expect *cooker* to mean; *cooker* is not blocked by *cook*,

but it has a more peripheral sense referring to a utensil.[1] Another example, from McCawley (1978), is the pair *kill*/*cause to die*. The lexical causative *kill* usually describes direct causation, the periphrastic *cause to die* indirect causation. In McCawley's pragmatic account, *cause to die* is restricted to indirect causation because the expression of direct causation is preempted by a simpler form. *Kill* doesn't entirely block *cause to die*, but it blocks one sense.

More generally, McCawley and Horn suggest that partial blocking involves a division of pragmatic labor whereby the less marked (less complex) form expresses the less marked meaning – the one associated with the more stereotypical situation – with the more marked (more complex) form relegated to covering the more marked meaning. McCawley and Horn appeal to Gricean maxims of quantity to explain the association between markedness of form and the stereotypicality of situation. The first is a speaker-oriented economy condition: *don't make your contribution more informative than is required*. If you intend to refer to a prototypical situation, you can afford to be brief. The second is hearer-oriented: *make your contribution as informative as is required*. If you intend to refer to a situation which is not prototypical, you may need to say more because if you use the economical form, the hearer will assume you are referring to the prototypical situation.

3. Differential coding and optimization

There is a clear connection between differential coding and the Gricean account of partial blocking sketched above. When associations are prototypical or unmarked, they need not be formally marked. When they are not prototypical, special marking is in order. The functional motivation of differential coding thus seems clear – it has to do with recoverability of grammatical function. This invites us to ask whether recoverability actually plays a role in determining the synchronic distribution of differential coding. In many cases, perhaps most, the answer is *no*. Differential coding is often overextended (generalized) and obligatory even where it is not needed to recover grammatical function. In Spanish, *Veo *(a) Juan,* 'I see Juan', the case-marking preposition *a* is required for *Juan* even though verb agreement (1st singular subject) leaves no doubt that *Juan* is the direct object. Similarly, Dyirbal has both differential subject marking AND differential object marking, but the two operate independently (Dixon 1972). As a result, there are clauses which require overt case on BOTH S and O (e.g. a clause with 3rd person S, 1st person O). Case on one or the other would be sufficient to insure recoverability of grammatical function; we don't need both.

In short, while there are implicational universals in the distribution of differential coding, it is still necessary in many cases to stipulate exactly what gets marked and what doesn't. The fact that definite inanimate objects in Hindi may be

[1] Partial blocking contrasts with (full) blocking, "the non-occurrence of one form…due to the simple existence of another" (Aronoff 1976:43). E.g. *men* blocks **mans,* and *fury* blocks **furiosity*.

case marked, while in Spanish they cannot be, probably does not follow from other more general properties of these grammars. Within an OT context, 'stipulate' means that the distribution of case marking is enforced by a quite specific constraint, as in (2):

(2) MARK OBJ/HUM & SPEC » *CASE » MARK OBJ

Here, the top constraint enforces case marking for human, specific objects and outranks a constraint penalizing case marking (*CASE). Case marking of other objects is turned off because *CASE outranks, MARK OBJ, a general contraint enforcing case marking of objects (cf. Aissen 2003).

However, there are other cases of differential coding where the distribution of the marked element, while also highly restricted, seems to be exactly determined by recoverability, i.e. overt marking is required exactly when its absence would lead to an interpretation other than the one intended. One example is the distribution of the 3rd person object marker in Takelma; another is the agent focus verb form in Tzotzil. In both cases, the distribution of differential coding is parasitic on the interpretation of the unmarked form and therefore should not be stipulated. Ideally, the analysis would stipulate little about the morphemes involved, allowing their distribution to follow from the way the unmarked form is interpreted. To achieve this, it is necessary to optimize both over form and interpretation.

4. Takelma

Takelma is no longer spoken. My discussion is based on Culy (2000), which was in turn based on Sapir (1922). The morphology of interest here is the suffix *-k^hwa*, a 3rd person object marker (OM) which is realized on the verb. The distribution of *-k^hwa* is very restricted, but I suggest that it is NOT determined by a highly specific constraint like the top one in (2), but by the interaction of more general constraints.

Takelma has a full set of object markers, shown in (3).

(3)

Object markers	Singular	Plural
1st	-xi	-am
2nd	-pi	-anp^h
3rd	ø /-k^{h}wa	ø /-k^{h}wa

Overt marking is required for 1st and 2nd person objects, with singular and plural distinguished. (Overt agreement is also required for 1st and 2nd person subjects, but

is not shown here.) For 3rd person objects, there is an alternation between ø (zero) and the suffix *–kʰwa*; there is no distinction between singular and plural.

Culy documents that the ø variant is found with O's of all kinds, including animates (4a) and inanimates (4b), covert pronouns (4c) and overt nominals (4a). The zero variant occurs in combination with subjects of all three persons (4a, b, c).[2]

(4) a. ani:ʔ ki: t'omoàʔn hamìʔtʰpan. (human object (TT 158:3))
NEG 1SG kill-1SG father-2PL
'I did not kill your father.'

b. kʰài nakai:tʰʔ (inanimate object (TT 56:9))
something do/say-2SG
'What did you say?'

c. alsinlò:kʰ. (covert object (TT 24:12))
meet
'They met him.'

The overt variant *-kʰwa*, on the other hand, is subject to three constraints. First, *-kʰwa* only occurs when the S is also 3rd person (Sapir 1922:168). Second, following Culy, *-kʰwa* is always used when O is higher in animacy than S. Usually, this means that the object refers to a human, as in (5b), or to a "mythic animal conceived of as a human being" (Sapir 1922:168), (5a).

(5) a. mi: p'owó:kʰwa
now sting-OM
'Now they (the yellowjackets) stung him (Coyote).' (TT 74:3)

b. mená yap'a t'omò:kʰwa
bear man kill-OM
'The bear killed the man.' (TG 158)

Third, when S and O are of equal animacy, *-kʰwa* occurs when O is topical, i.e. when it outranks S in topicality. In such cases, the O is usually pronominal (and covert). In both (6a, b), the O is topical at the point in the text where the sentence occurs.

[2] Most of the Takelma examples are taken directly from Culy 2000 (in the IPA orthography that he uses), but are identified according to the original source. Text examples (*TT*) are from Sapir's *Takelma Texts*, reprinted in Golla (1990). Other examples (*TG)* are from Sapir 1922, also reprinted in Golla (1990). Page numbers refer to those of the original publications.

(6) a. há:xank^{h}wahì:s.
burn-OM-almost
'He [Sinew-man] almost burned him [Daldal].' (TT 27:16)
b. xamkwitìk^{h}^{w}takwa mé:x.
threw.into.water-OM crane
'Crane threw her [Grizzly bear] into the water.' (TT 122:13)

Sapir saw the distribution of *-k^{h}wa* in terms of recoverability, and cited the pair in (7) to illustrate (1922:169).

(7) a. t'ipisi: t'ayák^{h}.
ants found
'He found the ants.'

b. t'ipisi: t'ayá:k^{h}wa.
ants found-OM
'The ants found him.'

He observed that (7a) has only the interpretation 'he found the ants'. If, as in (7b), the intended interpretation were, 'the ants found him', where the O refers to a human and the S is overt, then *-k^{h}wa* is needed. Otherwise, the ABSENCE of *-k^{h}wa*, as in (7a), leads to the inverse interpretation. It is the presence of *–k^{h}wa* which somehow deflects that interpretation and forces the overt nominal to be parsed as subject.[3]

The account I develop below builds on this conception of *-k^{h}wa* and expresses the generalization in (8).

(8) *-k^{h}wa* occurs only when its absence would make unrecoverable the intended linking of nominal arguments to grammatical function.

The three restrictions on *-k^{h}wa* identified above can be (informally) understood in the following terms: *-k^{h}wa* is limited to clauses with 3rd person S and 3rd person O because with any other combination of persons, obligatory agreement with 1st and 2nd person S and O unambiguously determines the linkage of nominal arguments to grammatical function. In clauses then with one or two local person arguments, *-k^{h}wa* is not needed to recover the intended interpretation, and in accord with (8), it does not occur. However, in clauses WITH 3rd person S and O, linkage to grammatical function is underdetermined by the agreement morphology; in some of those cases, but not all, *-k^{h}wa* is needed to determine that linkage.

When is it needed? Basically in clauses that run counter to (some of) the biases mentioned earlier – in particular, the bias that subjects be human and the bias that they be topical. Clauses which accord with those biases are unmarked and require no special coding. This is the case in Sapir's (7a), where the subject is

[3] See also fn. 11.

human and topical, and where *-k^{h}wa* is not used. However, clauses not in accord with these biases are marked and require the additional coding that *-k^{h}wa* provides (e.g. 5, 6, 7b). Agreement and bias play a crucial role then in delimiting the distribution of *-k^{h}wa* and this role should be reflected in the analysis.

5. (Weak) bidirectional optimization

Classic OT syntax took the perspective of production, in the sense that the input to evaluation was a meaning representation, and the candidate set consisted of alternative expressions of that meaning (Grimshaw 1997). Conversely, Hendriks and de Hoop (2001) have argued that OT semantics takes the perspective of comprehension, in the sense that the input to evaluation is a surface expression, with the candidate set consisting of alternative interpretations of that expression. However, various empirical problems, including partial blocking, suggest that optimization requires both perspectives at once and further, that this 'bidirectional' optimization proceeds under a single grammar (i.e. a single constraint ranking) (Blutner 1999).

To develop a bidirectional analysis of Takelma *-k^{h}wa*, we need to make explicit the relevant constraints, as well as their ranking. First, I assume that higher ranked constraints than the ones I discuss here eliminate various structures NOT found in Takelma (e.g. case marking, passives with overt agents). What IS relevant here are constraints which enforce agreement with local (1st, 2nd) person subjects and objects (9a), and one which enforces agreement with 3rd person objects (9b). I refer to this simply as *K^{H}WA* below. In line with the strategy sketched at the end of §3, the constraint in (9b) is simple and makes no reference to any of the three restrictions on *–k^{h}wa* documented in §4. In tension with constraints enforcing agreement is one which penalizes agreement, *AGR (9c). *AGR is violated once for each nominal argument linked to verb agreement.

(9) a. AGR/OBJECT$_{\text{LOCAL}}$, AGR/SUBJECT$_{\text{LOCAL}}$
b. AGR/OBJECT$_{\text{3RD}}$ (K^{H}WA)
c. *AGR
d. Bias: SUBJECT HUMAN, SUBJECT TOPIC

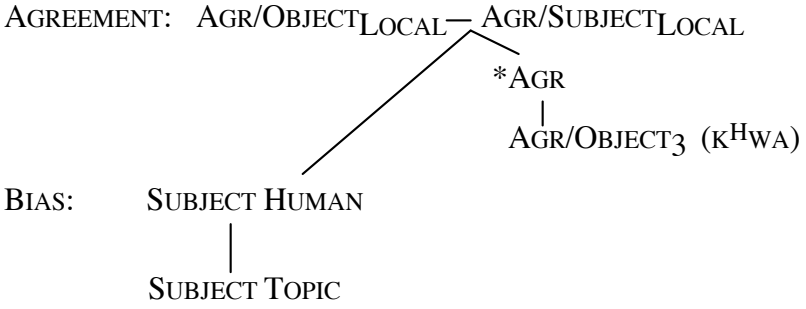
Finally, I assume that the biases discussed earlier function in grammars as markedness constraints. The relevant constraints are SUBJECT HUMAN and SUBJECT TOPIC (9d). These are satisfied if the subject is human and topic (respectively), but are violated otherwise. [4]

A little reflection makes clear that a classic unidirectional OT model based on the constraints in (9) cannot derive the distribution of ø and *-k^{h}wa*, for there is no

[4] For a more general discussion of Bias constraints, see Aissen (1999a, 2003).

ranking of *AGR and K^{H}WA that works. If *AGR » K^{H}WA, *-k^{h}wa* will never surface; if K^{H}WA » *AGR, ø will never surface. However, the right results can be achieved in a bidirectional model under the ranking *AGR » K^{H}WA. The overall ranking is shown in (10). We will build up to the crucial case, starting with simpler cases in which the ranking of (10) yields the right results in a classic, unidirectional (production-oriented) model.

(10)



Consider first inputs with a local person S or O, as in (11). The input meaning, *I found him,* is shown at the bottom of the tableau. There are three candidate forms, which differ in how much agreement they carry. The most economical form, *f1*, has no agreement so violates the high-ranking constraint that enforces agreement with a 1st person S. The least economical form is *f3*, which agrees with both S and O. It violates *AGR twice, once more than the intermediate form, *f2*, which is thus correctly determined as output. Bias constraints play no role here.

(11)

Context: i = Topic	**AGR/ SUBJECT$_{1ST}$**	***AGR**	***k^{h}WA***	**SU TOP**
f1 found	*!		*	*
☞ *f2 found-1SG$_{SUBJ}$*		*	*	*
f3 found- 3$_{OBJ}$ - 1SG$_{SUBJ}$		*!*		*
	m: I found him$_i$.			

The tableau in (12) shows an evaluation for a clause with 3rd person S and O, with the meaning *he found the ants*. The referent of *he* is the topic (cf. 7a). The subject is human and topical, the object non-topical and non-human. In this case, there are two relevant candidates, one with the object marker (*f1*) and one without (*f2*). In addition to the surface string and the morphological analysis, these candidates are associated with a syntactic structure (not shown) which links the subject with a null pronoun and the object with the nominal 'ants'. The input also includes enough information about context to identify the topic (shown in the upper left corner).

(12)

Context: i = Topic	***AGR**	***K^hWA***	**SU HUM**	**SU TOP**
☞ *f1 t'ipisi: t'ayák^h* ants found		*		
f2 t'ipisi: t'ayák^{h}wa *ants found-3$_{OBJ}$*	*!			
	m1: he$_i$ found the ants			

Both candidates satisfy the Bias constraints since the subject is in each case human, and topical. They differ on the other two constraints. Under the proposed constraint ranking, the more economical *f1* wins, correctly blocking *f2*.

The difficult case for the ranking in (10) is the one in which *-k^{h}wa* DOES surface. This is an input with 3rd person S and O, where O outranks S in animacy or, if they are both animate, where O is topical, e.g. one with the meaning *the ants found him*, as in (13) (cf. 7b). The two candidates have the same surface form as those in (12) – one with the object marker (*f2*) and one without (*f1*). The syntax (not shown) associates the subject with 'ants' and the object with the null pronoun. In this case, both candidates VIOLATE the two Bias constraints since in neither case is the subject human or topical.

(13)

Context: i = Topic	***AGR**	***K^hWA***	**SU HUM**	**SU TOP**
✗ *f1 t'ipisi: t'ayák^h* ants found		*	*	*
f2 t'ipisi: t'ayák^{h}wa *ants found-3$_{OBJ}$*	*!		*	*
	m2: the ants found him$_i$			

The problem is that *f1* is STILL optimal since it is the more economical form. This is the wrong result (indicated by ✗) since this meaning is in fact expressed by *f2*, not *f1*. The fact that *f2* has a worse constraint profile than *f1* cannot be solved by reranking the two top constraints. That would force agreement with ALL 3rd person objects, yielding the right result for (13), but the wrong result for (11) and (12).

The key intuition here is that *f1* cannot express *m2* because it is surface identical to *f1* in (12), and *m1* is a better interpretation for *f1* than *m2* is. Thus it is the pairing of *f1* with *m1* in (12) which blocks the pairing of *f1* with *m2* in (13). To achieve this formally, we must take into account not only the optimal

expression of *m2*, but also the optimal interpretation of (the unparsed surface string associated with) *f1*.

Putting (12) and (13) side-by-side makes clearer what is needed. Pairing the two forms {*f1, f2*} with the two meanings {*m1, m2*} yields four <*form, meaning*> pairs, represented by the four quadrants in (14). The Eval function should output two optimal pairs: <*f1, m1*> and <*f2, m2*> – the unmarked form is paired with the unmarked meaning (see ☞), the marked form with the marked meaning (see ➳).

(14)

Context: i = Topic	*AGR	*K^{h}WA*	SU HUM	SU TOP	*AGR	*K^{h}WA*	SU HUM	SU TOP
☞ *f1 t'ipisi: t'ayák^h* ants found		*				*	*	*
➳ *f2 t'ipisi: t'ayák^{h}wa* *ants found-3$_{OBJ}$*	*				*		*	*
	☞ m1: he$_i$ found the ants				➳ m2: the ants found him$_i$.			

A number of bidirectional OT architectures have been proposed as solutions to particular empirical problems (see Beaver and Lee (to appear) for a survey and discussion). Several of these cannot account for the partial blocking which characterizes Takelma *-k^{h}wa/ø*. One is STRONG OT OPTIMALITY (Blutner 1999). Beaver and Lee (to appear) define it as follows: a form-meaning pair <*f, m*> is *Strong OT optimal* iff (a) <*f, m*> ∈ GEN; (b) there is no pair <*f', m*> such that <*f', m*> ≻ <*f, m*>;[5] and (c) there is no pair <*f, m'*> such that <*f, m'*> ≻ <*f, m*>. There is only one Strong OT optimal pair in (14), which is <*f1, m1*>. Hence Strong OT optimality is too strong to account for Takelma, where there are two optimal pairs. This is a general property of Strong OT optimality, one which motivates WEAK OT OPTIMALITY, also introduced in Blutner (1999).

Weak OT optimality is similar to Strong OT optimality, but is recursive.[6] Having identified <*f1, m1*> in (14) as optimal, suboptimal pairs which share with it either a form or a meaning are eliminated from further competition. In (14), these are the shaded quadrants, <*f1, m2*> and <*f2, m1*>. With these candidates eliminated, we search for new Weak OT optimal pairs. Although <*f2, m2*> has the worst profile of all in (14), it is a Weak OT optimal pair since there is now no Weak OT optimal pair which shares either a form or a meaning with <*f2, m2*> and

[5] Read '≻' as 'more harmonic than', where relative harmony is defined as in classic OT.

[6] Beaver and Lee provide this definition for WEAK OT OPTIMAL: <*f, m*> is *Weak OT optimal* iff (a) <*f, m*> ∈ GEN; (b) there is no Weak OT optimal <*f', m*> ∈ GEN such that <*f', m*> ≻ <*f, m*>; and (c) there is no Weak OT optimal <*f, m'*> ∈ GEN such that <*f, m'*> ≻ <*f, m*>. Clauses (b) and (c) in this definition correspond to the Gricean principles mentioned earlier (see Blutner (1999) for discussion).

which is more harmonic than it. In short, there is no better interpretation for *f2* than *m2*, and no better expression of *m2* than *f2*.

The Takelma facts provide empirical support for Weak OT optimality over the Strong version.[7] Weak OT optimality derives the distribution of *-k^{h}wa*, and it does so through the interaction of general constraints. Bias constraints and constraints governing agreement with *local* person S and O bear the brunt of the analytical burden, rather than a complex constraint on *-k^{h}wa* itself.

6. Tzotzil[8]

The relation between the two 3rd person object markers in Takelma is not unique. Tzotzil has a bit of morphosyntax whose distribution is remarkably similar to that of Takelma *-k^{h}wa*. This is the so-called AGENT FOCUS verb form which occurs only when subject of a transitive clause is extracted, as in WH questions, relative clauses, and focus (Aissen 1999b). The AF form is derived from a transitive verb stem by suffixing *–on*: [9]

(15) a. Pero buch'u i-mil-<u>on</u>?
but who CP-kill-AF
'But who killed her?'

b. K'usi i-sibtas-<u>on</u> li antzetike?
what CP-frighten-AF the women
'What frightened the women?'

Aside from the restriction to subject extraction contexts, the AF form occurs in the same contexts as Takelma *-k^{h}wa*. It occurs only in clauses in which both S and O are third person, and it only occurs when the O > S in animacy or topicality (Aissen 1999b). The examples in (15) are typical: in (a) O > S in topicality; in (b), O > S in animacy. In all other contexts, the plain transitive verb occurs. I.e. it occurs when one or both of the core arguments is a local person; and it occurs when S is outranked by O in neither animacy nor topicality. In both examples in (16), the S is animate and the O is inanimate, and in neither case is the object topical.

(16) a. Buch'u i-s-pas mantal?
who CP-E3-make order
'Who's giving the orders?'

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[7] This is not to say that there are no problems facing weak OT optimality. See Beaver and Lee (to appear) for discussion. Another variant of bidirectional OT which cannot account for the Takelma facts is that of Wilson (2001). Space limitations preclude discussion here.

[8] Stiebels (2003) has independently suggested the desirability of a bidirectional OT account of Tzotzil AF verbs.

[9] Abbreviations in Tzotzil examples are: CP = completive aspect; ICP = incompletive aspect; E3 = ergative 3rd person; ENC = enclitic

b. li vinik [ta x-chon paxak] e…
the man ICP E3-sell pineapple-ENC
'the man who's selling pineapple'

The restrictions on the AF form can be understood in terms of the interpretations available to the PLAIN, TRANSITIVE VERB (the unmarked form). The plain form is always preferred over the AF form, as long as it can be associated with the target interpretation. As in Takelma, the interpretations available to the plain form are determined by agreement and bias. Only interpretations unavailable to the plain form are expressed by the AF form.

Like *-k^{h}wa* in Takelma, the AF verb occurs only when both S and O are 3rd person because it is only in this case that verb agreement *underdetermines* the linkage of nominal arguments with grammatical functions. When both S and O are 3rd person, the AF verb occurs only in clauses that go against the bias for human, topical subjects. Again, the relation between the plain form and the AF form is a partial blocking relation: both forms occur, but the marked form is relegated to the expression of more marked interpretations.

In virtue of this relation, the AF verb serves a disambiguating function in some clauses. The examples in (17) differ only in that (a) has the plain transitive verb, while (b) has the AF verb.

(17) a. K'usi i-s-sibtas li antzetike?
what CP-E3-frighten the women
'What did the women frighten?'

b. K'usi i-sibtas-on li antzetike?
what CP-frighten-AF the women
'What frightened the women?'

A priori, (17a) – with a plain transitive verb – might be expected to be ambiguous between (*m1*) *what did the woman frighten?* and (*m2*) *what frightened the woman?* However, it has only the interpretation shown (*m1*). The reason is that its interpretation is narrowed by the Bias constraints, as shown in the evaluation in (18). Here the four candidates are formed by pairing the two forms in 17a,b with the two interpretations in 17a,b.

(18)

	*AF	SUB HUM	SUB TOP	*AF	SUB HUM	SUB TOP
☛ *f1 k'usi s-sibtas li antzetike* *what E3-frighten the women*			*		*	*
⇛ *f2 k'usi sibtas-on li antzetike* *what frighten-AF the women*	*			*	*	*
	☛ m1: what did the women frighten?			⇛ m2: What frightened the women?		

Since *f1* (=17a) contains one human and one non-human argument, SUBJECT HUMAN prefers *m1* to *m2* as the optimal interpretation of *f1*. *f1* is also a better expression for *m1* than *f2* is, since *f2* violates *AF, a markedness constraint which penalizes the AF verb. <*f1, m1*> is thus Weak OT optimal (☛), and blocks both <*f1, m2*> and <*f2, m1*> (the shaded quadrants). With <*f1, m2*> and <*f2, m1*> removed from competition, <*f2, m2*> emerges as a new Weak OT optimal pair (⇛): the marked form is paired with the marked interpretation. Even though <*f2, m2*> has the worst constraint profile among the four candidates, *f2* is the optimal expression for *m2*, and *m2* is the optimal interpretation of *f2*. [10]

While (17a, b) are each unambiguous in Tzotzil, it is not the case that all ambiguity in contexts of extraction from transitive clauses is resolved by the grammar of Tzotzil. The example in (19), for example, is ambiguous.

(19) Buch'u i-s-mil li Xune?
who CP-E3-kill the Juan
Who killed Juan? *and* Who did Juan kill?

In order for the Bias constraints to favor one interpretation over another, the two arguments must be differentiated by the Bias constraints – either with respect to animacy or topicality. In (19), both arguments are human, and neither is (by assumption) topical. Hence the constraints discussed up to this point will not rank the two interpretations. There is no *general* proscription against ambiguity at work in (17a,b). The ranking of candidate interpretations is determined by language-particular grammars.

7. Recoverability in head-marking grammar

A common feature of Takelma *-k^{h}wa* and Tzotzil Agent Focus is that both constructions are limited to clauses with two 3rd person arguments. In both cases, this restriction follows from the fact that in any other case, agreement fully

[10] The restriction of AF forms to subject extraction contexts may be due to a higher-ranking faithfulness condition which is left inexplicit here. If so, the pair <*f2, m1*> would violate this constraint, and would have a worse profile than <*f2, m2*>. This would not affect the outcome.

determines the grammatical functions of nominal arguments so the extra marking provided by *-k^{h}wa* and the AF suffix is not needed.

The interpretive problem faced by clauses with two 3rd person arguments is of course not restricted to these languages. In general, head marking languages without much surface configurationality face the problem of recoverability in 3-3 clauses, but not in other clause types. It is fairly common in languages of the head-marking, low-configurationality type to find constructions or restrictions which are limited to 3-3 clauses (Nichols 1986).

Another restriction which tends to occur in the same languages that show animacy and topicality effects is a bias towards pronominal subjects and lexical objects. In a transitive clause with one overt nominal and one pronoun, this bias leads to parsing the pronoun as subject and the overt nominal as object.[11] Gerdts (1988) observed this in Halkomelem, dubbing it the ONE NOMINAL CONSTRAINT.[12]

(20) a. ni q'^{w}áq^{w}ətəs k^{w}θə swɔ́yʔqeʔ.
AUX club-TR-E3 DET man
He clubbed the man/*the man clubbed him. (p. 58)

b. !! ni q'^{w}ələtəs łə słéniʔ.
AUX bake-TR-E3 DET woman
!!He baked the woman./*The woman baked it. (p. 58)

What appears to be the same constraint has been described for a number of other head-marking languages, including Chamorro (Chung 1984) and Navajo (Platero 1982, among other references). The constraint seems clearly related to recoverability, as it too is restricted in these languages to clauses with two 3rd person arguments. As above, some more complex construction is needed to express the interpretation which is blocked, for example, in (20a).

In short, there are various biases which are active in these head-marking languages, all restricted to clauses with two 3rd person arguments. In earlier work of my own, I suggested that these phenomena could be analyzed in terms of ABSTRACT OBVIATION (Aissen 1997). This account was inspired by Algonquian morphosyntax, where there is an overt morphological category of OBVIATION which is only relevant to 3rd persons, and is only significant when there are multiple 3rd persons in a discourse segment. In these obviation systems, 3rd persons are ranked according to properties like animacy and topicality, and this ranking determines various aspects of morphosyntax. In Aissen (1999b), I

[11] One may ask whether the interpretation of (7a) (Takelma) might not follow from this constraint, rather than ones referencing animacy and topicality, as proposed above. Culy (2000) argues that such a constraint is neither necessary nor sufficient to account for the Taklema facts, while constraints based on animacy and topicality are.

[12] Gerdts uses "!! to mark forms which are structurally grammatical but semantically anomalous" (p. 9); TR = transitive suffix.

analyzed the agent focus construction in Tzotzil in terms of abstract obviation; Culy (2000) analyzed Takelma *-k^{h}wa* in the same terms. These accounts do not appeal to interpretive preferences, and do not relate these phenomena directly to the problem of recoverability that faces clauses with two 3rd person arguments. What I am suggesting here is that appeal to abstract obviation is not needed if Weak bidirectional OT is adopted. The restriction of Bias constraints to 3-3 clauses can be achieved in a Weak bidirectional OT without stipulation or abstract obviation since marked clauses with 1st and 2nd person arguments can afford to be expressed in the most economical fashion without risk of misinterpretation.

From this perspective, morphological obviation is one solution to the interpretive problem faced by head-marking languages in 3-3 clauses. But there are other solutions, including differential morphology like Takelma *-k^{h}wa* and the Tzotzil AF form. Morphological obviation systems like those of Algonquian, and Kutenai are grammaticized systems which overextend morphological marking beyond where it is needed, strictly speaking, for the sake of recoverability. The kinds of systems discussed here are not overextended – they appear to be used exactly where they are needed for recoverability and not beyond.

References

Aissen, Judith. 1997. On the syntax of obviation. *Language* 73:705-750.

Aissen, Judith. 1999a. Markedness and subject choice in optimality theory. *Natural Language and Linguistic Theory* 17:673-711.

Aissen, Judith. 1999b. Agent focus and inverse in Tzotzil. *Language* 75:451-485.

Aissen, Judith. 2003. Differential object marking: Iconicity vs. economy. *Natural Language & Linguistic Theory* 21:435-483.

Aronoff, Mark. 1976. *Word formation in generative grammar*. Cambridge: The MIT Press.

Beaver, David and Hanjung Lee. to appear. Input-output mismatches in OT. In R. Blutner & H. Zeevat (eds.) *Optimality theory and pragmatics*: Palgrave/Macmillan.

Blutner, Reinhard. 1999. Some aspects of optimality in natural language interpretation. In H. d. Hoop & H. d. Swart (eds.) *Papers on optimality theoretic semantics*. Utrecht: Utrecht Institute of Linguistics.

Chung, Sandra. 1984. Identifiability and null objects in Chamorro. In *Proceedings of the Tenth Annual Meeting of the Berkeley Linguistics Society,* 116-130. Berkeley: Berkeley Linguistics Society.

Comrie, Bernard. 1989. *Language universals and linguistic typology*. Chicago: University of Chicago Press.

Culy, Christopher. 2000. An incorporated topic marker in Takelma. In M. Butt & T. H. King (eds.) *Proceedings of the LFG00 Conference*: CSLI On-Line Publications. http://csli-publications.stanford.edu/LFG/5/lfg00culy.pdf.

DeLancey, Scott. 1981. An interpretation of split ergativity. *Language* 57:626-657.
Dixon, R. M. W. 1972. *The Dyirbal language of North Queensland*. Cambridge: Cambridge University Press.
Gerdts, Donna. 1988. *Object and absolutive in Halkomelem Salish*. New York: Garland.
Golla, Victor ed. 1990. *The collected works of Edward Sapir*. vol. VIII. Berlin: Mouton de Gruyter.
Grimshaw, Jane. 1997. Projections, heads, and optimality. *Linguistic Inquiry* 28:373-422.
Hendriks, Petra and Helen de Hoop. 2001. Optimality theoretic semantics. *Linguistics and Philosophy* 24:1-32.
Horn, Laurence. 1989. *A natural history of negation*. Chicago: University of Chicago Press.
Jelinek, Eloise and Richard Demers. 1983. The agent hierarchy and voice in some Coast Salish languages. *International Journal of American Linguistics* 49:167-185.
Kiparsky, Paul. 1982. Lexical morphology and phonology. In Linguistic Soc. of Korea (ed.) *Linguistics in the morning calm*. Seoul: Hanshin Publishing Co.
McCawley, James. 1978. Conversational implicature and the lexicon. In P. Cole (ed.) *Syntax and Semantics 9, Pragmatics,* 245-259. New York: Academic Press.
Nichols, Johanna. 1986. Head-marking and dependent-marking grammar. *Language* 62:56-119.
Platero, Paul. 1982. Missing noun phrases and grammatical relations in Navajo. *International Journal of American Linguistics* 48:286-305.
Sapir, Edward. 1922. The Takelma language of southwestern Oregon. In F. Boas (ed.) *Bulletin of American Ethnology: Handbook of American Indian Languages,* 1-296. Washington, D.C.: Government Printing Office.
Silverstein, Michael. 1976. Hierarchy of features and ergativity. In R. M. W. Dixon (ed.) *Grammatical categories in Australian languages,* 112-171. Canberra: Australian Institute of Aboriginal Studies.
Stiebels, Barbara. 2003. Agent focus in Mayan languages. Ms. Berlin.
Wilson, Colin. 2001. Bidirectional optimization and the theory of anaphora. In G. Legendre, J. Grimshaw & S. Vikner (eds.) *Optimality-theoretic syntax,* 465-508. Cambridge, MA: The MIT Press.

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