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On structural case in Finnish and Korean

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ABSTRACT

The Case Tier Hypothesis (CTH, Yip, Maling, and Jackendoff, 1987) accounts for the distribution of nominative and accusative in Finnish and Korean remarkably well, but a number of outstanding puzzles remain. We reformulate the CTH in Optimality Theory (Prince and Smolensky, 1993/2004), showing that the new proposal covers all the standard data and extends to several previously problematic phenomena, such as multiple nominatives and case variation in adverbials. After analyzing the core case patterns of Finnish and Korean, we go beyond these two languages and work out the general typological predictions of our proposal. This reveals what the theory admits and what it excludes, two central questions in theoretical linguistics.

1. Case in tiers

The assignment of structural case to subjects, objects, and adverbials is sensitive to at least two kinds of factors, both illustrated by the Finnish sentences in (1) and (2):

(1) Ota minu-t / kirja mukaan!
take.IMP 1P.SG-ACC / book.NOM along
'Take me / the book along!'

(2) Esa ott-i minu-t / kirja-n mukaan.
Esa.NOM take-PAST 1P.SG-ACC / book-ACC along
'Esa took me / the book along.'

The pattern in (1) shows that case assignment refers to EQUIVALENCE CLASSES of DPs: the object of an imperative receives the accusative case (ACC) if it is a personal pronoun, else it receives the nominative case (NOM). The pattern in (2) shows that case assignment refers to PROMINENCE RELATIONS among DPs: the highest grammatical relation (here: subject) receives NOM; all other grammatical relations (here: object) receive ACC. Note that the second generalization is reflected in (1) as well: the highest grammatical relation (here: object) receives NOM unless it is personal pronoun, a generalization known as "Jahnsson's Rule" (Jahnsson, 1871). The distinction between equivalence classes vs. prominence relations is made explicitly in Levin and Rappaport Hovav (2005, Ch. 5), and some version of it can be found in several recent analyses of case, such as Wunderlich and Lakämper (2001) and de Hoop and Malchukov (2007, 2008). For example, de Hoop and Malchukov (2008) propose that case

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serves two functions: it encodes semantic and pragmatic properties of arguments – the IDENTIFYING function – and it distinguishes arguments from each other – the DISTINGUISHING function. They further suggest that some languages are "radically identifying", others "radically distinguishing" (de Hoop and Malchukov, 2008:569). We will adopt this terminology in the subsequent discussion.

Our point of departure is the Case Tier Hypothesis (CTH, Yip et al., 1987) which emphasizes the distinguishing function of case. The CTH accounts for a wide range of case patterns in Finnish and Korean, both examples of predominantly distinguishing languages; see e.g. Maling (1987, 1993, 2004), and Maling et al. (2001). The main idea behind the CTH is that structural cases and grammatical functions constitute hierarchies that are associated with each other in much the same way as tones and syllables are associated with each other in Autosegmental Phonology (Goldsmith, 1976). The CTH is outlined in (3).

(3) The Case Tier Hypothesis

(a) The case tier: NOM > ACC

(b) The grammatical relations tier: SUBJ > OBJ > ADV

(c) Cases are associated to relations, one to one, left to right

(d) If the number of cases and relations is not identical, leftover cases remain unassociated and leftover relations are associated to the rightmost case

We now walk through the standard evidence for the CTH, using Finnish as the language of illustration. If there is only one DP in the sentence, this DP receives the unmarked NOM, irrespective of its grammatical relation. This is illustrated in (4). Parentheses, e.g. (SUBJ), mean that the grammatical relation is not overtly realized.[1]

(4)

(a)	(b)	(c)
Esa nukku-i	Osta kirja	Nuku tunti
Esa.NOM sleep-PAST	buy.IMP book.NOM	sleep.IMP hour.NOM
'Esa slept'	'Buy a book!'	'Sleep an hour!'
SUBJ (OBJ ADV)	(SUBJ) OBJ (ADV)	(SUBJ OBJ) ADV
NOM ACC	NOM ACC	NOM ACC

If there are two DPs in the sentence, the higher DP receives the unmarked NOM and the lower DP receives the marked ACC, irrespective of their grammatical relations. This is illustrated in (5):

(5)

(a) Esa ost-i kirja-n
Esa.NOM buy-PAST book-ACC
'Esa bought a book'

(b) Esa nukku-i tunni-n
Esa.NOM sleep-PAST hour-ACC
'Esa slept an hour'

(c) Lue kirja kerra-n
read.IMP book.NOM once-ACC
'Read the book once!'

SUBJ OBJ (ADV)	SUBJ (OBJ) ADV	(SUBJ) OBJ ADV
NOM ACC	NOM ACC	NOM ACC

If there are three DPs in the sentence, the highest DP receives the unmarked NOM and the lower DPs receive the marked ACC, irrespective of their grammatical relations. This is illustrated in (6):

(6)

(a)
Esa luk-i kirja-n kerra-n
Esa.NOM read-PAST book-ACC once-ACC
'Esa read the book once'

(b)
Esa juoks-i kerra-n kilometri-n
Esa.NOM run-PAST once-ACC kilometer-ACC
'Esa ran a kilometer once'

SUBJ OBJ ADV	SUBJ (OBJ) ADV ADV
NOM ACC	NOM ACC

[1] The labeling of *-n* is controversial. Following the tradition adopted in e.g. Maling (1993), we label this suffix "accusative" (ACC). This differs from Kiparsky (2001) and Hakulinen et al. (2004) who label it "genitive" (GEN). See Kiparsky (2001) for discussion.

These case patterns are remarkable in two ways. First, they show that case cannot be assigned solely based on the identity of the DPs. As noted by Kiparsky (2001:1), structural case and grammatical relations are independent, yet systematically related. This is evident from "case shift" and "case spreading": NOM may be assigned to subject, object, or adverbial, depending on which one is highest in the sentence ("case shift"), and ACC is assigned to all but the highest DP, whatever their grammatical relations ("case spreading"). Second, the examples show that structural cases can be assigned to adverbials as well as to arguments. This is true in many languages, including Chinese (Li, 1990), Finnish (Maling, 1993; Vainikka, 2003), Korean (Wechsler and Lee, 1996; Maling, 2004; Kim and Sells, 2006), Polish (Przepiórkowski, 1999), Russian (Pereltsvaig, 2000), and Warumungu (Simpson, 1991). Cross-linguistically, structural case typically appears on adverbs of duration, measure, and frequency, e.g. 'sleep the whole day', 'weigh a pound', 'read once'. Such adverbs cannot be easily dismissed as "frozen" forms because they undergo case alternations like objects. For example, in Finnish negated verbs assign the partitive case to both objects and the relevant adverbials, as shown in (7).[2]

(7) (a) Objects take the partitive case (PAR) under negation:

Esa osti kirja-n	Esa ei osta-nut kirja-a
Esa.NOM buy-PAST book-ACC	Esa.NOM not buy-PCP book-PAR
'Esa bought a book'	'Esa didn't buy a book'

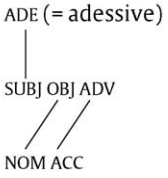
(b) Adverbials take the partitive case (PAR) under negation:

Esa nukku-i tunni-n	Esa ei nukku-nut tunti-a
Esa.NOM sleep-PAST hour-ACC	Esa.NOM not sleep-PCP hour-PAR
'Esa slept an hour'	'Esa didn't sleep an hour'

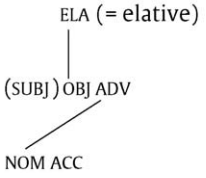
In addition to structural case, certain verbs require a LEXICAL CASE on some of their arguments. In Finnish, such lexical cases include adessive (ADE) and elative (ELA). Lexical cases are interesting because they remove the lexically marked DP from the domain of structural case assignment which continues to operate as if the lexically marked DP were not present in the sentence at all. This is illustrated by the Finnish examples in (8). We write lexical cases above and structural cases below the grammatical relations hierarchy.

(8) The interaction of lexical and structural case

(a)
Minu-lla ol-i flunssa viiko-n
1P.SG-ADE have-PAST flu.NOM week-ACC
'I had the flu for a week'



(b)
Pidä minu-sta viikko
like-IMP 1P.SG-ELA week.NOM
'Like me for a week!'



We have seen that the CTH correctly predicts a range of diverse case patterns in Finnish, suggesting that it is on the right track. More generally, the CTH makes the predictions listed in (9) (see Maling, 2004:176):

(9) Predictions of the Case Tier Hypothesis:

(a) *No multiple nominatives*. Once NOM has been assigned, the remaining DPs will receive ACC ("case spreading"). Hence it is possible to have multiple ACCs, but not multiple NOMs.

(b) *No accusative without nominative*. The highest available DP receives NOM, no matter its grammatical relation ("case shift"). Hence it is not possible to have ACC without also having NOM.

(c) *Structural case skips lexical cases.*

As noted by Maling (2004), these predictions are only approximately true of Finnish and Korean. Prima facie counterexamples to all three are not hard to find: there are sentences with multiple nominatives, accusatives without nominatives, and instances of case skipping that do not seem to be limited to lexical cases. The present paper has three major goals. We start by reformulating the CTH such that it correctly generalizes to these problematic examples while continuing

[2] For Korean examples where the case marking on adverbials is alternating, see Kim and Sells (2006).

to cover all the standard examples (section 2). The central principle in the new analysis is the CASE OCP, originally proposed by Mohanan (1994) and explored in subsequent work by Anttila and Fong (2000). We then sketch an analysis of the Finnish and Korean case systems, showing how the two languages differ, and explore the consequences of the analysis for a number of traditional syntactic problems in the two languages (sections 3–5). We then pursue the theory beyond Finnish and Korean, working out the implicational universals predicted by the system (section 6). Finally, we identify topics for future work (section 7) and conclude by summarizing the main results (section 8).

2. The constraints

Our analysis builds on three principles adopted from earlier work. The intuitive content of each principle is summarized in (10):

(10) Three principles of case assignment:
- (a) DPs need to be distinguished by morphological case.
- (b) DPs resist morphological case.
- (c) The more prominent the DP, the more strongly these two principles apply.

The first principle embodies the distinguishing function of case (see e.g. Wunderlich and Lakämper, 2001; de Hoop and Malchukov, 2007, 2008): it is violated if a sentence contains multiple DPs with identical case marking. The second principle militates against case marking in general (see e.g. Aissen, 2003): it is violated by any case-marked DP. The third is a metaprinciple that tells us how the first two principles are to be interpreted. This metaprinciple assumes that DPs are organized into prominence hierarchies, an idea central to both the CTH (Yip et al., 1987; Maling, 1993, 2004) and recent optimality-theoretic work on case (e.g. Aissen, 2003). These three principles are somewhat baffling from the perspective of theories where grammatical principles must be surface-true. How could a DP be both marked for case, as required by (10a), and not marked for case, as required by (10b)? And what exactly does "more strongly" mean, in (10c)? Such conflicting principles of different strengths are the stock in trade of Optimality Theory (Prince and Smolensky, 1993/2004) where constraints are ranked and violable.

We implement the first principle (10a) as a constraint on multiple occurrences of the same case within a syntactic domain. This constraint resembles the OBLIGATORY CONTOUR PRINCIPLE (OCP) which originated in Autosegmental Phonology as a constraint banning adjacent identical tones (Leben, 1973; Goldsmith, 1976). A similar constraint in the domain of case was identified by Mohanan (1994) who named it CASE OCP. In the context of Finnish case, this principle was clearly formulated by Toivainen (1993:111) who called it IDENTIFIABILITY: "The same case cannot be used for two different functions at the same syntactic level." Empirical evidence for the Case OCP from Finnish noun phrases was presented by Anttila and Fong (2000) who reinterpreted it as a violable constraint in the sense of Optimality Theory. While the version of Case OCP proposed in this paper differs from the earlier formulations, we will retain the name because the core idea remains the same: multiple occurrences of the same case within a syntactic domain are prohibited. Identifying this syntactic domain in particular languages remains an important open question. For the purposes of Finnish and Korean, we will tentatively assume that the Case OCP evaluates the DPs in the domain of an entire sentence that contains one finite verb.

In its simplest form, the Case OCP requires that all the DPs in the sentence be distinct in case. However, as we will see, this constraint does not apply equally across the board, but its strength is directly correlated with the DP's prominence. For this reason, we will relativize this constraint to grammatical relations: higher relations are punished more severely for Case OCP violations than lower relations. This can be stated as three constraints that form a STRINGENCY HIERARCHY (Kiparsky, 1994a; de Lacy, 2002):

(11)

OCP/S	Distinguish subjects from other relations.
OCP/SO	Distinguish subjects and objects from other relations.
OCP/SOA	Distinguish subjects, objects, and adverbials from other relations.

We now illustrate the Case OCP in terms of the optimality-theoretic tableau in (12). The input is a sentence with two DPs, subject (S) and object (O), given in the first column. There are four competing candidate case patterns, given in the second column. The task of the three Case OCP constraints is to select the optimal case pattern from among the four candidate case patterns. The number of violations of a constraint incurred by a candidate is marked by an integer.

(12) Illustrating the Case OCP

		OCP/S	OCP/SO	OCP/SOA
S O	nom nom	1	2	2
	→ nom acc			
	→ acc nom			
	acc acc	1	2	2

Both NOM NOM and ACC ACC incur the same violations: OCP/S is violated once because the subject is not distinct from the object; OCP/SO is violated twice because the subject is not distinct from the object and the object is not distinct from the subject;

OCP/SOA is violated twice for the same reason. For this particular input, OCP/SO and OCP/SOA have identical violations because the input contains no adverbials. The candidates NOM ACC and ACC NOM violate none of the constraints. As it stands, the grammar cannot distinguish between them. Selecting the optimal candidate falls on other markedness constraints, to be discussed next.

We implement the second principle (10b) as a constraint that is violated by the presence of a marked case on any DP in the sentence. We name this constraint *MARKED CASE (*MC). The goal of our analysis is to predict a particular distribution of marked and unmarked cases. For example, the case that is predicted to appear on the subjects of intransitive clauses is the unmarked case. In both languages, the predicted patterns of unmarked and marked case can be easily identified with NOM and ACC, respectively, and this is the labelling we will use in our tableaux.[3] Just like the OCP, the constraint *MC does not apply equally across the board, but its strength is directly correlated with the DP's prominence. This yields another stringency hierarchy:

(13)

*MC/S	Subjects resist marked case.
*MC/SO	Subjects and objects resist marked case.
*MC/SOA	Subjects, objects, and adverbials resist marked case.

We will now show how these two sets of constraints interact to account for the distribution of structural case in Finnish and Korean.

3. Finnish

3.1. The basic predictions

First, we replicate the predictions of the CTH discussed in section 1. The task is to rank the constraints in a way that yields the observed case patterns. The following partially ranked grammar for the Finnish case system was discovered with the help of the Constraint Demotion Algorithm (Tesar and Smolensky, 2000) implemented in OTSOFT (Hayes et al., 2003). The grammar consists of two constraint strata that are strictly ranked with respect to each other, but there is no evidence for within-stratum ranking.

(14) The grammar for Finnish

Stratum #1	≫	Stratum #2
*MC/S		*MC/SO
OCP/S		*MC/SOA
OCP/SO		
OCP/SOA		

We start by checking the predictions of this grammar for sentences with one DP. As shown in (15), in such sentences the distinguishing function (OCP) is idle and the general markedness constraints (*MC) single-handedly determine the outcome. The result is complete absence of case.

(15) Finnish: One DP

		*MC/S	OCP/S	OCP/SO	OCP/SOA	*MC/SO	*MC/SOA
S	→ nom						
	acc	1				1	1
O	→ nom						
	acc					1	1
A	→ nom						
	acc						1

Ranking is indicated by a solid line and absence of ranking by a dashed line. In this particular case, no rankings are actually needed: the candidate ACC will lose no matter how the constraints are ranked. Such candidates are called HARMONICALLY BOUNDED. This is indicated by graying out the entire row.

Next, consider sentences with two DPs. As shown in (16), both the OCP and *MC constraints are now active and the ranking among them is crucial for deriving the correct output.

[3] In Finnish, syntactic unmarkedness goes together with phonological unmarkedness: NOM is realized as zero, i.e. it has no overt phonological exponent.

(16) Finnish: Two DPs

		*MC/S	OCP/S	OCP/SO	OCP/SOA	*MC/SO	*MC/SOA
S O	nom nom		1	2	2		
	→ nom acc					1	1
	acc nom	1				1	1
	acc acc	1	1	2	2	2	2
S A	nom nom		1	1	2		
	→ nom acc						1
	acc nom	1				1	1
	acc acc	1	1	1	2	1	2
O A	nom nom			1	2		
	→ nom acc						1
	acc nom					1	1
	acc acc			1	2	1	2

The candidates ACC NOM and ACC ACC are harmonically bounded and can never win under any ranking. In contrast, both NOM NOM and NOM ACC are viable under some ranking. The desired winner is NOM ACC. This candidate becomes optimal if the constraints *MC/SO and *MC/SOA are demoted below the three OCP constraints. In other words, assigning ACC to a DP is costly, but less costly than not distinguishing this DP from another DP that bears a higher grammatical relation. This explains the phenomenon of "Case Shift".

Next, consider sentences with three DPs. As we just saw, Finnish requires the subject to differ in case from all other DPs. Since higher DPs resist case marking more than lower DPs the result is "Case Spreading": the subject is NOM, all other DPs are ACC, as illustrated in (17).

(17) Finnish: Three DPs

		*MC/S	OCP/S	OCP/SO	OCP/SOA	*MC/SO	*MC/SOA
S O A	nom nom nom		2	4	6		
	nom nom acc		1	2	2		1
	nom acc nom		1	1	2	1	1
	acc nom nom	1		1	2	1	1
	→ nom acc acc			1	2	1	2
	acc nom acc	1	1	1	2	1	2
	acc acc nom	1	1	2	2	2	2
	acc acc acc	1	2	4	6	2	3

Finally, consider the interaction of structural case and lexical case. We assume that lexical case is protected by an undominated faithfulness constraint FAITH. All the vacant DPs get structural case in the usual way. For example, the Finnish possessive construction requires the adessive (ADE) case on the subject. Given the input SOA, the lexically marked S is skipped and case assignment operates on the rest of the sentence just like on the input OA:

(18) Minu-lla oli flunssa viiko-n
1P.SG-ADE had flu.NOM week-ACC
'I had the flu for a week.'

(19) Finnish: The interaction of lexical and structural case

		FAITH	*MC/S	OCP/S	OCP/SO	OCP/SOA	*MC/SO	*MC/SOA
S-ade O A	ade nom nom		1		1	2	1	1
	→ ade nom acc		1				1	2
	ade acc nom		1				2	2
	ade acc acc		1		1	2	2	3
	nom acc acc	1			1	2	1	2

In sum, we have presented an optimality-theoretic analysis that replicates the predictions of the CTH for Finnish. The analysis does not assume a level of abstract case sharing feature labels with morphological case (cf. Kiparsky, 2001; Legate, 2008). Instead, grammatical relations are mapped directly onto morphological cases using violable mapping constraints. An undominated faithfulness constraint is used to preserve lexically assigned case.

3.2. Multiple nominatives

How about cases where the CTH fails? Let us start by considering multiple nominatives. Unlike the CTH, the Case OCP predicts that multiple nominatives are possible if the DPs are equally prominent, e.g. two objects (OO, OOA). This is because in such cases the Case OCP is idle. Recall that the purpose of case marking is to distinguish DPs of different prominence: if DPs are of equal prominence they need not be distinguished. If all DPs in the sentence are of equal prominence, *MC constraints rule out case marking completely predicting the unmarked NOM everywhere, as illustrated in (20):

(20) Multiple nominatives: input = OO, output = NOM NOM

		*MC/S	OCP/S	OCP/SO	OCP/SOA	*MC/SO	*MC/SOA
O O	→ nomnom						
	nom acc					1	1
	acc nom					1	1
	acc acc					2	2

Adding an adverbial activates the Case OCP which now strives to distinguish O and A. The adverbial is predicted to get ACC, being the lower grammatical relation, but there is still no reason to distinguish the two objects which are both predicted to remain NOM:

(21) Multiple nominatives: input = OOA, output = NOM NOM ACC

		*MC/S	OCP/S	OCP/SO	OCP/SOA	*MC/SO	*MC/SOA
O O A	nom nom nom			2	4		
	→ nom nom acc						1
	nom acc nom			1	2	1	1
	acc nom nom			1	2	1	1
	nom acc acc			1	2	1	2
	acc nom acc			1	2	1	2
	acc acc nom					2	2
	acc acc acc			2	4	2	3

These predictions can be tested in Finnish where some types of nonfinite clausal complements are transparent to case assignment. This means that the case assignment domain contains multiple clauses and thus possibly multiple objects. For example, verbs with the suffix /-ma/ head adverbial clauses whose function is determined by the oblique case ending on the verb. The traditional label for such nonfinite verbs is "third infinitive". In a recent study of nonfinite clauses in Finnish, Kiparsky (2010) points out that these nonfinite clauses, for which he uses the term "oblique infinitive", cannot have an overt subject, but show subject or object control. The following examples, adapted from Kiparsky (2001), show that the prediction of our analysis is borne out: in a complex sentence with two objects, both receive the nominative case.

(22) Double nominatives in Finnish: input = OO, output = NOM NOM

(a) Lähettä-kää sinne sukellusvene upotta-ma-an laiva
send-IMP.2PL there submarine.NOM sink-INF-ILL ship.NOM
'Send a submarine there to sink the ship.' (imperative)

(b) Sinne lähete-ttiin sukellusvene upotta-ma-an laiva
there send-PASS.PAST submarine.NOM sink-INF-ILL ship.NOM
'A submarine was sent there to sink the ship.' (passive)

The analysis also correctly predicts the case alternation between actives and passives. The active SOO yields the case pattern NOM ACC ACC, whereas the corresponding subjectless passive OO yields NOM NOM.

(23) The active: input = SOO, output = NOM ACC ACC
He pakott-i-vat Mati-n luke-ma-an kirja-n.
3P.PL.NOM force-PAST-3P.PL Matti-ACC read-INF-ILL book-ACC
'They forced Matti to read a book.'

(24) The passive: input = OO, output = NOM NOM
Matti pakote-ttiin luke-ma-an kirja.
Matti.NOM force-PASS.PAST read-INF-ILL book.NOM
'Matti was forced to read a book.'

As predicted, adding an adverbial to the passive sentence yields the case pattern NOM NOM ACC: both objects remain NOM, but the adverbial gets ACC.

(25) The passive with an adverbial: input = OOA, output = NOM NOM ACC
Matti pakote-ttiin luke-ma-an kirja kerra-n
Matti.NOM force-PASS.PAST read-INF-ILL book.NOM once-ACC
'Matti was forced to read the book once.'

In sum, we have seen that case spreading and Case OCP crucially differ in sequences of DPs of equal prominence. The predictions of the Case OCP turn out correct:

(26) Case spreading and Case OCP

	Input	Case spreading	Case OCP
(a)	OO	*NOM ACC	NOM NOM
(b)	OOA	*NOM ACC ACC	NOM NOM ACC

The present account agrees with the CTH on several points. Both view structural cases and grammatical relations as independent but systematically related dimensions and both make use of prominence hierarchies to establish a mapping between the two dimensions. The main difference lies in the nature of the mapping. We have argued that the mapping does not proceed from left to right, with spreading as the last resort. Instead, structural cases serve the purpose of distinguishing DPs of different prominence. The phonological parallel is nevertheless there: while cases do not spread like tones, they obey the OCP like tones.

4. Korean

The Korean case pattern is similar to that of Finnish, but differs in one important respect. As pointed out by e.g. Maling (1987), Maling et al. (2001), Maling (2004:180), and Kim and Sells (2006), in Korean structural case is sensitive not only to grammatical relations, but also to thematic prominence; see Grimshaw, 1990 for a general overview. In particular, the choice between the case patterns NOM ACC and NOM NOM depends on whether the subject of the clause is an external argument, as with verbs like 'run', or an internal argument, as with verbs like 'melt'. We illustrate this from the case patterns of adverbials drawing on examples from the work cited above. To describe thematic prominence, we adopt the following numerology: 1 = external argument, 2 = internal argument, 3 = non-argument. The first generalization is stated in (27), with illustrative examples in (28).

(27) Generalization 1: If the verb has an external argument, the adverbial is ACC.

(28) (a) ku malathonsenswu-ka chopan tongan-*i/ul ppalli talli-ess-ta
the marathoner-NOM first.half for-*NOM / ACC fast run-PAST-DECL
'The marathoner ran fast in the first half.' (S1 A3)

(b) Rice-ka Seoul-ey halwu tongan-*i/ul iss-ess-ta
Rice-NOM Seoul-LOC one day for-*NOM / ACC exist-PAST-DECL
'Rice stayed in Seoul for one day.' (S1 A3 A3)

(c) John-i sang-ul yelepen-*i/ul pat-ass-ta
John-NOM award-ACC several.times-*NOM / ACC receive-PAST-DECL
'John received awards several times.' (S1 O2 A3)

(d) John-i sensayngnim-kkey sey pen-*i/ul yatan mac-ass-ta
John-NOM teacher-DAT(HON) three times-*NOM / ACC be.scolded-PAST-DECL
'John was scolded by the teacher three times.' (S1 O2 A3)

The progressive expression *-ko iss-ta* 'in the process of' can be used to test for the presence of an agent. Since agents are always external arguments, the possibility of *-ko iss-ta* also serves as a test for the presence of an external argument. All the above examples can be made progressive. Consider the example in (29).

(29) John-i sensayngnim-kkey sey pen-*i/ul yatan mac-ko iss-ta
John-NOM teacher-DAT(HON) three times-*NOM / ACC be.scolded-COMP exist-DECL
'John is being scolded by the teacher three times.' (S1 O2 A3)

As Maling (2004:180) notes, an external argument subject (=S1) entails ACC on the adverbial. If the external argument is absent, NOM becomes possible or even obligatory. The second generalization is stated in (30), with illustrative examples in (31) (Kim, 1990; Kim, 1999).

(30) Generalization 2: If the verb has no external argument underlyingly, the adverbial shows variation NOM ∼ ACC. This includes unaccusative verbs, e.g. 'melt'.

(31) (a) ku khun kong-i two pen-i∼ul kwul-ess-ta
the big ball-NOM two.times-NOM ∼ ACC rotate-PAST-DECL
'The ball rotated twice.' (S2 A3)

(b) pi-ka han sikan tongan-i∼ul o-ass-ta
rain-NOM one hour for-NOM ∼ ACC come-PAST-DECL
'It rained for one hour.' (S2 A3)

(c) hay-ka twu sikan-i∼ul pichi-ess-ta
sun two hours-NOM ∼ ACC shine-PAST-DECL
'The sun shone for two hours.' (S2 A3)

(d) ku elum cokak-i han sikan-?i/ul nok-ass-ta
that ice piece-NOM one hour-?NOM / ACC melt-PAST-DECL
'That piece of ice melted for one hour.' (S2 A3)

With certain predicates, the adverbial is obligatorily NOM. The third generalization is stated in (32), with illustrative examples in (33).

(32) Generalization 3: With simplex psychological predicates (e.g. 'dislike') and adjectival predicates (e.g. 'be dark', 'be cute'), the adverbial is obligatorily NOM.

(33) (a) John-i Tom-i/*ul silh-ta
John-NOM Tom-NOM / *ACC dislike-PRES-DECL
'John dislikes Tom.' (S2 O2)

(b) i pang-i nac tongan-i/*ul etwup-ta
this room-NOM day time.for-NOM / *ACC dark-DECL
'This room is dark during the day time.' (S2 A3)

(c) ku malathonsenswu-ka chopan tongan-i/*ul ppal-ass-ta.
the marathoner-NOM first.half for-NOM / *ACC fast-PAST-DECL
'The marathoner was fast in the first half.' (S2 A3)

In (33a), we have two internal arguments, both with the unmarked NOM. This is possible since the two DPs are of equal prominence. In (33b) and (33c), we have one internal argument and an adverbial expression. Again, both DPs get the unmarked NOM. Note that in all these examples the subject is nonagentive. Evidence for nonagentivity comes from the impossibility of *-ko iss-ta* 'in the process of':

(34) *i pang-i nac tongan-i etwup-ko iss-ta
this room-NOM day during-NOM dark-COMP exist-DECL
'Literally: This room is becoming dark during the day time.'

We conclude that Korean requires the addition of a thematic dimension into the analysis. First, we must rethink the inputs. Simply combining relational and thematic categories yields $3 \times 3 = 9$ DP types of which at least five actually occur. These five categories are listed in (35).

(35) Categories
S1 = external subject (canonical subject) O2 = internal object (canonical object)
S2 = internal subject A3 = adverbial
S3 = non-argument subject (e.g. expletives)

The empirically missing combinations are O1 (external object), O3 (non-argument object) and A1 and A2 (adverbial argument). The five attested categories occur in various syntactic combinations. Our discussion will focus on the set of constructions listed in (36).

(36) Constructions

(a)	S1	(= subject, external)	*Kim* runs.
	S2	(= subject, internal)	*Kim* fell.
	S3	(= subject, non-argument)	*It* is raining.
	O2	(= object, internal)	Eat *the apple*!
	A3	(= adverbial, non-argument)	Walk *a mile*!
(b)	S1 O2		*Kim* ate *apples*.
	S1 A3		*Kim* walked *a mile*.
	S2 O2		*Kim* dislikes *Sandy*.
	S2 A3		*The ice* melted *for an hour*.
	S3 A3		*It* was raining *for an hour*.
	O2 A3		Read *the book once*!
(c)	S1 O2 A3		*Kim* walked *Fido a mile*.
	S1 O2 O2		*Kim* gave *Sandy an apple*.

Second, we need to revise the grammar to allow reference to thematic prominence. Our solution is to posit a set of OCP constraints relativized to thematic roles. These constraints parallel the OCP constraints relativized to grammatical relations. The new OCP constraints are listed in (37).

(37)
OCP/1	Distinguish external.
OCP/12	Distinguish external and internal.
OCP/123	Distinguish external, internal, and non-argument.

We assume that these three OCP-constraints are universal and thus part of the grammar of both Korean and Finnish. As we will see shortly, only OCP/1 is empirically necessary for Korean. For reasons of symmetry, one might nevertheless want to posit the constraints OCP/12 and OCP/123. They would do no harm in the analysis and there may well be evidence for them in other languages. However, to keep the discussion as simple as possible, we will not include them in the subsequent discussion. Finnish needs no thematic constraints whatsoever. Adding OCP/1 into the Finnish grammar makes no difference; the same outcome is obtained with and without it. This is because the high-ranked OCP/S, OCP/SO, and OCP/SOA mask any potential effects of OCP/1 in Finnish.

The following partially ranked grammar for the Korean case system was discovered with the help of the Constraint Demotion Algorithm implemented in OTSoft. The grammar consists of three constraint strata that are strictly ranked with respect to each other, but there is no evidence for within-stratum ranking.

(38) The grammar for Korean

Stratum #1	≫	Stratum #2	≫	Stratum #3
OCP/1		*MC/SO		OCP/S
*MC/S		*MC/SOA		OCP/SO
				OCP/SOA

We will now examine the constructions where Finnish and Korean differ and show how the difference can be analyzed in terms of the constraint OCP/1. In Korean, S1 O2 is NOM ACC, but S2 O2 is NOM NOM. Actual examples were given in (28c,d) and (33a), respectively. The crucial constraint is the high-ranking OCP/1 which requires that the external argument differ in case from all other DPs. This constraint is active in S1 O2 which has an external argument, but not in S2 O2 which has no external argument. In the latter case, OCP/1 is inactive and nothing forces the two DPs to differ in case. This exposes the construction to the force of markedness constraints which rule out case completely, yielding NOM NOM, as illustrated in (39).

(39) Motivating OCP/1

		*MC/S	OCP/1	*MC/SO	*MC/SOA	OCP/S	OCP/SO	OCP/SOA
S1 O2	nom nom		1			1	2	2
	→ nom acc			1	1			
	acc nom	1		1	1			
	acc acc	1	1	2	2	1	2	2
S2 O2	→ nom nom					1	2	2
	nom acc			1	1			
	acc nom	1		1	1			
	acc acc	1		2	2	1	2	2

The situation is slightly different if the lower DP is an adverbial: S1 A3 is NOM ACC, but S2 A3 varies between two possible outcomes: NOM ACC ∼ NOM NOM. Actual examples were given in (28a,b) and (31), respectively. These patterns are correctly predicted as illustrated in (40) below. S1 A3 has an external argument and the high-ranking OCP/1 decides in favor of NOM ACC. In contrast, S2 A3 has no external argument and therefore OCP/1 is inactive. The decision falls on the unranked constraints in the lowest stratum. These constraints disagree about the winner, predicting either NOM ACC or NOM NOM, depending on which ranking is chosen. This prediction is confirmed by the examples in (31).

(40) Motivating OCP/1

		*MC/S	OCP/1	*MC/SO	*MC/SOA	OCP/S	OCP/SO	OCP/SOA
S1 A3	nom nom		1			1	1	2
	→ nom acc				1			
	acc nom	1		1	1			
	acc acc	1	1	1	2	1	1	2
S2 A3	→ nom nom					1	1	2
	→ nomacc				1			
	acc nom	1		1	1			
	acc acc	1		1	2	1	1	2

A particularly interesting situation arises in constructions where multiple accusatives alternate with multiple nominatives. Maling (2004:178) notes that Korean has a variety of constructions where multiple accusatives in the active alternate with multiple nominatives in the passive, posing a problem for the CTH. Double object constructions are a case in point:

(41) The Korean double object construction (Maling, 2004:178)

(a) Cheli-ka Mary-lul panci-lul senmul-ul ha-ess-ta
Cheli-NOM Mary-ACC ring-ACC gift-ACC do-PST-DEC
'Cheli presented Mary with a ring' (active, NOM ACC ACC)

(b) Mary-ka panci-ka senmul-i toy-ess-ta
Mary-NOM ring-NOM gift-NOM become-PST-DEC
'Mary was presented with a ring' (passive, NOM NOM)

Maling suggests that the solution lies in the descriptive generalization "All internal arguments of a predicate must get the same grammatical case" and proposes to revise the CTH accordingly:

> If this suggestion is on the right track, it indicates that the Case Tier maps onto both direct and indirect objects at once; in other words, the G[rammatical] F[unction] hierarchy is not articulated into two object functions, at least for the purposes of assigning syntactic case. Different internal arguments can, of course, bear different morphological cases if other sources of case-marking are available in a language, e.g. lexical case-marking. (Maling, 2004:178)

These facts follow from our analysis. As shown in (42), the predicted mappings are S1 O2 O2 → NOM ACC ACC in the active, but S2 O2 → NOM NOM in the passive.

(42) The Korean double object construction and Case OCP

		*MC/S	OCP/1	*MC/SO	*MC/SOA	OCP/S	OCP/SO	OCP/SOA
S1 O2 O2	nom nom nom		2			2	4	4
	nom nom acc		1	1	1	1	2	2
	nom acc nom		1	1	1	1	2	2
	acc nom nom	1		1	1			
	→ nom acc acc			2	2			
	acc nom acc	1	1	2	2	1	2	2
	acc acc nom	1	1	2	2	1	2	2
	acc acc acc	1	2	3	3	2	4	4
S2 O2	→ nom nom					1	2	2
	nom acc			1	1			
	acc nom	1		1	1			
	acc acc	1		2	2	1	2	2

Again, the crucial constraint is OCP/1. In the active variant, OCP/1 requires that the external argument differ in case from both internal arguments, hence NOM ACC ACC. In the passive variant, there is no external argument. The OCP/1 is therefore inactive and the markedness constraints rule out case completely, yielding the case pattern NOM NOM.

More examples of multiple nominatives come from stative predicatives. There is no limit to the number of consecutive NOM phrases as long as they are equally prominent, i.e. share the same thematic role, such as that of possessive (Kim and Sells, 2007b). This is exactly as predicted by OCP/1. An example is given in (43).

(43) John-i nwun-i oynccok-i alay-ka aphu-ta
John-NOM eyes-NOM left-NOM bottom-NOM sick-DECL
'It is John who has pain in the bottom of the left eyes.'

In sum, Finnish and Korean differ in the type of prominence relevant for structural case. In both languages, the most prominent DP in the sentence is required to differ in case from all other DPs. In Finnish, the most prominent DP is the subject; in Korean the most prominent DP is the external argument. We have outlined an analysis of this effect in terms of the Case OCP, originally proposed by Mohanan (1994). The Case OCP analysis improves on the CTH, replicating all its correct predictions and explaining a number of residual problems that remained outstanding puzzles for the CTH.

As two anonymous reviewers point out, the ranking of Case OCP constraints is not the only difference between Finnish and Korean. For example, the specific verbs that show unaccusative behavior may vary to some extent from language to language. In our analysis, such differences must be stipulated as part of the input, but it is entirely possible that they are amenable to a systematic treatment in terms of constraint ranking in a more comprehensive grammar. Developing such a grammar is a task left for future work.

5. Implications for syntax

In this section, we will discuss some implications of our analysis for Finnish and Korean syntax. The purpose of this section is to put the present case theory into a bigger perspective and point out topics for future research.

5.1. Partitive as a lexical case

It is often assumed that the Finnish partitive is a structural case (see e.g. Vainikka and Maling, 1996; Kiparsky, 2001; Keine and Müller, 2008), along with nominative and accusative. However, the partitive case has a range of puzzling semantic functions that are related to the lexical semantics of the verb, the aspectual properties of the VP, and the quantificational properties of the DP (Kiparsky, 1998). Given this, it is not immediately clear where the partitive fits in the hierarchy of structural cases, if it fits there at all. Is the partitive a lexical case skipped by structural cases or can we find a place for it in the structural case hierarchy? The evidence from adverbial case assignment suggests that the partitive case is indeed lexical, not structural, in at least some of its functions.

For the sake of the argument, let us assume that the partitive is a structural case. This means that it must be ordered somewhere along the case tier. For example, Keine and Müller (2008) propose a markedness hierarchy where PAR is sandwiched between NOM and ACC, with the total ordering NOM > PAR > ACC. Now, consider the following two examples:

(44) (a) Pekka etsi kirja-a *viikko / viiko-n
Peter.NOM search-PAST book-PAR *week.NOM / week-ACC
'Peter was looking for the book for a week.' (SOA → NOM PAR ACC)

(b) Etsi kirja-a viikko / *viiko-n
search.IMP book-PAR week.NOM / *week-ACC
'Look for the book for a week!' (OA → PAR NOM)

Mapping (44a) SOA → NOM PAR ACC implies that PAR is ordered between NOM and ACC. In contrast, mapping (44b) OA → PAR NOM implies that PAR is ordered above NOM, leading to an ordering paradox. This suggests that our initial assumption was incorrect and that PAR is not a structural case after all. Indeed, PAR turns out to behave like a lexical case: it is simply skipped in the process of NOM and ACC assignment. Consider the following additional examples:

(45) (a) Lue kirja-a viikko / *viiko-n
read.IMP book-PAR week.NOM / *week-ACC
'Read the book for a week (but only in part)' (OA → PAR NOM)

(b) Lue kirja *kerta / kerra-n
read.IMP book.NOM *once.NOM / once-ACC
'Read the book once (in its entirety)' (OA → NOM ACC)

Both sentences are of type OA, but differ in aspect: in (45a), we have a "partial object" marked by the partitive which results in a nominative adverbial; in (45b), we have a "total object" marked by the nominative which results in an accusative adverbial. The partitive is thus skipped in structural case assignment just like other lexical cases.

"Case shifts" of this sort are problematic for Keine and Müller's (2008) analysis which posits an abstract syntactic accusative realized as NOM (/-∅/), GEN (/-n/), ACC (/-t/), or PAR (/-a/) as a result of lexical insertion in postsyntactic morphology (Halle and Marantz, 1993). Since lexical insertion is a context-free postsyntactic process, the choice among NOM, GEN, ACC, and PAR is predicted not to have any syntactic effects (Keine and Müller, 2008:119–120, fn.15). In particular, the case of an object should not be able to interact with the case of an adjunct in the same sentence. However, as shown in (45), such interactions do occur. Evidently, then, structural case belongs to both morphology and syntax (Kiparsky, 2001). While the CTH emphasizes the distinguishing function of case, Keine and Müller's (2008) theory emphasizes the identifying function of case. In reality, both are needed.

5.2. Accusatives without nominatives

As we have seen, the new analysis easily handles the "multiple nominatives" problem. The "accusative without nominative" problem is different. Taking the sentence structure at face value, neither CTH nor Case OCP gets such patterns right.

5.2.1. Finnish pro-drop

In standard Finnish, first and second person subject pronouns are optional. This optionality in no way affects case marking: the adverbial gets ACC as if the NOM subject were present even when it is realized as silence. This is a problem if we assume that structural case assignment operates on surface DPs: the mapping A → ACC violates the prediction "no accusative without nominative".

(46) Nuku-i-n koko päivä-n / *päivä
sleep-PAST-1P.SG whole day-ACC / *day.NOM
'I slept the whole day' (A → ACC)

A possible solution is to assume that the subject is always present, audible or not, and receives the unmarked nominative (Toivainen, 1993:119). The fact that the verb continues to agree with the missing subject in number and person provides evidence that the absence of the subject is purely phonological, with no syntactic consequences. Under our analysis, the phonologically null subject is assigned the unmarked case, i.e. nominative, which is itself phonologically null. We can thus maintain the assumption that null DPs are never overtly marked for case.

(47) (a) ∅ nuku-i-n koko päivä-n / *päivä
NOM sleep-PAST-1P.SG whole day-ACC / *day.NOM
'I slept the whole day' (SA → NOM ACC)

(b) Minä nuku-i-n koko päivä-n / *päivä
1P.NOM sleep-PAST-1P.SG whole day-ACC / *day.NOM
'I slept the whole day' (SA → NOM ACC)

5.2.2. Finnish psychological causatives

Psychological causatives ("tunnekausatiivit") are verbs that describe psychological states over which the subject has no control. On the surface, we have the mapping OA → PAR ACC. In other words, there is (typically) no subject, the object is PAR, i.e. the verb is "irresultative", and crucially, the adverbial is invariably ACC.

(48) Minu-a nuku-tt-i koko päivä-n / *päivä
1P.SG-PAR sleep-CAUS-PAST whole day-ACC / *day.NOM
'I was sleepy the whole day' (OA → PAR ACC)

Under the assumption that PAR is a lexical case, we would expect the adverbial to be NOM. This is an apparent problem for both the CTH and our analysis. The class of psychological causative verbs is not negligible and new such verbs can be productively derived from both verbs and nouns. The following list is based on Penttilä (1963:589) and Hakulinen et al. (2004, Sections 313, 467).

(49) Some psychological causative verbs
(a) Verbs of experiencing nausea or disgust: *etoa* 'nauseate', *inhottaa* 'disgust'
(b) Verbs of experiencing anger or frustration: *harmittaa* 'annoy', *kismittää* 'peeve', *risoa* 'rankle'
(c) Verbs of experiencing physical deprivation, pain, or the like: *kolottaa* 'ache', *paleltaa* 'freeze', *syyhyttää* 'itch'
(d) Verbs of experiencing worry, fear, shame, sadness, or regret: *ahdistaa* 'oppress', *hirvittää* 'horrify'
(e) Verbs of experiencing puzzlement: *ihmetyttää* 'puzzle', *oudoksuttaa* 'strike as odd'
(f) Verbs of experiencing pleasure: *huvittaa* 'amuse', *miellyttää* 'please', *viehättää* 'attract'
(g) Verbs that describe an involuntary desire to do something (productively derived from both verbs and nouns): *puhu(tu)ttaa* 'feel like talking', *karkituttaa* 'feel like eating candy'

Again, one can plausibly argue that these verbs have a zero subject that steals the unmarked NOM. Thus, the sentence in (48) actually looks like this:

(50) ∅ minu-a nuku-tt-i koko päivä-n / *päivä
NOM 1P.SG-PAR sleep-CAUS-PAST whole day-ACC / *day.NOM
'I was sleepy the whole day' (SOA → NOM PAR ACC)

As with pro-drop, the subject DP with the semantic role of "stimulus" can be overtly present. In such cases, the verb agrees with this DP in person and number:

(51) (a) Mei-tä harmitt-i viiko-n.
1P.PL-PAR be.annoyed-PAST week-ACC
'We were annoyed for a week.'

(b) Virhee-t harmitt-i-vat mei-tä viiko-n
error-PL.NOM be.annoyed-PAST-3P.PL 1P.PL-PAR week-ACC
'The errors annoyed us for a week.'

However, some psychological causative verbs do not easily admit an overt stimulus subject. Such verbs include at least *hiukaista* 'feel hungry', *särkeä* 'ache', and *paleltaa* 'freeze'. These apparent exceptions may well have a semantic explanation that remains to be found.

5.2.3. Finnish existential sentences

The structure of existential sentences is one of the most thoroughly debated questions in Finnish syntax (see e.g. Hakulinen et al., 2004, Section. 893). An existential sentence typically consists of a locative DP, followed by an intransitive verb (e.g. *olla* 'be', *tulla* 'come', *ilmestyä* 'appear'), followed by a partitive DP. If there is an adverbial, it is invariably ACC. This poses a problem for the prediction "no accusative without nominative" made by both the CTH and the Case OCP. Examples of existential sentences with adverbials are given in (52).

(52) (a) Kellari-ssa ol-i vet-tä viiko-n / *viikko
basement-INE be-PAST water-PAR week-ACC / *week.NOM
'There was water in the basement for a week.'

(b) Siellä kulk-i laivo-j-a koko vuode-n / *vuosi.
there go-PAST ship-PL-PAR whole year-ACC / *year.NOM
'Ships plied there all year' (Kiparsky, 2001:40)

(c) Viera-i-ta käv-i koko viiko-n / *viikko.
guest-PL-PAR visit-PAST whole week-ACC /* week.NOM
'Guests were visiting the whole week.'

(d) Ihmis-i-ä kävel-i kadu-lla koko päivä-n / *päivä.
person-PL-PAR walk-PAST street-ADE whole day-ACC / *day.NOM
'There were people walking on the street for the whole day.'

The syntactic analysis of existential sentences is controversial. There is disagreement about whether the partitive DP is a subject or an object (see e.g. Kiparsky, 2001 and references there). For our purposes, the main puzzle is why the adverbial is invariably ACC. Would the zero subject analysis work here? The adverbial ACC would be expected if we could justify an empty subject that steals NOM. This in turn would imply that the partitive DP is an object. Indeed, the partitive DP does have several object-like properties. For example, it does not agree with the verb in number/person, as shown in (53a), and it takes the partitive of negation, as shown in (53b–c).

(53) (a) Kellari-ssa ol-i rott-i-a.
basement-INE be-PAST rat-PL-PAR
'There were rats in the basement.'

(b) Siellä ol-i Anna.
there be-PAST Anna
'There was Anna.'

(c) Siellä ei ol-lut Annaa-PAR.
there NEG be-PCP Anna
'Anna wasn't there.'

However, there is also evidence against the object analysis. Kiparsky (2001) argues that the partitive DP is the subject (in our terms S2, i.e. an internal argument subject) and this view is also adopted in a recent descriptive grammar of Finnish (Hakulinen et al., 2004). One argument for the subject analysis is that the partitive DP is incompatible with an overt nominative subject, which is as expected if the partitive DP itself is the subject. In this respect, existential sentences sharply differ from psychological causatives:

(54) *Ihmise-t käv-i-vät viera-i-ta koko viiko-n.
person-PL visit-PAST-3P.PL guest-PL-PAR whole week-ACC.
Intended reading: 'People were visiting as guests the whole week.'

Intuitively, the subject is excluded because it is not licensed by the argument structure. The verb in an existential sentence is always intransitive and its only argument is realized as the partitive DP. There is thus no suitable thematic role available to

serve as the subject (cf. the "stimulus" role in psychological causatives), neither does Finnish allow expletive subjects. For this reason, the zero subject analysis seems implausible. We will leave the problem unresolved here. At any rate, the case of adverbials in existential sentences pose a problem for both the CTH and the Case OCP analysis. A possible line of attack will be suggested in section 5.3.

5.2.4. Imperatives

Korean differs from Finnish in the case marking of imperatives with one DP, e.g. 'Eat an apple!' In Finnish, this DP is categorically NOM, as predicted by both the CTH and our new analysis. In Korean, it is equally categorically ACC. This is again an apparent problem for both analyses. The Korean examples in (55) show that ACC is assigned to both objects and adverbials.

(55) (a) sakwa-lul mek-ela
apple-ACC eat-IMP
'Eat an apple!'

(b) hansikan-ul talli-ela
one.hour-ACC run-IMP
'Run an hour!'

One possibility would be to assume that Korean imperatives have a silent subject *pro*. This *pro* would receive NOM, analogously to Finnish pro-drop and psychological causatives (see sections 5.2.1 and 5.2.2). Empirical evidence for a null subject comes from subject-verb agreement: if the subject refers to a person with a higher status than the speaker, the verb appears in the honorific form (Kim and Sells, 2007a):

(56) sakwa-lul tusip-si-yo
apple-ACC eat-HON-IMP
'Eat (hon.) an apple!'

(57) han sikan tongan talli-si-yo
one hour during run-HON-IMP
'Run (hon.) for an hour!'

In contrast, the case evidence indicates that Finnish imperatives have no subject. Kiparsky (2001:335) notes that first and second person imperatives allow an optional postverbal DP that initially looks like a subject, but on closer inspection turns out not to be one:

(58) Näh-kää (te / poja-t) Napoli!
see-IMP.2P.PL you.PL.NOM boy-PL.NOM Naples.NOM
'You guys see Naples!'

These DPs seem to have a vocative-like function (Toivainen, 1993:119). As Kiparsky (2001:335) points out, they are not properly licensed subjects on two counts: they do not agree in person with the imperative verb, as shown by the fact that they can be replaced by full nouns, e.g. *poja-t* 'boy-PL.NOM', and they are obligatorily postverbal:

(59) *Te näh-kää Napoli!
you.PL.NOM see-IMP-2PL Naples-NOM

In the third person, this DP is a real subject (Carlson, 1978): it agrees with the imperative verb in person; it entails the accusative case on the object; and it may appear preverbally.

(60) Näh-kööt he Napoli-n!
see-IMP.3P.PL they.NOM Naples-ACC
'Let them see Naples!'

(61) He näh-kööt Napoli-n!
they.NOM see-IMP.3P.PL Naples-ACC
'Let them see Naples!'

However, the evidence for the absence of subject in first and second person imperatives is not as unambiguous as one might hope. There are two troubling symptoms that suggest the presence of a subject. First, as the above examples show, the imperative verb has overt agreement morphology in all three persons. Second, imperatives are compatible with possessive suffixes which are typically subject-bound anaphoric elements:

(62) Maksa vasta peri-lle saavu-ttua-si.
pay.IMP only destination-ALL arrive-PAST-2P.SG
'Pay only once you have arrived at your destination.'

These facts remain unsolved puzzles for our analysis.

5.3. Variation in the Finnish passive

The Finnish passive is an impersonal construction with no subject. What makes the passive interesting is that the accompanying adverbial admits free variation NOM ∼ ACC under specific circumstances.[4] This is yet another case where ACC may appear without NOM, posing a problem for the prediction "no accusative without nominative" made by both the CTH and the Case OCP. We start by illustrating this variation from the intransitive passive sentence in (63) where the only DP is the adverbial. Crucially, variation only appears on adverbials, never on objects, which always receive NOM. This is illustrated by the transitive passive sentence in (64).

(63) Men-nään vielä kerta ∼ kerra-n
go-PASS still once.NOM ∼ once-ACC
'Let's go one more time!'

(64) Lue-taan vielä runo / *runo-n
read-PASS still poem.NOM / *poem-ACC
'Let's read one more poem!'

Transitive clauses also show variation if the object case is lexically marked. We illustrate this using data from the *Aamulehti 1999* corpus (see Corpora). In the following examples the object is PAR and the adverbial can be either NOM or ACC. In the first set of examples, the nominatives are from *Aamulehti 1999*, but accusatives also seem possible.

(65) (a) nii-tä polte-ttiin muutama vuosi (∼ muutama-n vuode-n)
they-PAR burn-PASS.PAST a.few year.NOM (∼ a.few year-ACC)
'They [lights] were burning for a few years'

(b) Tö-i-tä paine-ttiin koko päivä (∼ päivä-n)
work-PL-PAR do-PASS.PAST whole day.NOM (∼ day-ACC)
'One was working the whole day'

(c) Pushkin-in runo-j-a lausu-ttiin koko päivä (∼ päivä-n)
Pushkin-GEN poem-PL-PAR recite-PASS.PAST whole day.NOM (∼ day-ACC)
'Pushkin's poems were being recited the whole day'

In the next set of examples, the accusatives are from *Aamulehti 1999*, but nominatives also seem possible.

(66) (a) Kirkonkello-j-a soite-ttiin koko (päivä) ∼ päivä-n
church.bell-PL-PAR toll-PASS.PAST whole (day.NOM) ∼ day-ACC
'The church bells were tolling the whole day'

(b) hei-lle makse-taan palkka-a koko (vuosi) ∼ vuode-n
they-ALL pay-PASS.PRES salary-PAR whole (year.NOM) ∼ year-ACC
'They are paid salary the whole year'

[4] A recent descriptive grammar (Hakulinen et al., 2004, Section 973) suggests that only NOM is possible in this context, which seems incorrect.

(c) Divaripallo-a näh-dään vielä (kerta) ~ kerra-n tänä vuon-na
division.football-PAR see-PASS.PRES still (once.NOM) ~ once-ACC this-ESS year-ESS
'Division football can be watched once more this year'

(d) Neuvottelu-j-a jatke-ttiin koko (päivä) ~ päivä-n
negotiation-PL-PAR continue-PASS.PAST whole (day.NOM) ~ day-ACC
'Negotiations continued the whole day'

The example in (67) provides evidence for the reality of variation. Here the passive verb is accompanied by two adverbials that differ in case: one adverbial has ACC ('all the time'), the other adverbial has NOM ('a few years').

(67) Työ-tä on teh-tä-vä koko aja-n, ei vain muutama vuosi.
work-PAR is do-PASS-PCP whole time-ACC not only a.few year.NOM
'Work must be done all the time, not just for a few years'

The variation in transitive sentences arises not only with PAR objects, but with any lexically marked object. In (68), the word *seokse-n* 'mixture-GEN' has the "dative genitive" assigned by the verb *anta-* 'give' (Carlson, 1978; Kiparsky, 2001). Again, the NOM ~ ACC variation is possible on the adverbial:

(68) Seokse-n anne-taan muhi-a muutama päivä ~ muutama-n päivä-n
mixture-GEN let-PASS.PRES ferment-INF a.few day.NOM ~ a.few day-ACC
'The mixture is allowed to ferment for a few days'

These patterns can be summarized as follows: The NOM ~ ACC variation arises on adverbials under two circumstances: (i) if the adverbial is the only DP in the sentence or (ii) there are other DPs, but they receive lexical case (e.g. PAR, GEN). Generalizing further, we can replace this disjunctive statement by the final generalization in (69).

(69) Case variation on adverbials: NOM ~ ACC variation arises on adverbials in sentences where there are no other DPs eligible for structural case.

This generalization seems to approximate the empirical facts reasonably well. Consider the minimal pair in (70) where the choice of object case interferes with adverbial case: if the object is PAR ("partial object"), variation on the adverbial is possible; if the object is NOM ("total object"), the adverbial is categorically ACC.

(70) (a) Teksti-ä lue-ttiin kerta ~ kerra-n.
text-PAR read-PASS.PAST once.NOM ~ once-ACC
'The text was read once (but only in part)'

(b) Teksti lue-ttiin kerra-n / *kerta.
text.NOM read-PASS.PAST once-ACC / *once.NOM
'The text was read once (in its entirety).'

While we cannot yet offer a detailed quantitative analysis of this puzzling variation, our analysis correctly predicts its locus. We will assume that variation arises when high-ranking constraints are inactive, leaving the decision to low-ranking constraints that may be only partially ranked (see e.g. Kiparsky, 1994b; Anttila, 2007). The variation environment can be identified as one where the low-ranking constraint *MC/SOA becomes relevant for the decision. This happens precisely when the adverbial is the only DP eligible for structural case.

(71) The constraint *MC/SOA crucially decides the winner.

		*MC/S	OCP/S	OCP/SO	OCP/SOA	*MC/SO	*MC/SOA
A	→ nom						
	acc						1

We can now revise the analysis to capture the variation as follows. Assume a constraint that favors case marking. Following Aissen (2003:447), let us call this constraint $^{*}\varnothing_{C}$ (read: star zero case). This constraint is violated by DPs not marked for case. An anonymous reviewer suggests this constraint can be viewed as a placeholder for some as yet unidentified constraint(s) that favor the presence of case marking. By placing $^{*}\varnothing_{C}$ in the stratum at the bottom of the grammar where it is freely ranked with *MC/SOA we predict the observed variation.

(72) Variation as a tie between *MC/SOA and $^{*}\varnothing_{C}$

		*MC/S	OCP/S	OCP/SO	OCP/SOA	*MC/SO	*MC/SOA	$^{*}\varnothing_{C}$
A	→ nom							1
	→ acc						1	

The introduction of $^{*}\varnothing_{C}$ is not just a mere formal trick to get NOM ~ ACC variation to appear wherever desired. The variation is limited to one special environment: an adverbial that is the sole DP eligible for structural case. Everywhere else NOM ~ ACC variation is blocked. As far as we can tell, this prediction is correct. More generally, in Optimality Theory it is not possible to introduce variation arbitrarily in specific locations because allowing variation in one environment has consequences throughout the grammar. We will return to this issue shortly.

This analysis is intended as a starting point for future work. It is almost certain that there are other factors that interact with the choice of case in the adverbial variation. For example, only some verbs and/or adverbials appear to allow variation:

(73) (a) Men-nään vielä kerta ~ kerra-n.
go-PASS.PRES still once.NOM ~ once-ACC
'Let's go one more time.'

(b) Nuku-taan vielä tunti / *tunni-n.
sleep-PASS.PRES still hour.NOM ~ hour-ACC
Let's sleep one more hour.'

(c) Tuoksu-taan hyvä-ltä viikko / *viiko-n
smell-PASS.PRES good-ABL week.NOM / *week-ACC
'Let's smell good for a week.'

The variation analysis also provides a possible solution to the remaining "no accusative without nominative" problems. The general idea is to associate case patterns with construction-specific rankings. In particular, the obligatory ACC in existential sentences could be accounted for by assuming that existential sentences come with the ranking $^{*}\varnothing_{C} \gg$ *MC/SOA; the obligatory NOM in imperatives could be accounted for by assuming the reverse ranking *MC/SOA $\gg$ $^{*}\varnothing_{C}$ for imperatives; and finally, both rankings would be possible in the passive, predicting the NOM ~ ACC variation. Under this analysis, the choice among the three case patterns remains arbitrary, but the locus of the NOM ~ ACC variation is restricted to one special environment: adverbials that are the sole DPs eligible for structural case.

A possible alternative analysis would posit an empty subject for passives. The Finnish passive is an impersonal construction where the logical subject is a third person plural human *pro* (Kiparsky, 2001). Positing an optional zero subject would account for the adverbial case variation:

(74) (a) Kirkonkello-j-a soite-ttiin koko päivä.
church.bell-PL-PAR toll-PASS.PAST whole day.NOM
'The church bells were tolling the whole day'

(b) ∅ kirkonkello-j-a soite-ttiin koko päivä-n.
NOM church.bell-PL-PAR toll-PASS.PAST whole day-ACC
'The church bells were tolling the whole day'

This analysis would seem to be supported by the fact that in colloquial registers the passive verb in fact does co-occur with an overt first person plural pronoun subject:

(75) Me soite-ttiin kirkonkello-j-a koko päivä-n.
we rang-PASS.PAST church.bell-PL-PAR whole day-ACC
'We rang the church bells the whole day.'

However, unlike in the case of psychological causatives, here the zero subject analysis quickly proves wrong. For example, it predicts that an overt pronominal subject should render objects and adverbials invariably accusative. This prediction fails on both counts: in reality the object is invariably NOM whereas the adverbial is variably NOM ∼ ACC:

(76) (a) Me näh-tiin Anna / *Anna-n siellä kerra-n.
we see-PASS.PAST Anna.NOM / Anna-ACC there once-ACC
'We saw Anna there once.'

(b) Me soite-ttiin kirkonkello-j-a koko päivä ∼ päivä-n.
we rang-PASS.PAST church.bell-PL-PAR whole day.NOM ∼ day-ACC
'We rang the church bells the whole day.'

The following attested examples show that the presence of an apparent pronominal NOM subject in no way blocks the variation on the adverbial, as it should if it really were the subject. In the first example, the adverbial is NOM, in the second example ACC:

(77) (a) Me istu-ttiin koko yö kuisti-lla
we sit-PASS.PAST whole night.NOM porch-ADE
'We sat on the porch the whole night.'

(b) Me istu-ttiin koko aja-n olohuonee-ssa
we sit-PASS.PAST whole time-ACC living.room-INE
'We sat in the living room the whole time.'

We conclude that the case variation in adverbials in passive sentences cannot be explained by the optionality of a subject because Finnish passives have no subject. Given the present understanding, the solution involving alternative rankings is better motivated.

6. Typological consequences

We have found a ranking that generates the Finnish case pattern and another that generates the Korean case pattern. That is all very well, but we still do not know what sorts of case patterns are predicted to be possible in general. In theoretical linguistics, it is important to know what one's theory predicts beyond the specific languages one happens to work with. For this reason, we will now work out the general predictions of the theory in some detail.

From the very beginning, Optimality Theory has emphasized the importance of typological work. The typological dimensions of case systems were first discussed by Legendre et al. (1993) in one of the first papers written in Optimality Theory. What we present here implements the seminal idea in Legendre et al. (1993), developing some important analytical insights in Aissen (2003). The important question is what kinds of languages are admitted and what kinds of languages are excluded by our theory of case. We start by showing how these questions can be answered for inputs that contain exactly one DP. The problem is laid out in the violation table shown in (78): there are eight constraints and five inputs, each input with two output candidates. Since we are interested in general typological predictions, no language-specific rankings are assumed.

(78) Violation profile for inputs with one DP

		OCP/1	OCP/S	OCP/SO	OCP/SOA	*MC/S	*MC/SO	*MC/SOA	$*\varnothing_C$
S1	nom								1
	acc					1	1	1	
S2	nom								1
	acc					1	1	1	
S3	nom								1
	acc					1	1	1	
O2	nom								1
	acc						1	1	
A3	nom								1
	acc							1	

Next, we compute the FACTORIAL TYPOLOGY for this grammar using OTSoft (Hayes et al., 2003). We discover that our constraints predict four possible distinct languages (= Output):

(79)

	Output #1	Output #2	Output #3	Output #4
/S1/:	nom	nom	nom	**acc**
/S2/:	nom	nom	nom	**acc**
/S3/:	nom	nom	nom	**acc**
/O2/:	nom	nom	**acc**	**acc**
/A3/:	nom	**acc**	**acc**	**acc**

Various generalizations emerge from (79). For example, both NOM and ACC are possible for all inputs, depending on the constraint ranking: Output #1 has NOM (= the unmarked case) everywhere, whereas Output #4 has ACC (= the marked case) everywhere.[5] The inputs S1, S2, and S3 turn out indistinguishable, i.e. they have identical constraint violations and therefore identical typological patterns. This is because the only constraint that refers to thematic structure (OCP/1) is idle in sentences with only one DP and activated only when there is more than one DP present.

Crucially, the factorial typology excludes many logically possible languages. For example, the fact that both NOM and ACC are possible for all five inputs does not mean that anything is possible. Consider the asymmetry between the inputs S1 and O2:

(80)

	Output #1	Output #2	Output #3	Output #4
/S1/:	nom	nom	nom	**acc**
/O2/:	nom	nom	**acc**	**acc**

This asymmetry reveals a TYPOLOGICAL ENTAILMENT predicted by the system: for all languages in the typology, if an external argument subject is ACC, an internal argument object must also be ACC. This typological entailment holds true for all the languages in the factorial typology. Since this typology is universal in the sense that it assumes no language-specific rankings, we have a typological entailment of a particularly strong kind: it holds true no matter how the constraints are ranked. In other words, we have an IMPLICATIONAL UNIVERSAL. More succinctly, a typological entailment can be stated as a binary relation on <input, output> pairs:

(81) A typological entailment:
<S1, acc> → <O2, acc>

This typological entailment is a consequence of our constraints: there can be no language where external subjects have marked structural case, but internal objects do not. However, since this entailment was found by casual inspection, it is entirely possible that more entailments exist. Factorial typologies have the virtue of being explicit, but they are hard for humans to understand, especially when the number of predicted languages is large. In this case, the factorial typology is small (5 inputs, 4 languages) and the entailments are relatively easy to work out with paper and pencil, but for larger typologies manual methods quickly prove impractical. Fortunately, since typological entailments can be mechanically looked up from the factorial typology, and ultimately from the grammar itself, we can leave this task to a computer.

We call the set of all typological entailments derived by a grammar a TYPOLOGICAL ORDER (T-ORDER). We computed the T-order for our grammar using T-ORDER GENERATOR (Anttila and Andrus, 2006), a free open-source Python program for computing and visualizing T-orders. The T-order for sentences with exactly one DP is shown in (82). It contains 26 implicational universals. Our sample universal (81) appears first on the list.

(82) (a) Accusative in the antecedent implies accusative in the consequent:
<S1, acc> –> <O2, acc>
<S1, acc> –> <A3, acc>
<S2, acc> –> <O2, acc>
<S2, acc> –> <A3, acc>
<S3, acc> –> <O2, acc>

[5] An anonymous reviewer points out that Output #4 looks typologically odd: it is a language that has marked case on all grammatical functions. If we encountered this situation in an actual language, we would most likely not call this case accusative because this language lacks the contrast between unmarked and marked case, i.e. it lacks nominative. This example highlights the distinction between marked vs. unmarked case on the one hand and the language-specific morphological labels on the other.

<S3, acc> –> <A3, acc>
<S1, acc> –> <S2, acc>
<S1, acc> –> <S3, acc>
<S2, acc> –> <S1, acc>
<S2, acc> –> <S3, acc>
<S3, acc> –> <S1, acc>
<S3, acc> –> <S2, acc>
<O2, acc> –> <A3, acc>

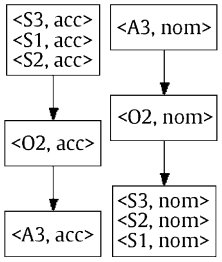
(b) Nominative in the antecedent implies nominative in the consequent:

<O2, nom> –> <S1, nom>
<O2, nom> –> <S2, nom>
<O2, nom> –> <S3, nom>
<A3, nom> –> <S1, nom>
<A3, nom> –> <S2, nom>
<A3, nom> –> <S3, nom>
<A3, nom> –> <O2, nom>
<S1, nom> –> <S2, nom>
<S1, nom> –> <S3, nom>
<S2, nom> –> <S1, nom>
<S2, nom> –> <S3, nom>
<S3, nom> –> <S1, nom>
<S3, nom> –> <S2, nom>

Each accusative universal in (82a) has a reverse nominative universal in (82b). This is because only two outcomes are possible: NOM and ACC. In this sense, the grammar only derives 13 informative universals.

The structure in (82) becomes easier to understand if we visualize it as a directed graph. To make the graph visually more pleasing, we have removed transitive arrows and collapsed two-way entailments (= cycles) into boxes. Stated in prose, the graph conveys the following information: ACC on a subject implies ACC everywhere else and ACC on an object implies ACC on an adverbial. The reverse pattern holds for NOM.

(83) The T-order for inputs with one DP (= 26 implicational universals)



It is now possible to see that many case patterns in Finnish and Korean are not language-specific, but have their source in implicational universals. For example, recall that the NOM ~ ACC variation in Finnish emerges on adverbials that are the sole DPs eligible for structural case in the sentence. However, no such variation is found on objects. Why should this be?

(84) (a) Men-nään vielä kerta ~ kerra-n
go-PASS still once.NOM ~ once-ACC
'Let's go one more time!'

(b) Lue-taan vielä runo / *runo-n
read-PASS still poem.NOM / *poem-ACC
'Let's read one more poem!'

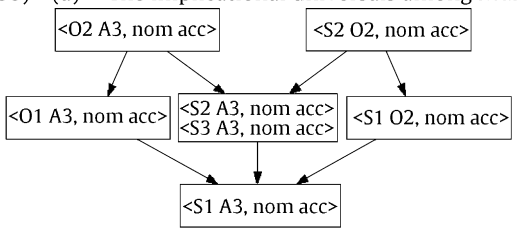
The source of the asymmetry lies in the implicational universals in (85). They allow systems like Finnish with accusative adverbials and nominative objects, but exclude mirror-Finnish with accusative objects and nominative adverbials.

(85) (a) <O2, acc> --> <A3, acc>
(b) <A3, nom> --> <O2, nom>

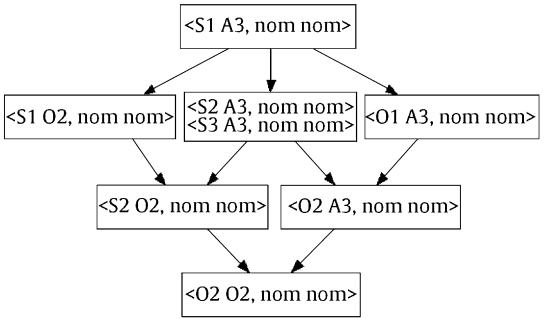
/O2/	/A3/		
NOM	NOM		a language with no case
NOM	ACC	–	Finnish
ACC	NOM		universally ill-formed
ACC	ACC		a language with marked case on both DPs

Next, let us consider inputs with two DPs. This time, the T-order consists of 64 implicational universals that form three unconnected graphs. Note that the T-order is no longer symmetric because there are three possible outcomes: NOM ACC, NOM NOM, and ACC ACC. The outcome ACC NOM is ruled out as universally impossible.

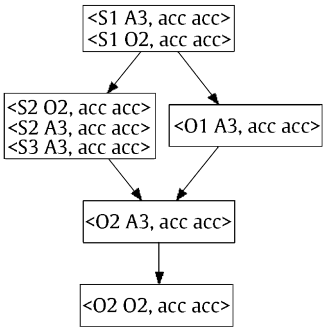
(86) (a) The implicational universals among NOM ACC patterns



(b) The implicational universals among NOM NOM patterns



(c) The implicational universals among ACC ACC patterns



This is a much richer set of implicational universals. To get a glimpse of its intuitive content, we again unpack the structure a bit by picking out specific empirical patterns, showing how they follow from the present system. For example, Korean allows double nominatives only if the subject is an internal argument, i.e. S1 O2 → NOM ACC, but S2 O2 → NOM NOM. What is the status of this pattern? Is it universal or language-specific? Could we have mirror-Korean where S1 O2 → NOM NOM and S2 O2 → NOM ACC? The implicational universal in (87) provides the answer: this pattern is impossible. The implicational universal admits three case patterns, all attested, but excludes mirror-Korean.

(87) <S2 O2, nom acc> --> <S1 O2, nom acc>

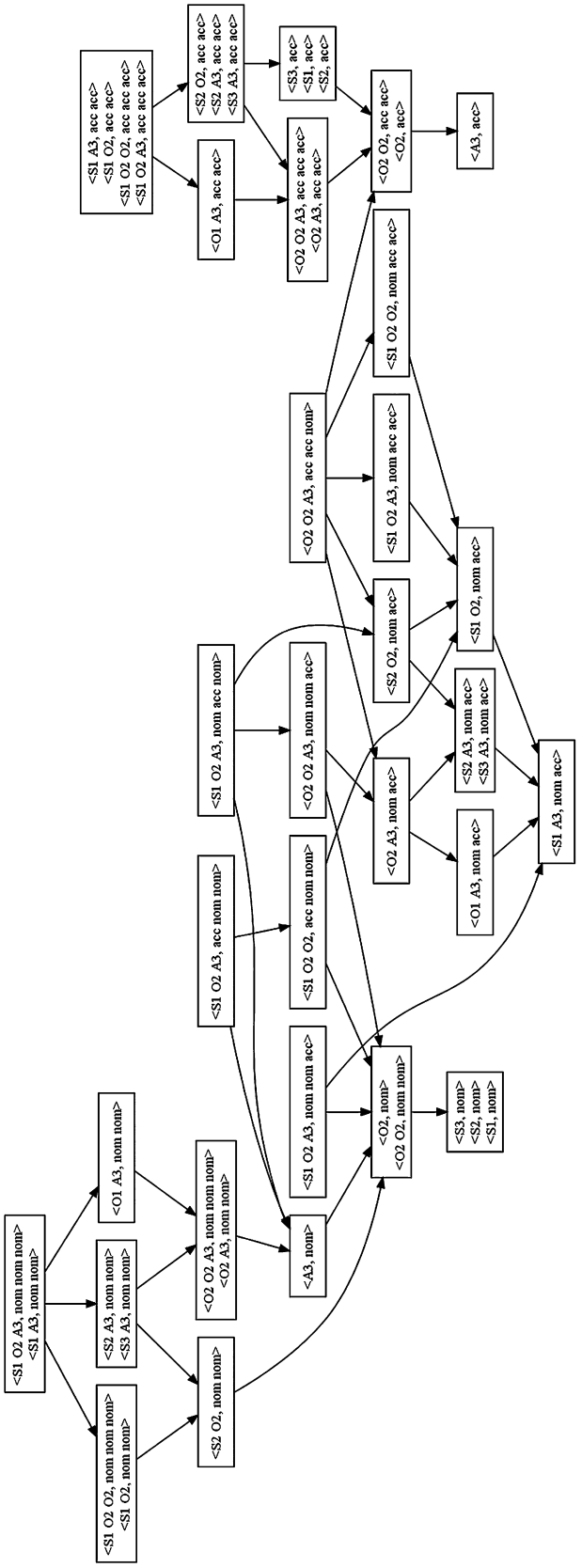
/S2 O2/	/S1 O2/	
NOM NOM	NOM NOM	a language with no case
NOM NOM	NOM ACC	Korean
NOM ACC	NOM NOM	universally ill-formed
NOM ACC	NOM ACC	Finnish

As another example, consider the following pattern. The input S1 O2 yields NOM ACC in both Finnish and Korean. The input S2 O2 yields NOM ACC in Finnish, but NOM NOM in Korean. Finally, O2 O2 yields NOM NOM in both languages. Is this pattern universal or should we expect it to vary cross-linguistically? For example, could we have a language with a double nominative in S2 O2, but not in O2 O2? The answer turns out to be no. The relevant implicational universals are shown in (88). Of the eight logically possible case systems, four are ruled out on universal grounds. Among them are the languages with a double nominative in S2 O2, but not in O2 O2.

(88) (a) <S1 O2, nom nom> --> <S2 O2, nom nom>
(b) <S2 O2, nom nom> --> <O2 O2, nom nom>
(c) <S1 O2, nom nom> --> <O2 O2, nom nom> (by transitivity)

/O2 O2/	/S2 O2/	/S1 O2/	
NOM NOM	NOM NOM	NOM NOM	a language with no case
NOM NOM	NOM NOM	NOM ACC	Korean
NOM NOM	NOM ACC	NOM NOM	universally ill-formed
NOM ACC	NOM NOM	NOM NOM	universally ill-formed
NOM NOM	NOM ACC	NOM ACC	Finnish
NOM ACC	NOM NOM	NOM ACC	universally ill-formed
NOM ACC	NOM ACC	NOM NOM	universally ill-formed
NOM ACC	NOM ACC	NOM ACC	a language with no double nominatives

Finally, we display the complete T-order that contains inputs of all lengths: one, two, and three DPs. The graph contains 308 implicational universals.


<S1 O2 A3, nom nom nom>
<S1 A3, nom nom>
<S1 O2 O2, nom nom nom>
<S1 O2, nom nom>
<S2 A3, nom nom>
<S3 A3, nom nom>
<S2 O2, nom nom>
<O1 A3, nom nom>
<O2 O2 A3, nom nom nom>
<O2 A3, nom nom>
<A3, nom>
<S1 O2 A3, acc nom nom>
<S1 O2 A3, nom acc nom>
<S1 O2 A3, nom nom acc>
<S1 O2 O2, acc nom nom>
<S1 O2 O2, nom acc nom>
<S1 O2 O2, nom nom acc>
<O2, nom>
<O2 O2, nom nom>
<S3, nom>
<S2, nom>
<S1, nom>
<S1 A3, acc acc>
<S1 O2, acc acc>
<S1 O2 O2, acc acc acc>
<S1 O2 A3, acc acc acc>
<O1 A3, acc acc>
<S2 O2, acc acc>
<S2 A3, acc acc>
<S3 A3, acc acc>
<O2 O2 A3, acc acc acc>
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<S2, acc>
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<A3, acc>
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<O2 A3, nom acc>
<S2 O2, nom acc>
<S1 O2 A3, nom acc acc>
<S1 O2 O2, nom acc acc>
<O1 A3, nom acc>
<S2 A3, nom acc>
<S3 A3, nom acc>
<S1 O2, nom acc>
<S1 A3, nom acc>

Sentences with three DPs provide the crucial evidence for "case spreading". Both Finnish and Korean show rightward case spreading, i.e. we have NOM ACC ACC. What else should we expect to find in such languages? To find out the answer, we can look up the implicational universals with <S1 O2 A3, nom acc acc> in the antecedent. There are two such implicational universals:

(89) (a) <S1 O2 A3, nom acc acc> --> <S1 A3, nom acc>
(b) <S1 O2 A3, nom acc acc> --> <S1 O2, nom acc>

Two additional case patterns are predicted: in sentences with an external subject and an adverbial (= S1 A3) or an external subject and an internal object (= S1 O2), the case pattern must be NOM ACC. This prediction is correct for both Finnish and Korean. Another interesting fact that emerges from the typology is that leftward spreading is impossible given the present constraints: the mapping /S1 O2 A3/ → ACC ACC NOM is harmonically bounded.

In this section, we went beyond Finnish and Korean and illustrated the typological predictions of our theory of case. We did this by displaying all the implicational universals derived by the theory. Following Anttila and Andrus (2006), we called this structure a T-order. We introduced T-orders via factorial typologies. Another way to accomplish the same is to find the Elementary Ranking Conditions (ERCs) for each <input, output> mapping and the entailments among them. These notions are introduced and explored in Prince (2002a,b, 2006).

T-orders were inspired by AISSEN LATTICES (Aissen, 2003; Grimm, 2005); see especially O'Connor et al. (2004). However, the two are quite different. In Aissen's lattice diagrams, the nodes are constraints built by harmonic alignment and constraint conjunction; the ordering relation is that of optimality-theoretic ranking. By moving a constraint such as *STRUC_C (Aissen, 2003:448) along the hierarchy we obtain different outputs (marked case vs. unmarked case) for the same input. In T-order diagrams, the nodes are <input, output> mappings; the ordering relation is that of entailment between sets of Elementary Ranking Conditions (ERCs), see e.g. Prince (2006). Despite this fundamental difference, both types of diagrams serve the same purpose: they visualize the implicational universals predicted by the theory. The main advantage of T-orders is their greater generality: they can be mechanically constructed for any optimality-theoretic grammar, no matter whether the constraints are built by harmonic alignment, constraint conjunction, or whatever, and they show all the implicational universals derived under any ranking, not just those that depend on the relative ranking of one particular constraint, such as *STRUC_C, against a set of constraints with a particular fixed ranking.

The purpose of this section was to make understandable the predictions of the proposed theory by visualizing its predictions. Linguistic theories tend to be complex and they often have subtle consequences that are hard to pin down by casual inspection. Working out the predictions systematically and visualizing them in an appropriate way (e.g. as T-order graphs) can take one a long way towards understanding one's theory's virtues as well as limitations. This also emphasizes the usefulness of software tools in theoretical linguistics.

7. Future directions

One major issue we have not addressed is DIFFERENTIAL OBJECT MARKING (DOM). For recent work, see e.g. Aissen (2003); de Hoop and Malchukov (2008), and Keine and Müller (2008). In Finnish, differential object marking distinguishes personal pronouns from other DPs (see e.g. Kiparsky, 2001). Consider the following example: O2 O2 has the case pattern NOM NOM if the DPs are common nouns, but personal pronouns are marked ACC.

(90) (a) Matti pakote-ttiin luke-ma-an kirja.
Matti.NOM force-PASS.PAST read-INF-ILL book.NOM
'Matti was forced to read a book.' (O2 O2, passive)

(b) Sinu-t pakote-ttiin luke-ma-an kirja.
you-ACC force-PASS.PAST read-INF-ILL book.NOM
'You were forced to read a book.' (O2 O2, passive)

(c) Matti pakote-ttiin näke-mä-än minu-t.
Matti.NOM force-PASS.PAST read-INF-ILL me-ACC
'Matti was forced to see me.' (O2 O2, passive)

(d) Sinu-t pakote-ttiin näke-mä-än minu-t.
you-ACC force-PASS.PAST read-INF-ILL me-ACC
'You were forced to see me.' (O2 O2, passive)

Differential subject and object marking reflect the identifying function of case: personal pronouns tend to be marked as objects because they are "untypical" objects, whereas other DPs tend not to be so marked because they are "typical" objects. It seems that the present analysis can be easily extended along the lines suggested in e.g. Kiparsky (2001), Aissen (2003), de Hoop and Malchukov (2008), and Keine and Müller (2008). This would result in even more intricate T-orders.

Another major issue we have not mentioned is ergative case marking. Both Finnish and Korean are nominative-accusative languages. Extending the analysis to cover the generalizations in the large descriptive and theoretical literature on ergative case is another obvious direction for future work. For an interesting recent discussion of ergative case alternating with its absence in Nez Perce, see Deal (2010).

8. Conclusions

Following earlier work, in particular Yip et al. (1987) and de Hoop and Malchukov (2008), we started out with three initial hypotheses:

(91) (a) Case identifies arguments.
(b) Case distinguishes arguments.
(c) Case refers to prominence relations among arguments.

We implemented these hypotheses in Optimality Theory (Prince and Smolensky, 1993/2004), showing that the resulting analysis correctly handles the basic case patterns of Finnish and Korean and extends to some previously problematic patterns, in particular multiple nominatives. We also discussed the implications of the analysis for other patterns, in particular accusatives without nominatives.

Going beyond Finnish and Korean, we noted that optimality-theoretic grammars derive rich patterns of implicational universals that tend to be ignored because they are hard to work out manually, but the structure is there and it is easy to find using software tools (e.g. Anttila and Andrus, 2006). Such implicational universals are of the highest theoretical importance because they show what the theory predicts and what it excludes, both central questions in theoretical linguistics.

Corpora

Aamulehti 1999. An electronic document collection of the Finnish language containing 16,608,843 words, Research Institute for the Languages of Finland and CSC - Scientific Computing Ltd. Available through CSC, http://www.csc.fi/.

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