

Experimental approaches to ergative languages

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Abstract: In this chapter, we summarize major results in the domain of experimental approaches to ergativity, focusing on three major topics. First, we discuss studies that explore the competition between accusative and ergative alignment, where researchers have attempted to derive the typological preference for accusative alignment from processing- and learnability-based constraints. Next, we examine studies concerning the interrelated issues of long-distance dependencies and agreement. The unique dissociation of case and argument-hood in ergative languages has afforded researchers new means of testing conclusions regarding the privileged grammatical status of subject, the relative import and function of case and agreement in the grammar, and the origins of constraints on extraction in ergative languages and beyond. Given that linguists have only recently begun to conduct experimental research on ergative languages, we conclude by suggesting areas for future research where ergativity might provide genuine insights rather than just replicate existing studies of accusative languages.

Keywords: Ergativity, processing, learnability, relative clauses, subject processing advantage, ERP, split ergativity, syntactic ergativity

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30.1 Introduction

The objectives of this chapter are twofold. First, we present and analyze experimental work on ergative languages; our discussion combines the review of existing work and the presentation of new experiments on Niuean and Avar. Second, we outline possible future avenues of experimental investigation where ergative languages can make a significant difference as compared to languages without morphological or syntactic ergativity. To anticipate the discussion below, we will focus primarily on psycholinguistic and computational research on the languages under discussion. Due to space limitations, we will not address work on language acquisition.

Until recently, experimental work has by necessity been confined to a small number of easily available languages, with English of course being the most prominent. Such work has also been limited to the university setting, with researchers testing undergraduates who are already comfortable with relevant aspects of the setting (familiarity with computers, experience with test-taking, etc.). Data from these types of participants may include some individual differences, but experimental work on familiar topics such as passives, past tense, or relative clauses suggests that such individual differences are negligible in relation to more general patterns.

Experimental investigations of ergative languages, in contrast, often take researchers out of their comfort zone and in many cases call for a new look at familiar methodologies. Some ergative languages are endangered or spoken by very small communities, presenting a challenge for statistical analyses. Moreover, speakers in such communities are often bilingual, speaking both the minority language and the dominant language of their society. Bilinguals are of course a respectable population for testing, but extra provisions may be necessary to establish comparisons between such speakers and monolingual speakers whose data abound in experimental work. Indeed at least two studies have found that bilingual speakers respond differently than their monolingual counterparts when exposed to identical stimuli (Zawiszewski et al. 2011; Clemens et al. 2015). An additional confound is that many ergative languages are only used as a means of oral communication, making reading-based studies difficult or impos-

sible. The remoteness of many communities where ergative languages are spoken has likewise made it impossible to study them using more complex technology, such as brain imaging, available only in the lab. Finally, some ergative languages, although they are by no means unique in this regard, are spoken in communities where speakers lack formal education. This has an effect on the pattern of responses, for example, causing lower accuracy and response time (as we show below for Niuean and Avar). These challenges need to be taken into special consideration in work on at least some ergative languages (see [Gagliardi 2012](#); [Clemens et al. 2015](#); [Christianson and Ferreira 2005](#); [Wagers et al. 2015](#) for discussion).

Existing experimental work on ergative languages can be roughly divided into the following categories: “accidental tourist” studies, experimental work on the competition between accusative and ergative alignment, experimental work on long-distance dependencies, and experimental work on agreement. In the “accidental tourist” studies, the choice of a given language is due to properties other than ergativity. [Skopeteas et al.’s \(2012\)](#) work is an example of such a study. The authors examine the processing of dative subjects and objects in Georgian and conclude that case marking plays a more important role in online parsing than word order. This is an important result, but Georgian is chosen because of its parallels to Icelandic, not its ergative alignment. Similarly, [Duñabeitia et al. \(2007\)](#) compare morphological decomposition in Spanish and Basque, but the choice of Basque is motivated by its agglutinative properties, not by ergativity; [Erdocia et al. \(2012\)](#) likewise offer an impressive study of verb-final and verb-medial orders in Basque, which are orthogonal to ergativity. We will not discuss “accidental tourist” studies further in this chapter (although we will briefly return to [Skopeteas et al. \(2012\)](#) in section 5).

The remainder of the chapter devotes one section each to the three types of studies mentioned above: in Section 2 we survey work that explores the competition between accusative and ergative alignments; in Section 3 we discuss experimental work on long-distance dependencies in ergative languages; and in Section 4 we take up experimental approaches to agreement. We outline possible directions for future experimental work on ergativity in Section 5.

30.2 Competition between ergative and accusative alignment

Accusative languages can exist without ergativity, but few languages exhibit consistent ergative alignment, whether through case marking or agreement, without some other alignment (accusative or neutral) in one of their subsystems. The result is the well-known phenomenon of splits, where ergative alignment is observed only in a subset of aspectual forms, or with a subset of DPs. Indeed several researchers have proposed that ergative alignment systems appear to be a “recessive feature” cross-linguistically, susceptible to degradation and total loss in diachronic development and in contact scenarios with neighboring accusative languages (see Nichols 1993, Maslova and Nikitina 2007, Bickel 2008, Bickel and Witzlack-Makarevich 2008, van de Visser 2006 among others); split systems, in contrast, have been contended to be stable over time (Jäger 2007). Experimental work in this domain has focused on deriving the typological preference for accusative alignment from general constraints on processing or learnability. The underlying assumption – which is not unquestionable itself – is that phenomena that are harder to process or learn should be less common. If ergative alignments are more difficult to process or to learn, this would offer a compelling explanation for the cross-linguistic infrequency of ergative alignment systems.

From the processing perspective, the co-occurrence of accusative (or neutral) and ergative alignment in split-alignment languages makes it possible to test if one alignment incurs additional processing costs compared to the other. Bornkessel-Schlesewsky et al. (2008) attempt to measure just this differential processing in Hindi, which has an alignment split along aspectual lines (see also below on the work by Nevins et al. 2007 and Dillon et al. 2012). The agreement system of Hindi may be described as follows. Verbs agree in number and gender with the structurally highest unmarked argument in the clause (Mohan 1994; Keine 2010, 2012). Thus, if a subject appears in the nominative, which is unmarked, the verb agrees with that subject; if the subject appears in the ergative, marked with *-ne*, the verb agrees with the unmarked object (in the absolutive), and if the subject and object both appear with case marking, the verb shows default agreement third person masculine singular (see (1-d,e)). Such

default agreement may be overridden by what is often described as long-distance agreement (LDA), with an argument of a structure immediately embedded under the agreeing verb (see (1-e)). LDA is common in control structures, where a matrix control verb may agree with the object in the embedded clause, provided the embedded clause verb also agrees with that object. [Bornkessel-Schlesewsky et al. \(2008\)](#) provide the following paradigm representing some possible agreement variations in such a subject-control situation. These data also serve as the basis of their experiment – although as we discuss below, the pattern of results does not fully reflect the Hindi paradigm.¹

- (1) a. Raam₁ [∅₁ saikal calaa-naa] caah-taa hai.
 Raam.M.NOM NOM cycle.F.NOM ride-INF.M want-IPFV.M AUX
- b. Raam₁ [∅₁ saikal calaa-nii] caah-taa hai.
 Raam.M.NOM ERG cycle.F.NOM ride-INF.F want-IPFV.M AUX
- c. *Raam₁ [∅₁ saikal calaa-nii] caah-tii hai.
 Raam.M.NOM ERG cycle.F.NOM ride-INF.F want-IPFV.F AUX
- d. Raam-ne₁ [∅₁ saikal calaa-naa] caah-aa hai.
 Raam.M.ERG NOM cycle.F.NOM ride-INF.M want-PFV.M.DFLT AUX
- e. *Raam-ne₁ [∅₁ saikal calaa-nii] caah-aa hai.
 Raam.M.ERG NOM cycle.F.NOM ride-INF.F want-PFV.M.DFLT AUX
- f. Raam-ne₁ [∅₁ saikal calaa-nii] caah-ii hai.
 Raam.M.ERG NOM cycle.F.NOM ride-INF.F want-PFV.F AUX
 ‘Raam wants to ride a bicycle’

[Bornkessel-Schlesewsky et al.’s \(2008\)](#) study is based on a well-known experimental paradigm whereby a sentence with an initial argument ambiguous between a subject and object interpretation incurs a steep processing cost when the initial argument is resolved as an object. No such cost is associated with a subject resolution, indicating that the processor assumes the initial ambiguous argument to be a subject by default ([Miyamoto 2008](#); [Kuperberg 2007 a.o.](#)). Likewise, there is no processing cost associated with a sentence-initial unambiguous object.

¹In the examples below, we represent the presumed subject of the infinitival clause atheoretically as a null element and show its presumed case as it is done in [Bornkessel-Schlesewsky et al.’s \(2008\)](#) stimuli.

Bornkessel-Schlesewsky et al.'s (2008) hypothesis is that an accusative processing preference should be detectable in this same way: if a sentence-initial argument is a nominative subject and the verb turns out not to agree with it (so that the sentence is ungrammatical), there should be an increase in processing costs, given that the assumption of accusative alignment was revised. According to this hypothesis, the contrast between (1-a) and (1-c), where (1-a) is processed more easily, should support the accusative preference. By contrast, they speculate that no increased cost will appear in the context of an ergative subject because the processor knows there will be no accusative alignment after it encounters the first word (compare (1-d) and (1-f) above).

A second hypothesis Bornkessel-Schlesewsky et al. (2008) aim to test is whether an accusative preference in the main clause can be modulated by the alignment patterns in the embedded control clause: an accusative alignment should “strengthen the [accusative alignment] preference for the matrix subject” while an ergative alignment should “counteract it” (Bornkessel-Schlesewsky et al. 2008: 411). Their hypothesis is that there should be notable differences, measurable in reading time and neural activity, in the processing of sentences like (1-a), where the control clause and the matrix clause have accusative agreement, and sentences like (1-b), where the control clause has ergative agreement. Their experiment relied on sentences like those in (1) to test these hypotheses using self-paced reading, electrophysiology (ERP), and acceptability judgments.

While we share the authors' interest in the potential differences in the processing of ergative and accusative alignments, we are concerned that their experimental paradigm does not directly address the relevant question. All else being equal, we agree that observing a processing time increase when the processor is forced to revise its initial assumption of accusative alignment would be a substantial result. However, in their experiment, the revision, so to speak, involves a sentence that is not grammatical. The increase in processing cost may thus result from speaker's confusion regarding the acceptability of the sentence or their surprise at hearing an ungrammatical form. In order to meaningfully compare the processing costs

of two sentences in the context of a proposed accusative alignment preference, we hold that they should be minimally different in their alignment. To accomplish this, we would need a clause that is initially ambiguous between an accusative and an absolutive alignment, with the ambiguity resolved later in the clause. Having one ungrammatical sentence in the minimal pair introduces unnecessary and poorly understood complications to the data.

With respect to the authors' second hypothesis, the data do suggest that ergative alignment in a controlled clause affects the processing of matrix accusative alignment. In examples with accusative alignment in both matrix and embedded clauses, the appearance of the sentence-final agreeing verb triggered a neural response (a high P300 value) consistent with its appearance being anticipated by the processor (see [Polich 2007](#) for a recent overview of P300). No such response was triggered when the embedded clause exhibited an ergative alignment. That said, it is not immediately evident how this result bears on the original question motivating the experiment. That ergative alignment can interfere with the processor's ability to predict the alignment of the matrix clause does not on its own entail that there is a differential processing cost associated with accusative/ergative alignments. The two phenomena seem to be unrelated.

We conclude that [Bornkessel-Schlesewsky et al.'s \(2008\)](#) results, while interesting, do not allow us to directly answer the question of whether the processor favors accusative or ergative alignment.

Computational linguists have also taken up the issue of competition between accusative and ergative alignment systems, specifically from the perspective of learnability. In one experiment, [Van Everbroeck \(2003\)](#) explicitly sets out to test the relative learnability of accusative versus ergative alignment, with the alignment expressed via agreement, case marking, or both. In the experiment, artificial neural networks were tasked with learning various toy languages which varied according to three parameters meant to simulate the typological variety attested across the world's languages: word-order, head versus dependent-marking, and word-order correlation. Thus each toy language consisted of a fixed set of SVO, SOV, VSO, VOS, OVS,

or OSV sentences (word-order). The languages also varied on whether the grammatical roles of its arguments via head-marking on the verb (agreement), case marking on the arguments (dependent-marking), both, or neither. Both accusative and ergative alignments were represented. Finally, each toy language varied based on whether it had postpositions or prepositions and whether relative clauses were pre- or post-nominal (word-order correlation). A separate toy language was constructed for every instantiation of the parameter settings.

A neural-network was exposed to a subset of 3000 sentences of the corpus associated with each language (the training-set), then provided with the remaining sentences in the corpus (the test-set) and tasked with parsing these sentences according to the grammar learned from the training-set.

Languages with ergative alignment were not significantly harder to learn in the subject-before-object cases, where the learned grammar was able to almost perfectly parse the data in both the accusative and ergative alignment cases. In the object-before-subject languages, results for accusative languages were slightly worse than in the corresponding subject-before-object languages, as measured by Mean Sum of Squared Errors (MSE) across the various word order and head- versus dependent-marking parameters. Object-before-subject languages with ergative alignment, however, were significantly harder to learn, as compared to both corresponding accusative object-before-subject languages and ergative subject-before-object languages. The results were particularly striking in the VOS and OSV cases.

The finding that in the object-before-subject domain, the ergative pattern was significantly more difficult to learn provides preliminary evidence that a learning-based explanation for the relative infrequency of ergative alignment cross-linguistically is on the right track. That said, as van Everbroeck notes in the discussion of the data, there are a number of complications preventing us from drawing conclusive typological results. First, if there was a direct correlation between the ease of learning these toy languages and the typological distribution of the various characteristics controlled in the experiment (word order, head-/dependent-marking, and alignment), we would expect, for example, that VSO and SVO languages be more prevalent

than SOV languages, the latter being significantly more difficult to learn in the experiment. Likewise, VOS languages, all else being equal, should be much more likely to surface with accusative alignment. In reality, SOV word order is basic in approximately 50% of the world's languages (see [Van Everbroeck's 2003](#) discussion), and VOS languages can have all types of alignment, with ergative VOS observed across Mayan, Salish, and Austronesian languages ([Coon 2013a](#); [Polinsky in press-b](#)). Beyond these difficulties in extrapolating the learnability results to explain typological variation, there are also conceptual obstacles that suggest a measure of caution is needed in interpreting the data. Most notably, several categories of information available to a human learner were absent in the experiment, including semantic content, prosodic cues, and information regarding animacy and agency of arguments. This prevented the learning algorithm from making use of the universal tendency for subjects to be animate and agentive, or for semantic based grouping of words into part of speech categories. Despite these difficulties, [Van Everbroeck's \(2003\)](#) data offers tantalizing, albeit tentative, evidence in favor of a learnability-based explanation for the cross-linguistic distribution of ergative and accusative languages.

To summarize, experimental approaches to the typological distribution of accusative versus ergative alignment have focused on two major areas: processing and learnability. In the domain of processing, so-called split-alignment languages provide an ideal testing ground for the hypothesis that ergative alignments are more difficult to process than corresponding accusative alignment. While we believe it is possible to devise an experimental paradigm to test the validity of this hypothesis, the work to date in this area has been inconclusive. Moving on, experimentation regarding learnability has focused on whether ergativity is intrinsically more difficult to learn than accusative alignment. The experimental work of [Van Everbroeck \(2003\)](#) on the learnability of various toy languages by artificial neural-networks is an exciting first step.

30.3 Subject-object asymmetries

Long-distance dependencies have long been at the center of linguists' attention, and have played an important role in the ongoing dialogue between theoreticians and experimentalists. As both groups of researchers share an interest in the motivation for empty categories and in the nature of filler-gap relationships, A'-dependencies (topicalization, focusing, wh-question formation, and relative clause formation) have been widely explored both experimentally and theoretically. One major result supported by a large body of research is the existence of recurrent subject-object asymmetries with respect to A'-extractions. Owing to their near universality cross-linguistically, relative clauses (RCs) have proved an especially fertile domain for studies of such asymmetries.

In the processing literature, extensive experimentation has revealed two major generalizations concerning subject-object asymmetries in RCs. The first generalization has two components: (i) unambiguous subject RCs are easier to process than unambiguous object RCs; (ii) when speakers are faced with an RC that is ambiguous between an interpretation where it is subject-headed and one where it is object-headed, there is a strong preference for resolving the ambiguity in favor of the subject-headed interpretation (see [Kwon et al. 2010](#) for an overview). We will refer to these two asymmetries collectively as the Subject Processing Advantage (SPA). The SPA thus favors the nominative argument, which is most commonly the subject, in an accusative language.

The second generalization pertains to the strategies used by the parser to anticipate the upcoming material, specifically the use of a particular form or category as a cue for another form or category that can be projected. In an accusative language, the presence of an accusative-marked argument in a clause informs the parser that the clause is transitive and that a nominative-marked argument should be projected; the presence of a nominative does not have the same effect because nominatives can occur with intransitive verbs. More specifically, within a relative clause, nominative gaps are predicted to be correspondingly easier to parse because the presence of accusative case “cues” the parser to the presence of a nominative

argument which, if absent, is likely to be the head of the RC. Several studies provide empirical evidence in favor of this cueing effect in RCs, most notably in Korean (Kwon et al. 2006) and Japanese (Ueno and Garnsey 2008); see also Bornkessel-Schlesewsky and Schlewsky 2009: 159 and Skopeteas et al. (2012) for evidence that morphological case is a strong cue in processing). Thus, based on cueing effects, the nominative gap in a relative clause of an accusative language should also have a processing advantage.²

Given that nominative case and subject status of the respective DP align in accusative languages, independent of transitivity, the effects of the SPA and of case-cueing converge. It is therefore difficult to test experimentally if they are truly independent phenomena. In ergative languages, transitive and intransitive clauses exhibit different mappings between grammatical function and morphological case. Indeed the case-cueing effect, if it exists in these languages, should be expected to be triggered by ergative, but not absolutive, case: the presence of an ergative argument informs the parser that there must be an absolutive argument projected in the relative clause.³ This means that the processing of an absolutive gap should be easier than the processing of an ergative gap, at least on the basis of case-cueing alone. In contrast, the SPA predicts that ergative-subject gaps and absolutive-subject gaps should be easier to process than absolutive-object gaps. The two principles are thus at odds, allowing a careful experimenter to distinguish their relative impact on RC processing. Thus ergative alignment has the potential to offer novel insights into the mechanisms of long-distance dependency processing.

- (2) a. **SPA_{ERG}**: ergative-subject gaps and absolutive-subject gaps should be easier to process than absolutive-object gaps
- b. **case-cueing_{ERG}**: An absolutive-object gap should be easier to process than an ergative gap because the presence of an ergative argument acts as a cue that

²Of course not all subjects in accusative languages are nominative, but a large portion of experimental work has focused mainly on the contrast between nominative subjects and accusative objects.

³This logic applies to those ergative languages that do not have split ergativity; if the ergative can encode subjects of transitive and unergative predicates, then the predictions are different.

informs the parser about the presence of a absolutive argument in the relative clause

Studying the processing of RCs in ergative languages also has the potential to afford us insights into the nature of *syntactic ergativity* and extraction constraints in general. Syntactic ergativity is a phenomenon attested in a subset of morphologically ergative languages whereby transitive (ergative) subjects cannot undergo A'-extraction by leaving a gap in the base position, while intransitive subjects (absolutive) and transitive objects (absolutive) may freely do so.

It is still an open question as to why some but not all morphologically ergative languages exhibit this behavior (see e.g. [Campana 1994](#); [Manning 1994](#); [Aldridge 2004](#); [Coon et al. to appear](#); [Polinsky to appear a](#), [Polinsky to appear b](#), for analyses). This type of pattern does not obtain in accusative languages, where the accessibility hierarchy (AH) for A'-extraction seems to directly track grammatical function: if an intransitive subject can extract, so can a transitive subject ([Keenan and Comrie 1977](#), [Comrie and Keenan 1979](#)).⁴ One line of inquiry, following the ideas developed in [Hawkins \(1994, 2004, 2014\)](#), is to propose that certain grammatical constraints follow from processing constraints; the latter become grammaticized thus forcing grammar to follow a given principle. If we extend this logic to ergativity, one could hypothesize that syntactic ergativity stems from the more general processing load associated with ergative-argument gaps. Under this account, in languages without syntactic ergativity, ergative-argument gaps should impose a heavier processing load than absolutive-argument gaps, which means that they should be dispreferred, the way other types of constructions that tax the processor are dispreferred (see [Kluender 1998](#) for a similar processing account of island effects). Syntactically ergative languages then take what is in some languages a mere constraint

⁴In their seminal paper of the accessibility to relativization, Keenan and Comrie acknowledge that ergative languages pose a potential challenge to their hierarchy; their solution is to interpret ergative clauses either as passive-like (where the ergative subject is more like a by-phrase, hence lower on the AH) or as related to passives diachronically. This solution however has some problems. First, the ergative is not like a by-phrase with respect to other typical subject properties (binding, imperative formation, nominalizations). Second, not all ergative languages have developed from the passive, and even if all the languages with syntactic ergativity have, it is unclear how this diachronic development can still influence a language learner.

against using constructions that are difficult to parse to the logical extreme, and forbid such constructions entirely. If this is correct, we should expect to see a general processing difficulty of ergative-argument extraction in those languages that are not syntactically ergative.

Finally, ergative languages also allow us to resolve a closely related puzzle regarding the processing of case and agreement that is otherwise intractable. Specifically, many languages express their accusative or ergative alignment, respectively, not via case marking on nominals (dependent-marking) but rather via agreement morphology on the verb (head-marking). The same logic employed to justify the existence of cueing effects of dependent marked case morphology in principle extends to languages with head-marking, so that we might expect a cueing effect also to arise in languages with head, but not dependent, marking. This effect is difficult to test for in accusative languages, given that the SPA and cueing via dependent-marking both serve to make subject RCs easier to parse. Just as with case cueing, in ergative head-marking languages we can dissociate the effects of subjecthood and of head-marking triggered cueing by checking the relative ease of parsing RCs with ergative and absolutive subject gaps.

While addressing these research questions in an experimental paradigm is straightforward, it entails several modifications from standard studies on the processing of RCs. First, experiments on RC processing in accusative languages have historically assessed the subject-object asymmetry in transitive clauses. In an ergative language, however, one needs to include intransitives as well to establish comparison between absolutive subjects (intransitive) and absolutive objects (transitive). Of course experimental stimuli must be balanced by length (measured in the number of words, syllables, noun phrases, etc.); this means that an intransitive RC in processing experiments on ergative languages should include a PP to match a transitive clause in the maximal possible way.

Second, in order to rule out possible frequency biases, one needs to ascertain the distribution of different types of RCs in a given language. If we limit our statistics to subject and object RCs, a typical distribution observed in an accusative language is as follows: intransitive subject RCs are most common, followed by transitive subject and object RCs (see Gordon and

Hendrick 2005 for English). As far as we can tell, the distribution of these three types of RCs in ergative languages is quite comparable; for example, in Niuean and Avar, which we discuss below, intransitive subject RCs constitute respectively 40% and 43% of all subject and object RCs; the frequency of transitive subject RCs is 31% and 26% respectively, and object RCs are at 31% and 28%.⁵ In Basque, Carreiras et al. (2010) estimate the occurrence of object RCs at 36%; they do not provide the breakdown of intransitive and transitive subject RCs for the remaining 64%.

The final modification pertains to types of populations tested in the experiments, an issue we alluded to in the introduction. A number of ergative languages lack a robust reading tradition or a reading tradition altogether, which makes it impossible to use self-paced reading in RC experiments, a paradigm that has been immensely successful in languages such as English, German, and Spanish. In such cases, one effective method is sentence-picture matching, which has been shown to yield largely compatible results to self-paced reading (Clemens et al. 2015).

30.3.1 Basque

Basque provides a good opportunity for dissociating the effects of case-cueing and the SPA, as well as for comparing the processing of prenominal RCs. Both subjects and objects may relativize with a gap. There is apparent agreement with both the absolutive and the ergative arguments, although some researchers suggest that at least the ergative markers may be instances of clitic doubling (Preminger 2009; Arregi and Nevins 2012). Basque also exhibits case homophony; in particular, the affixal exponent(s) *-a-k/-ak* are ambiguous between an agglutination of *-a-*, the definite determiner, and *-k*, the ergative marker, on the one hand and *-ak*, the marker of absolutive plural, on the other.

Carreiras et al. (2010) exploit this ambiguity in an experiment designed to test for effects of the SPA. Crucially, given the ambiguity of *-ak*, transitive RCs can be constructed where the argument in the clause is ambiguous between an ergative and absolutive, and the ambiguity

⁵The data are based on our text counts of 23,000 Niuean clauses from elicited dialogues, and 30,000 Avar clauses from a mixed corpus.

in the RC is not resolved until the penultimate word of the sentence (W6 in the examples below). In spoken language, the ambiguity can be resolved prosodically, but in reading that is impossible.

- (3) a. [_ irakasle-ak aipatu ditu-en] ikasle-a-k lagunak **ditu** orain
 teacher-ABS.PL mention AUX-ADN student-DET-ERG friends **has** now
 ‘the student who mentioned the teachers has friends now’
- b. [irakasle-a-k _ aipatu ditu-en] ikasle-ak lagunak **dira** orain
 teacher-DET-ERG mention AUX-ADN student-ABS.PL friends **are** now
 ‘The students that the teacher mentioned are friends now.’

Carreiras et al. (2010) tested this type of stimuli in a self-paced reading experiment with 54 native speakers. The reading time data is presented below.

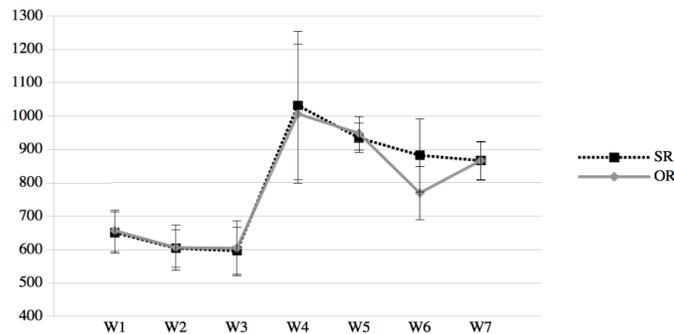


Fig. 30.1: Results from Carreiras et al. (2010: 85)

As expected, the reading times for each of the stimuli are identical up to W6, which is the first word where the stimuli actually diverge in content. At W6, there was a severe slowdown for resolution of the ambiguity in favor of an ergative-subject gap compared to resolution in favor of an absolutive-object gap. This suggests that object RCs are easier to process, possibly due to case-marking (as Carreiras et al. 2010: 91 propose). That said, we feel that the case-marking of the extracted argument in Basque was not the only factor that came to bear on the experimental results. At least two other factors may have played a role. The first is that the disambiguating words differed in transitivity: *ditu* “has” (3-a) versus *dira* “are” (3-b). While it is critical to study transitive and intransitive RCs in any experiment on RC

processing in ergative languages, the difference in transitivity here is in the matrix clause, not in the RC. The object RC modifies the subject of an intransitive matrix clause, and the subject RC modifies the subject of a transitive clause. This variation potentially introduces a poorly understood transitivity confound to the data; note that in most experiments on extraction (both in accusative and ergative languages), the properties of the head noun are either kept constant or are balanced across conditions.

Second, we believe that the inherent assumption made in the experiment, namely that the parser leaves resolution of the ambiguity in the RC until there is enough information to decide one way or another (W6), is not accurate. There is significant evidence that the parser will most likely commit to one interpretation immediately and revise if necessary rather than delay commitment (see [Clemens et al. 2015](#) for discussion). This initial commitment is usually determined on the basis of prior experience and statistical preferences, both of which favor the more common ergative singular over the less common absolutive plural ([Clemens et al. 2015](#); [Austin 2007](#)). In fact, an independent experiment ([Laka and Erdocia 2012](#)) also confirms that Basque speakers prefer to interpret the potentially ambiguous N-ak segments as ergative DPs rather than absolutive DPs. For the Basque experiment discussed here, if the parser assumes the ambiguously-marked argument to be an ergative, then it is committing to the interpretation of the missing (gapped) argument in the RC as an absolutive object. The ergatively-interpreted argument serves as a cue for the parser to project the absolutive object. This cueing effect may be weak, because Basque also has ergative intransitives ([Laka \(2006\)](#)), but it cannot be ignored; once the parser reaches the RC predicate, it can ascertain that an absolutive object is indeed projected. At the disambiguation points (the head noun and/or the predicate of the main clause), the object RC interpretation thus requires no revision of the initial commitment. In contrast, the subject RC interpretation does require a revision down the line, which leads to higher processing costs.

[Carreiras et al. \(2010\)](#) also conducted a neuroimaging (ERP) study of 22 subjects using the same stimuli as in the reading experiment. They propose that the response to subject

RCs in Basque evokes a P600 effect (Carreiras et al. 2010: 88-89), a somewhat puzzling result suggesting that subject RCs may be associated with a perception of ungrammaticality.⁶ However, on closer examination, the reported ERP data do not fit the distribution of a standard P600. While the authors entertain (and ultimately reject) the idea that this may be a negativity to object RCs, we would like to suggest that left anterior negativity (LAN) to object RCs is indeed the right interpretation of their results. One of the reasons for which Carreiras et al. (2010) reject the LAN interpretation is that it is inconsistent with the behavioral results presented above; however, we have already discussed reasons to treat those results cautiously. Turning to the actual ERP data, the main effect is observed in the left anterior region, which is a signature LAN distribution. In contrast, P600 is normally found in central posterior region and may be skewed to the right hemisphere (Hagoort et al. 1999). Fig. 4 in (Carreiras et al. (2010): 88) shows negativity between 300 and 500 ms, a typical LAN latency, well within anterior-negativity bounds. Anterior negativity triggered by long-distance dependencies with an object gap has been observed in a number of languages, from English (King and Kutas 1995) and German (Fiebach et al. 2001) to other head-final languages: Japanese (Ueno and Garnsey 2008) and Korean (Kwon et al. 2010). If the LAN interpretation is correct, the Basque results are pleasing because they are consistent with the similar electrophysiological responses to object RCs as observed in other languages; as the object is structurally lower than the subject in clause structure, integrating it with the remainder of the RC and then with the head noun imposes a heavier processing load.

30.3.2 Avar and Niuean

The Basque study served as an inspiration for a reading study of another head-final language with morphological ergativity: Avar (Nakh-Dagestanian). Avar case morphology distinguishes between ergative and absolutive; the language is consistently ergative and has agreement in gender is with the absolutive argument. Unlike Basque, there is no ergative marking in

⁶P600 is typically associated with syntactic and/or morphological violations (Hagoort et al. 1993; 1999); see also Brouwer et al. 2012 for a recent overview.

intransitive clauses. Both subjects and objects in Avar relativize by leaving a gap at the extraction site.

Polinsky et al. (2012) carried out a self-paced reading study of Avar RCs where they tested participants on the three types of extraction exemplified below: absolutive subject, absolutive object, and ergative subject. In each condition, the head noun of the relevant RC appeared as the subject of an intransitive clause (not shown).

- (4) a. [_ bercinay artistka-*yal-da* ask'o-y č':u-n y-ik'-*ara-y*] yas...
 beautiful actress-OBL-LOC near-II standing-GER II-be-PTCP-II girl.ABS
 'the girl that stood next to a beautiful actress'
- b. [bercinay artistka-*yal* _ repetici-*yal-de* y-ač':-un y-ač'-*ara-y*]
 beautiful actress-ERG rehearsal-OBL-LOC II-bring-GER II-come-PTCP-II
 yas...
 girl.ABS
 'the girl that a/the beautiful actress brought to a rehearsal'
- c. [_ bercinay yas repetici-*yal-de* y-ač':-un y-ač'-*ara-y*]
 beautiful girl.ABS rehearsal-OBL-LOC II-bring-GER II-come-PTCP-II
 artistka...
 actress.ABS
 'the actress that brought a/the beautiful girl to a rehearsal'

The chart below shows residual reading times from their experiment, where each data point represents the average time spent on a given word. Participants read the heads of RCs with absolutive-subject gaps faster than corresponding RCs with absolutive-object gaps or ergative-subject gaps. This difference manifests most clearly at the head noun of the RC, and in the spill-over region. There was a clear advantage with the intransitive subject gap, but the ergative and absolutive-object gaps were processed roughly at the same reading speed albeit with a different time course. With object RCs, there was a clear case-cueing effect of the ergative DP; readers slowed down significantly at an ergative DP inside the RC, but not at an absolutive in that position. The slowdown at the ergative follows from the additional processing involved in projecting a transitive clause with an absolutive argument. The SPA observed after the RC and case-cueing observed inside the RC are roughly equivalent in terms

of effect size. These two effects, clearly visible at the individual word points, cancel each other out, which results in the roughly comparable response times to both conditions. However, the reading times were excessively long, which indicates that Avar is mostly used as a spoken language.

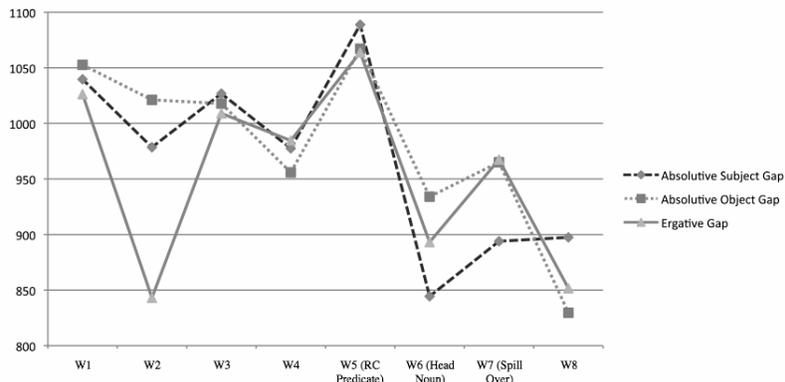
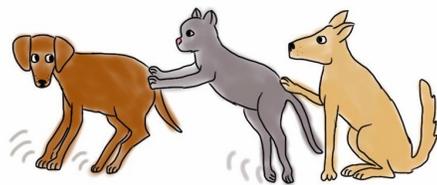


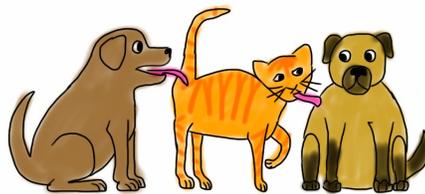
Fig. 30.2: Avar reading time measurements (Polinsky et al. 2012: 272)

To test Avar RCs differently, we also conducted a picture-matching experiment (see [Longenbaugh and Polinsky](#) to appear for a full discussion of the experiment). There were three conditions: absolutive-subject gap with a PP in the RC (in order to balance the length of the stimuli with the transitive condition), absolutive-object, and ergative-subject gap, with 36 stimuli recorded by a native speaker of the standard dialect of Avar. 45 participants (avg. age 44;6) took the experiment in Maxachkala (Dagestan). In a within-subjects design, subjects saw pictures on a computer screen, depicting three participants. In the transitive condition, one kind of participant (A_1) acts on another kind of participant (B), who acts on another participant of the first kind (A_2). In the intransitive condition, two kinds of participants, A_1 and B, do one thing, and another one (A_2) does something else.

Subjects saw the pictures and heard a question such as "Where is the X that is Y-ing the Z/that Z is Y-ing?", with the RC built the same way as in the reading experiment (cf. (4)). (Examples of the questions are given below for Niuean in (5).) The questions about B served as fillers. The subjects had to choose the participant in the picture; the direction varied left/right for each picture. We recorded the number of correct and incorrect answers



(a) Intransitive (X is in front of Z)



(b) Transitive (X is licking Z)

Fig. 30.3: Experimental images

(accuracy) and response time (RT) in the form of the time elapsed between the start of the sound recording and the mouse-click on the relevant portion of the picture. The error rate of responses to the three types of RCs were about the same (73.7% correct responses in the intransitive subject condition, 76.1% in the ergative-subject condition, and 74.3% in the absolutive-object conditions). These numbers are much lower than what we normally find in experiments on familiar languages, but they are consistent with the lower pattern of responses observed in older, less literate populations who are not used to experimental testing. There was no difference in RTs between correct and incorrect answers, which supports the reliability of the data. There was no significant difference in the response time to correctly selected RCs with an ergative-subject gap (4812 ms, s.d. 4300) and correctly selected RCs with absolutive-objects gaps (5128 ms, s.d. 8950), $p = .15$. However, correctly selected RCs with the absolutive-subject gap were processed much faster, at 2943 ms, s.d. 4100 ($p = .009$).

⁷ This is consistent with the results from the self-paced reading experiment. All told, the picture-matching experiment results replicate the results obtained by reading Polinsky et al. (2012). There was no difference between the processing of ergative and absolutive-object gaps.

Basque and Avar are both head-final languages with prenominal RCs; case-cueing in such RCs occurs early, which may produce special processing benefits for the missing absolutive.

⁷Again, these numbers are much greater than what is found in the lab but consistent with emerging data on RTs from older and less experimentally savvy subjects (cf. Clemens et al. 2015)

To determine whether word order may influence the processing of ergative structures, we conducted a further experimental study of the Polynesian language Niuean, which has unmarked VSO word order and postnominal RCs (see Longenbaugh and Polinsky to appear for a full discussion). Ergative alignment, which is consistent throughout the language (there is no split ergativity), is expressed via case marking on nominals: both absolutive and ergative are marked overtly. Niuean lacks an overt agreement system. Both subjects and objects may undergo relativization with a gap. In that regard, Niuean is different from its close Polynesian relatives where the ergative cannot relativize with a gap and either requires resumption (see, for example, (Otsuka 2000) on Tongan), or relativization via a nominalized construction, as in Samoan (Mosel and Hovdhaugen 1992: 630-637).

Given that Niuean is mostly used as a spoken language, we conducted auditory picture-matching study using the same paradigm as in Avar (24 stimuli were normed with three native speakers and were recorded by another native speaker). 41 L1 speakers of Niuean (avg. age 42;8), who were recruited in and around Auckland, New Zealand, took part in the experiment. Example stimuli corresponding to Figure 30.3 are shown below.⁸

- (5) a. Ko fe e puti ne mua he kuli?
 where ABS cat NFT be.ahead OBL dog
 ‘Where is the cat that is in front of the dog?’
- b. Ko fe e puti ne epoepo he kuli?
 where ABS cat NFT lick ERG dog
 ‘Where is the cat that the dog is licking?’
- c. Ko fe e puti ne epoepo e kuli?
 where ABS cat NFT lick ABS dog
 ‘Where is the cat that is licking the dog?’

The pattern of results is very similar to that found in Avar. The accuracy of response in the three conditions was 64.0% for absolutive-subject gaps, 72.6% for ergative gaps, and 76.8% for absolutive-object gaps. These numbers are much lower than what we normally find in experiments with undergraduates, but they are consistent with the lower pattern of responses

⁸Wh-questions in Niuean involve pseudo-clefts (see Potsdam and Polinsky 2011).

observed in populations who are not used to experimental testing. There was no difference in RTs between correct and incorrect answers, which supports the reliability of the data. Within the correct answers, the mean correct RT was 4317 ms (s.d. 5881) for intransitive subject extraction, 4979 ms (s.d.4900) for the ergative extraction, and 6074 ms (s.d.13293) for the absolutive object extraction. The difference in response to ergative gaps and absolutive-object gaps was not significant ($p = .9$); meanwhile, the difference between the response to absolutive-subject gaps and the two other types of gaps was highly significant ($p < 0.001$). We interpret this result as indicating that morphological cueing (whereby the ergative case serves as the cue in projecting the absolutive argument) and the SPA are roughly equivalent in terms of their effects on the processing of RCs. With ergative-subject gaps, the SPA acts in favor of easier processing and case-cueing acts against easier processing. With absolutive-object gaps, there is a disadvantage with respect to the SPA, but case cueing acts in favor of easier processing. The absolutive-subject gap –where only the SPA is expected to be in play– is processed faster than the other two types of gaps, despite the fact that the stimuli were of equal length and the presence of a PP in the intransitive condition. This suggests an intransitive bias in Niuean processing.

The similarity of Avar and Niuean experimental results indicates that headedness in general and the pre-/post-nominal position of RCs in particular do not come to bear on the processing of these constructions across ergative languages. This is consistent with findings in accusative languages; researchers are generally in agreement that subject preference is also independent of headedness, although Mandarin Chinese has long remained a problematic case (see [Kwon et al. 2010](#) for an overview). Niuean does not have morphological agreement, and Avar has gender agreement with the absolutive. Additionally, the strong similarity of the results from the two languages suggests that agreement does not advantage the processing of the argument it tracks, given that Niuean does not have morphological agreement, and that Avar has gender agreement with the absolutive. Anticipating the discussion below, the processing of head-marking ergative languages further supports this conclusion.

One could view the absence of a difference between ergative-subject and object RCs in Avar and Niuean as a null result, but it is important to evaluate this lack of difference against the initial hypotheses. First, since ergative gaps are not more difficult to process than absolutive-object gaps, the experimental results argue against the processing account of syntactic ergativity which we introduced earlier. Therefore, an explanation for this recurrent constraint has to be sought in structural properties of syntactically ergative languages. Second, the idea that morphological cueing by case-forms and structural dominance play a substantial role in processing is not new. In ergative languages these two factors work at cross purposes. The lack of a difference between ergative and absolutive-object gaps confirms that the processing of gaps in RCs is simultaneously subject to the morphological pressures and the pressures imposed by hierarchical syntactic structure. This conclusion also has implications for accusative languages, where the strong SPA may be due to two converging factors: the structural superiority of subjects over objects and the cueing effect of the accusative, which again favors the nominative subject. Finally, the equivalence of ergative and absolutive gaps is replicated in a reading-time study and two picture-matching studies, which allows us to assume, albeit cautiously, that such equivalence is not spurious.

30.4 Agreement

Experimental studies of agreement have also, in recent years, expanded to include ergative languages. The experiments we discuss below make use of ergative languages for many of the same reasons as the work we have already discussed: the unique dissociation of grammatical function and agreement based on transitivity in ergative languages, the ability for some (split-)ergative languages to exhibit ergative and accusative alignment in the same clause, etc.

Many languages express their accusative or ergative alignment not via case marking on nominals (dependent-marking) but rather via agreement morphology (head-marking). In such languages, agreement presents the potential to cue the processor in exactly the same way as case. Just as with case-cueing, we can isolate these effects by comparing the relative ease of

extracting ergative and absolutive subjects: all else being equal, if both head-marked cueing and the SPA are active, we should expect to see that ergative extraction, where the principles act at odds, to be more difficult than absolutive subject extraction, where the principles converge.

Clemens et al. (2015) tested exactly this hypothesis in two Mayan languages, Ch’ol and Q’anjob’al. Both languages are head initial and uniformly ergative with no splits. Crucially, both languages express ergative alignment solely via agreement on the verb: ergative morphemes on the verb mark transitive subjects, while absolutive morphemes mark intransitive subjects and transitive objects. There is no nominal case morphology in either language. Relative clauses in both languages are postnominal.

Both languages have RCs that are ambiguous between containing an absolutive-object gap and an ergative-subject gap; this ambiguity serves as the basis of Clemens et al.’s (2015) experimental paradigm.⁹

The experiments in Ch’ol and Q’anjob’al compared the processing of four types of gaps in RCs: unambiguous absolutive-subject gaps, gaps ambiguous between ergative subject and absolutive object, ambiguous gaps semantically biased towards ergative subjects, and ambiguous gaps semantically biased towards absolutive object. Similarly to the experiments detailed above in Niuean and Avar, participants were given auditory stimuli in the form of direct (“show me . . .”) and indirect commands (“where is . . .”), with the relative clause embedded in the command; thus, the head noun was intransitive subject in half of the stimuli and absolutive object in the other half. The task was to identify the region of a picture corresponding to the item picked out by the RC embedded in the command. Unlike the Niuean and Avar experiment which used one picture with three characters, this experiment involved the choice between two pictures, each with two characters.

In Ch’ol, participants were significantly faster and more accurate at interpreting gaps in transitive clauses, suggesting a transitive bias. This is the opposite of what was observed in

⁹The actual syntax of A’-extraction differs slightly in Ch’ol and Q’anjob’al, necessitating a slightly different set of stimuli (see Clemens et al. 2015 for discussion).

Niuean and Avar. There was a clear preference for subject gaps, both in terms of response times and the choice of interpretation of ambiguous RCs: in cases ambiguous between subject and object extraction, participants preferred subject extraction, and moreover when they did choose object-extraction interpretations, the response time was longer. In the case of biased extraction, participants responded significantly faster to subject extraction.

Q'anjob'al was essentially identical to Ch'ol in terms of its preference for subject extraction. Transitive-subject gaps were in every case processed faster than corresponding absolutive-object gaps. In every case except with biased transitive clauses, subject gaps were also processed more accurately than object gaps. Additionally, participants demonstrated a strong preference to interpret ambiguous RCs as containing a subject gap as opposed to an object gap.

These results are consistent with the following conclusions. First, the SPA seems to be in effect in Mayan. The processor prefers subjects to objects across all conditions. This result is different from what was observed in Niuean and Avar, where the processing of absolutive-subject gaps differed from the processing of both types of gaps in transitive RCs. This result is significant in at least two ways. First, it challenges the uniformity of the SPA and calls for its re-evaluation, both experimentally and theoretically. Second, it suggests that there may be parametric variation in the way transitivity affects parsing; the intransitive bias in Niuean/Avar contrasts with the transitive bias in Mayan. We believe that a better understanding of valency effects in parsing is a prerequisite to explaining these effects.

Recall that morphological-case-cueing effects are expected to diminish the SPA in the case of ergative-subject extraction versus absolutive-object extraction. Agreement-cueing, if it exists, should function in the same way, diminishing any processing advantage an ergative subject might have over an absolutive object. But the Mayan data are not consistent with such an expectation. The processing of ergative subjects is by every measure preferred over the processing of absolutive objects. On the basis of this data, [Clemens et al. \(2015\)](#) conclude that head-marking (agreement), at least in Mayan, does not contribute cueing effects on a par with

those effects triggered by dependent-marking (case). This suggests that the processor may treat case and agreement in a fundamentally different way. If this conclusion is on the right track, it offers novel support to the conception that case and agreement are not fully aligned (see [Bobaljik 2008](#) for agreement as a post-syntactic operation, [Preminger 2011](#) for evidence of structural case that cannot be agreement-triggered, [Kornfilt and Preminger](#) to appear for the lack of distinction between abstract and morphological case and for agreement that does not trigger case, and finally [Levin and Preminger 2015](#) for an argument that agreement licensing is dependent on case licensing). The re-evaluation of the interaction between case and agreement has been an active area of study, and it makes sense to integrate the results of theory and experimentation in that domain.

Another area where the experimental study of ergative agreement systems can inform linguistic theory relates to the mechanism by which the human language processor handles errors. Neuroimaging of language has shown that morphosyntactic, syntactic, and semantic errors are associated with different electrophysiological responses, in particular with different ERP effects. A longstanding debate in this domain is whether these various ERP responses signal the processor's recognition of the cause of an error or merely its content. These seemingly similar notions are, in reality, subtly different in a way that has deep consequences for the theory of sentence processing: a processor that tracks the content and the cause of the errors it encounters has the potential to revise its parse by singling out the source of the aberration and determining whether there is an appropriate correction. Indeed many models of sentence processing explicitly assume such a mechanism to be available ([Fodor and Inoue 1994](#); [Lewis 1998](#)). In contrast, models of processing that posit many ranked, alternative parses held in parallel and revised according to the input do not necessarily need to know the source of a given error: they simply demote in their ranking those parses which are inconsistent with the relevant anomaly.

In this context, determining the precise nature of responses associated with a given error takes on a special significance. Such a determination requires dissociating the source and

the content of an error, a difficult task that has mostly eluded researchers. Thus while there is a wealth of research on the processing of subject-verb agreement mismatches, or on the interpretation of garden-path sentences, which initially appear anomalous but are ultimately well formed, few studies have actually attempted to dissociate an error from its source (see Dillon et al. 2012 for discussion). Two studies have explicitly attempted to address this issue. The first involves the cueing effects associated with non-canonical OVS constructions in Spanish (Casado et al. 2005), while the second involves the cueing of perfective aspect in Hindi (Dillon et al. 2012). The experiment on Hindi falls within the purview of this chapter in that it explicitly makes use of the previously discussed split-ergative alignment in the language, so we turn our attention here.

Dillon et al.'s (2012) experiment focuses on Hindi sentences whose unacceptability stems from anomalous future tense/imperfective aspect morphology on the verb. The basic idea is that by modulating the content in the sentence that is incompatible with future tense and imperfective aspect, it is possible to compare different sources to the same error: a mismatch in test/aspect morphology. If the ERP response when the processor encounters the anomalous verbal morphology varies depending on the source of the error, it would be strong evidence that the processor has access both to the content and the source of the error.

The first source of error that Dillon et al. (2012) consider is based on the aforementioned split alignment system of Hindi. Ergative subjects, which may be identified by the presence of the *-ne* affix, are limited to transitive clauses in the perfective aspect.¹⁰ The presence of an ergative subject thus acts as a dependable cue that the clause must be in the perfective aspect. Future tense, imperfective aspect morphology is thus anomalous in the presence of an ergative marked subject. We will refer to this as the syntactic cue. The second source of error relates to the incompatibility of past tense adverbials and non-past tense verbs. As in English and many other languages, a past tense adverbial must co-occur with a verb in the past tense. Accordingly, just as ergative case cues the processor to the presence of imperfective aspect, a

¹⁰Subjects of certain non-perfective clauses may also exhibit the *-ne* affix. This use is usually associated with a volitional meaning rather than ergative case marking. See Dillon et al. (2012) for discussion. We ignore this use here.

past tense adverbial is a reliable cue that the clause must be in the past tense. We will refer to this as the semantic cue.

Accordingly, by comparing the ERP responses in sentences where future tense/imperfective aspect morphology on the verb is anomalous because of the presence of an ergative subject against cases where the anomaly arises because of the presence of a past tense adverbial, it is possible to determine if the processor is sensitive to the source of errors. Crucially, both ergative subjects and past tense adverbials can occur linearly before the verb, so that the locus of the tense/aspect mismatch is the relevant morphology on the verb. Some examples of the sentences tested are given below. The examples in (6-a) and (7-a) differ from the examples in (6-b) and (7-b), respectively, according to the presence or absence of anomalous future tense/imperfect aspect marker *-gaa*. Speakers were shown the stimuli one word at a time and were asked to rate the sentence as acceptable or unacceptable at the end of the task.

(6) Syntactic cueing

- a. Haalaanki **us bunkar-ne** ek baRaa sveTar jaldi **bun-aa**, lekin
 although **that weaver-erg** one big sweater quickly **weave-perf**, but
 grahaak-ne sabhii-kii kimat ek-hii dii
 customer-erg all-of prices same give-perf
 ‘Although **that weaver wove** one big sweater quickly, the customer paid the same
 for all of them.’
- b. *Haalaanki **us bunkar-ne** ek baRaa sveTar jaldi **bun-e-gaa**, lekin
 although **that weaver-erg** one big sweater quickly **weave-agr-fut**, but
 grahaak-ne sabhii-kii kimat ek-hii dii
 customer-erg all-of prices same give-perf
 ‘Although **that weaver will weave** one big sweater quickly, the customer paid
 the same for all of them.’

(7) Semantic cueing

- a. Haalaanki **pichle shaam** vo raahgiir patthar ke-uupar **gir-aa**, lekin use
 although **last night** that traveler stone upon **fall-perf**, but to-him
 choT nahiin aa-yii
 injuries not happen-perf
 ‘Although **last night** that traveler **fell** upon a stone, he was not injured.’

- b. *Haalaanki **pichle shaam** vo raahgiir patthar ke-uupar **gir-e-gaa**, lekin
 although **last night** that traveler stone upon **fall-agr-fut**, but
 use choT nahiin aa-yii
 to-him injuries not happen-**perf**
 ‘Although **last night** that traveler **will fall** upon a stone, he was not injured.’

The grammaticality judgments in the cueing examples above were widely reflected among participants, with the accuracy scores for acceptability judgments comparable across all the conditions (all in the 90% range).¹¹ The ERP results showed a categorical difference between syntactic and semantic violations. Syntactically cued ungrammaticality triggered a right-lateralized anterior negativity response (RAN) as well as a clear P600 response to the anomalous verb form. The semantically cued ungrammaticality triggered, in contrast, early posterior negativity in the 200-400 ms interval, and a significantly smaller P600 response. This is a strong confirmation that the processor is sensitive to both the content and the source of the error.

In the context of this chapter, these results are also significant in that they demonstrate a strong syntactic association between perfective aspect and ergativity in Hindi. Splits have been the subject of numerous investigations both in particular languages and theoretically, and this result bears on the proper analysis. A number of explanations for splits, aspectual splits in particular, have been couched in terms of markedness whereby morphosyntactic realizations follow from certain conceptually-based patterns (DeLancey 1981; Tsunoda 1981; Dixon 1994:98-101 a.o.). Researchers have argued that it is more natural to view an incomplete or unrealized event from the viewpoint of the agent, because the agent is the participant that is capable of volitionally initiating such an event; meanwhile, a realized and completed event is best judged by its results, which are typically apparent in the state of the undergoer (theme, patient). Accordingly, the argument representing the focal viewpoint appears in the least marked or unmarked form: the nominative for agents, and the absolutive for undergoers. At

¹¹To echo some of the earlier discussion, the accuracy range reported for Hindi is higher than behavioral accuracy results in Niuean, Avar, or the Mayan languages. This can be seen as another sign of possible experimental differences associated with literacy levels as all the subject in the Hindi study were college students.

the other end of the theoretical spectrum, explanations for splits have been couched in purely structural terms, the basic idea being that the imperfective is associated with two separate licensing domains, and each of those domains licenses the absolutive (Coon 2013a, 2013b). If aspectual splits followed the conceptually-driven markedness it would be more natural to expect a non-structural response to mismatches in marking, but the response observed in this experiment is in clear contrast to the meaning-based mismatch in adverbials. Thus the findings of the Hindi study lend support to the structural explanation of split ergativity.

30.5 Looking ahead

The experiments discussed in this chapter are in many ways pioneering work that sets the stage for future discoveries. In this section, we identify several areas where further experimental work may bring us to a better understanding of ergativity and/or test existing theoretical constructs.

30.5.1 Typological gaps and the distribution of ergativity

While neither experiment ultimately yielded definitive results, the processing- and learnability-based approaches to the typological distribution of ergative alignment pioneered by Bornkessel-Schlesewsky et al. (2008) and Van Everbroeck (2003), respectively, are quite promising. Indeed we believe that the confounds that beset these experiments, aberrant stimuli in the case of Bornkessel-Schlesewsky et al. (2008) and unrealistic simplification in the case of Van Everbroeck (2003), can be amended to produce potentially informative results.

On the processing side, an approach similar to Bornkessel-Schlesewsky et al.'s (2008) could be employed to compare the following splits: the split between the accusative and the ergative system along aspectual lines (as in many Indo-Aryan languages), and the same type of split based on the nature of the DPs (animacy, person), as in Salish or Inuit; the split between the ergative and the neutral system, also along aspectual or DP-based lines.¹² Georgian, which

¹²See Coon and Preminger for a syntactic approach to such splits, and Legate (2014) for the morphological account.

has three main alignments based in lexical verb types and aspect, is a particularly promising candidate for this type of inquiry.

Computational modeling of learnability along the lines of [Van Everbroeck's \(2003\)](#) experiment can complement this type of study via direct cross-linguistic comparisons between attested and unattested types. For instance, although splits are rampant, there are no languages where pronouns show ergative alignment and common nouns show accusative alignment. An account based on different licensing domains puts pronouns higher than common nouns in clausal architecture; in this type of structure, the pronoun is licensed in its own domain and is not visible for the ergative case assignment. If so, languages with the ergative pronominal system and accusative nominal system are not simply rare, they should be unlearnable. A computational experiment testing this kind of (un)learnability in contrast with some other system that may be learnable but rare would be a welcome addition to the experimental work on alignment types.

In addition to the structure-based account referenced above, some researchers account for person/animacy splits from a semantic perspective ([Silverstein 1986](#); [Tsunoda 1981](#); see also [McGregor 2009](#): 486-490 for an overview). Following the precedent set by [Dillon et al. \(2012\)](#), one can imagine another class of experiments that explore whether violations of case- or agreement-marking in an animacy-based split system are processed as semantic or syntactic violations. Such experiments would proceed in two steps. Once a particular language is selected (a typical case would be a language where all pronouns follow the accusative alignment and all common nouns have the ergative alignment), one could first establish ERP responses to a clear syntactic violation in that language, unrelated to splits; similarly, an unrelated semantic violation could be evaluated. These independent data points could be used as benchmark comparison in assessing if the response to split violations is syntactic or semantic. In the second step of such a study, speakers of such a language could be tested on the use of ergative with pronouns, the use of accusative with nouns, and the absence of any marking on either type of DPs. It is not inconceivable that responses to the violations in pronouns may be

different from those to violations in the common-noun paradigm.

Another well known typological gap that might be amenable to a learnability-based study is the lack of languages with an accusative case system but an ergative agreement pattern. In contrast, the converse pattern, where a language has ergative case marking and accusative agreement, is attested (for example, in Warlpiri and Chukchi, see [Bobaljik 2008](#); in Burushaski, see Baker this volume and references therein; in Coast Tsimshian, see [Mulder 1994](#), and in Ngiyambaa, see [Donaldson 1980](#)). One approach to deriving this gap is couched in a system where agreement piggybacks on morphological case ([Bobaljik 2008](#)). The specific proposal is that if a verb agrees with an argument, it agrees with the structurally highest “accessible” argument, where accessibility is determined by morphological case according to the following hierarchy:

(8) Unmarked Case > Dependent Case > Lexical/Oblique Case

Nominative and absolutive are usually taken to be unmarked cases, while ergative and accusative are dependent cases. As such, if only unmarked case is accessible for agreement, then agreement will always be with the nominative (as in English) or absolutive (as in Nakh-Dagestanian languages). In languages with ergative case marking and nominative agreement, the claim is that both unmarked and dependent case are accessible for the determination of agreement morphology. As such, the verb will always agree with the structurally highest argument bearing ergative or absolutive case, which will be the subject, yielding an accusative agreement pattern.

In contrast, this system predicts that accusative case-marking cannot co-occur with ergative agreement: even if nominative and accusative are both accessible for agreement, the structurally superior subject will always end up being the trigger. If [Bobaljik 2008](#) is on the right track, we once again predict that a language with accusative case-marking and ergative agreement should be not just rare but impossible, which means that a computational model is expected to treat such a pattern differently from, for example, patterns that are attested

but merely rare

30.5.2 Structural vs. inherent case

A majority view in syntactic theory is that ergative is an inherent case, licensed either by a transitive *v* or Voice head (Legate 2008; Aldridge 2008), by a P head (Markman and Grashchenkov 2012), or by both types of head (Polinsky in press-b). That said, a small number of researchers have suggested that ergative may be a structural case; this analysis has been advocated for Basque by some researchers (Rezac et al. 2011, but see Laka 2006 for the inherent-case analysis) and Shipibo (Baker, this volume). In general the distinction between structural and inherent case has received relatively little attention in the experimental paradigm. Most work has been done using German, where the structural cases (nominative and accusative) were compared with the inherent dative (e.g., Jacobsen 2000). Similarly, in Japanese researchers have investigated the processing of nominative-marked vs. dative-marked *wh*-phrases (Aoshima et al. 2004). A recent study on Georgian (Skopeteas et al. 2012) also compared the structural nominative and the inherent dative. The results of the existing studies have been largely inconclusive, although Jacobsen (2000: 148-149) indicates that structural but not inherent case evoked a late positivity in German, and that violations of structural case evoked a higher negativity. Given that the distinction between structural and inherent case is still theoretically precarious (cf. the discussion in Bobaljik and Wurmbrand 2008), finding whether this distinction has processing correlates would be desirable. If such correlates could be obtained, they could then be used to assess the case status of ergative vis-a-vis absolutive in individual languages.

Georgian may be a particularly intriguing case in that regard given that it shows a complex split system based on aspect and mood. The advantage of Georgian is that most of its verbs participate in the alternations across three screeves, each with its own case-licensing properties (see Nash, this volume). That means that the cases associated with these screeves can be evaluated in terms of their licensing rather than in terms of whether some case cues are

more informative (as one would expect for lexical case) or less informative (as is expected for structural case).¹³

30.5.3 Ergative languages as a heterogeneous class

Just as nominative-accusative languages are not all the same, ergative languages may form a heterogeneous class as well. Approaches to such heterogeneity vary, with some researchers placing the burden on the variation in the ergative case assignment, and others, on the absolutive. Adopting the latter approach, ergative languages can be divided into two broad classes (Legate 2008 2014; Aldridge 2008). In the first class, the absolutive is a morphological default (ABS=DEF). ABS=DEF languages simply lack nominative and accusative case morphology, and at the point when vocabulary insertion has to apply the nominative and accusative structural cases are realized by the absolutive simply because it is the most appropriate morphological default. Walpiri, Hindi, and Niuean seem to be examples of this type. In these languages, the absolutive form is used for DPs which arguably lack abstract case whatsoever (such as hanging topics); objects may appear as the sole absolutive argument in a non-finite clauses; agreement tracks the subject or the highest unmarked structural case (as in Hindi); when conditions for a particular case assignment are not met, absolutive can appear, which can result in multiple absolutives per clause, and there is no evidence of syntactic ergativity. The second type of ergative languages has ABS=NOM; in such languages, the accusative is never assigned, and what is called the absolutive is simply a reflex of the nominative case. Georgian may be considered an ABS=NOM language. It is beyond the goals of this chapter to critically evaluate the distinction between ABS=DEF and ABS=NOM. However, this distinction makes a testable prediction. From the processing standpoint, a morphological default is treated as the absence of a certain feature or value, which means that a mismatch where the default is expected and does not appear would be parsed differently than a mismatch where a particular, specified, case is expected (see Clahsen 1999 for a general discussion of psycholinguistic

¹³For example, English filler-gap dependencies could be studied using a case-ambiguous form to measure locality biases, and a case-specific form as an unambiguous control (cf. Lee 2004; Wagers and Phillips 2009).

work on defaults, and Penke et al. 1997 for neuroimaging evidence of defaults). Conversely, if the default appears in unexpected contexts, the parser is predicted to respond differently than when one specified form replaces another. This suggests that in a ABS=DEF language, if case *X* is mismatched and case *Y* appears instead, the response to a violation would differ from the contexts where case *X* is expected and the absolutive default appears. In ABS=NOM languages, the absolutive is a genuine case, not a morphological default, so its appearance in lieu of another case would be treated as a featural violation. This type of experimental study would not only confirm the division of ergative languages into subclasses but would also serve as a tool to test the specific hypothesis concerning the morphological default status of the absolutive.

30.6 Names and subjects for indexing

endangered language

alignment competition

long-distance dependency

agreement

Georgian

Icelandic

Basque

split ergativity

Hindi

long-distance agreement (LDA)

subject processing preference, see subject processing advantage

event-related brain potentials (ERP)

learnability

head-marking

dependent-marking

neural network
Mayan languages
Salish languages
Austronesian languages
A'-dependency
subject-object asymmetry
relative clause
subject processing advantage (SPA)
case-cueing
agreement-cueing
syntactic ergativity
morphological ergativity
Accessibility hierarchy
Niuean
Avar
German
Spanish
sentence-picture matching (task)
self-paced reading
neuroimaging
P600
left anterior negativity (LAN)
Japanese
Korean
intransitive bias
headedness
Ch'ol

Q'anjob'al
garden-path sentences
aspectual-split
animacy-split
Inuit
Warlpiri
Chukchi
Burushaski
Coast Tsimshian
Ngiyambaa
unmarked case
dependent case
lexical/oblique case
inherent case
Nakh-Dagestanian languages
ABS=DEF
ABS=NOM

References

- Aldridge, E. (2008). Generative approaches to ergativity. *Language and Linguistics Compass*, 2:966–995.
- Aldridge, E. C. (2004). *Ergativity and word order in Austronesian languages*. PhD thesis.
- Aoshima, S., Phillips, C., and Weinberg, A. (2004). Processing filler-gap dependencies in a head-final language. *Journal of Memory and Language*, 51:23–54.
- Arregi, K. and Nevins, A. (2012). *Morphotactics: Basque auxiliaries and the structure of spellout*. Springer.

- Austin, J. (2007). Grammatical interference and the acquisition of ergative case in bilingual children learning Basque and Spanish. *Bilingualism Language and Cognition*, 10:315.
- Bickel, B. (2008). A refined sampling procedure for genealogical control. *Sprachtypologie und Universalienforschung*, 61:221–233.
- Bickel, B. and Witzlack-Makarevich, A. (2008). Referential scales and case alignment: reviewing the typological evidence. *Scales*, 86:1–37.
- Bobaljik, J. (2008). Where’s phi? Agreement as a post-syntactic operation. In *Phi-Theory: Phi Features Across Interfaces and Modules*, pages 44–58. Oxford University Press.
- Bobaljik, J. and Wurmbrand, S. (2008). Case in GB/minimalism. In Malchukov, A. and Spencer, A., editors, *The Oxford Handbook of Case*, pages 44–58. Oxford University Press.
- Bornkessel-Schlesewsky, I., Choudhary, K. K., Witzlack-Makarevich, A., and Bickel, B. (2008). Bridging the gap between processing preferences and typological distributions: Initial evidence from the online comprehension of control constructions in Hindi. *Scales (= Ling. Arbeits Berichte 86)*, pages 397–436.
- Bornkessel-Schlesewsky, I. and Schlewsky, M. (2009). *Processing syntax and morphology: A neurocognitive perspective*. Oxford University Press.
- Brouwer, H., Fitz, H., and Hoeks, J. (2012). Getting real about semantic illusions: rethinking the functional role of the P600 in language comprehension. *Brain Research*, 1446:127–143.
- Campana, M. (1994). *A movement theory of ergativity*. McGill University.
- Carreiras, M., Duñabeitia, J. A., Vergara, M., de la Cruz-Pavía, I., and Laka, I. (2010). Subject relative clauses are not universally easier to process: Evidence from Basque. *Cognition*, 115:79–92.

- Casado, P., Martín-Loeches, M., Muñoz, F., and Fernández-Frías, C. (2005). Are semantic and syntactic cues inducing the same processes in the identification of word order? *Cognitive Brain Research*, 24:526–543.
- Christianson, K. and Ferreira, F. (2005). Conceptual accessibility and sentence production in a free word order language (Odawa). *Cognition*, 28:105–135.
- Clahsen, H. (1999). Lexical entries and rules of language: A multidisciplinary study of German inflection. *Behavioral and brain sciences*, 22:991–1013.
- Clemens, L. E., Coon, J., Mateo Pedro, P., Morgan, A., Polinsky, M., Tandet, G., and Wagers, M. (2015). Ergativity and the complexity of extraction: A view from Mayan. *Natural Language & Linguistic Theory*.
- Comrie, B. and Keenan, E. L. (1979). Noun phrase accessibility revisited. *Language*, pages 649–664.
- Coon, J. (2013a). *Aspects of split ergativity*. Oxford University Press.
- Coon, J. (2013b). TAM Split Ergativity, Part II. *Language and Linguistics Compass*, 7:191–200.
- Coon, J., Pedro, P. M., and Preminger, O. (to appear). The role of case in A-bar extraction asymmetries: evidence from Mayan. *Linguistic Variation*.
- Coon, J. and Preminger, O. Towards a unified account of person splits. In *Proceedings of the 29th West Coast Conference on Formal Linguistics (WCCFL 29)*, editors=Jaehoon Choi, Alan Houge, Jessamyn Schertz, Jeff Punske, Deniz Tat & Alex Trueman, pages=310-318, city=Somerville, MA, publisher=Cascadilla Press, year=2012.
- DeLancey, S. (1981). An interpretation of split ergativity and related patterns. *Language*, pages 626–657.

- Dillon, B., Nevins, A., Austin, A. C., and Phillips, C. (2012). Syntactic and semantic predictors of tense in Hindi: An ERP investigation. *Language and Cognitive Processes*, 27:313–344.
- Dixon, R. M. (1994). *Ergativity*. Cambridge University Press.
- Donaldson, T. (1980). Ngiyambaa- The language of the Wangaaybuwan.
- Duñabeitia, J. A., Perea, M., and Carreiras, M. (2007). Do transposed-letter similarity effects occur at a morpheme level? Evidence for morpho-orthographic decomposition. *Cognition*, 105:691–703.
- Erdocia, K., Laka, I., and Rodriguez-Fornells, A. (2012). Processing verb medial word orders in a verb final language. In *Case, Word Order and Prominence*, pages 217–237. Springer.
- Fiebach, C. J., Schlesewsky, M., and Friederici, A. D. (2001). Syntactic working memory and the establishment of filler-gap dependencies: Insights from erps and fmri. *Journal of psycholinguistic research*, 30(3):321–338.
- Fodor, J. D. and Inoue, A. (1994). The diagnosis and cure of garden paths. *Journal of Psycholinguistic Research*, 23:407–434.
- Gagliardi, A. C. (2012). *Input and Intake in Language Acquisition*. PhD thesis, PhD dissertation, University of Maryland. Links [PDF].
- Gordon, P. C. and Hendrick, R. (2005). Relativization, ergativity, and corpus frequency. *Linguistic Inquiry*, 36(3):456–463.
- Hagoort, P., Brown, C., and Groothusen, J. (1993). The syntactic positive shift (SPS) as an ERP measure of syntactic processing. *Language and cognitive processes*, 8:439–483.
- Hagoort, P., Brown, C. M., and Osterhout, L. (1999). The neurocognition of syntactic processing. In Brown, C. and Hagoort, P., editors, *The neurocognition of language*, pages 273–316.

- Hawkins, J. A. (1994). *A performance theory of order and constituency*. Cambridge University Press.
- Hawkins, J. A. (2004). *Efficiency and complexity in grammars*. Oxford University Press.
- Hawkins, J. A. (2014). *Cross-linguistic Variation and Efficiency*. Oxford University Press.
- Jacobsen, T. (2000). *Characteristics of processing morphological structural and inherent case in language comprehension*. PhD thesis, Max Planck Institute of Cognitive Neuroscience Leipzig.
- Jäger, G. (2007). Evolutionary game theory and typology: A case study. *Language*, pages 74–109.
- Keenan, E. L. and Comrie, B. (1977). Noun phrase accessibility and universal grammar. *Linguistic inquiry*, pages 63–99.
- Keine, S. (2010). *Case and agreement from Fringe to Core: a minimalist approach*, volume 536. Walter de Gruyter.
- Keine, S. (2012). On the role of movement in Hindi/Urdu long-distance agreement. In Sloggett, S. K. . S., editor, *Proceedings of NELS 42*. GLSA.
- King, J. and Kutas, M. (1995). Who did what and when? using word-and clause-level erps to monitor working memory usage in reading. *Cognitive Neuroscience, Journal of*, 7(3):376–395.
- Kluender, R. (1998). On the distinction between strong and weak islands: A processing perspective. In Culicover, P. W. and McNally, L., editors, *The Limits of Syntax*, pages 241–280. Academic Press.
- Kornfilt, J. and Preminger, O. (to appear). Nominative as no case at all: an argument from raising-to-accusative in Sakha. In *Proceedings of the 9th Workshop on Altaic Formal Linguistics*. Cambridge, MA. MITWPL.

- Kuperberg, G. R. (2007). Neural mechanisms of language comprehension: Challenges to syntax. *Brain research*, 1146:23–49.
- Kwon, N., Gordon, P. C., Lee, Y., Kluender, R., and Polinsky, M. (2010). Cognitive and linguistic factors affecting subject/object asymmetry: An eye-tracking study of prenominal relative clauses in Korean. *Language*, 86:546–582.
- Kwon, N., Polinsky, M., and Kluender, R. (2006). Subject preference in Korean. In D. Baumer, D. M. and Scanlon, M., editors, *Proceedings of the 25th West Coast Conference on Formal Linguistics*, pages 1–14. Cascadilla Press.
- Laka, I. (2006). On the nature of case in Basque: Structural or inherent. *Organizing Grammar*, pages 374–382.
- Laka, I. and Erdocia, K. (2012). Linearization preferences given free word order; subject preferences given ergativity: A look at Basque.
- Lee, M.-W. (2004). Another look at the role of empty categories in sentence processing (and grammar). *Journal of Psycholinguistic Research*, 33:51–73.
- Legate, J. A. (2008). Morphological and abstract case. *Linguistic Inquiry*, 39:55–101.
- Legate, J. A. (2014). Split ergativity based on nominal type. *Lingua*, 148:183–212.
- Levin, T. and Preminger, O. (2015). Case in sakha: Are two modalities really necessary. *Natural Language and Linguistic Theory*.
- Lewis, R. L. (1998). Leaping off the garden path: Reanalysis and limited repair parsing. In Fodor, J. and Ferreira, F., editors, *Reanalysis in Sentence Processing*, pages 247–268. Kluwer Academic.
- Longenbaugh, N. and Polinsky, M. (to appear). Subject/object symmetry in Niuean: A theoretical and experimental investigation. In *Proceedings of AFLA XXII*.

- Manning, C. D. (1994). *Ergativity: Argument structure and grammatical relations*. PhD thesis, Stanford University.
- Markman, V. G. and Grashchenkov, P. (2012). On the adpositional nature of ergative subjects. *Lingua*, 122:257–266.
- Maslova, E. and Nikitina, T. (2007). Stochastic universals and dynamics of cross-linguistic distributions: the case of alignment types. *Unpublished Manuscript, Stanford University*.
- McGregor, W. B. (2009). Typology of ergativity. *Language and Linguistics Compass*, 3:480–508.
- Miyamoto, E. T. (2008). Processing sentences in Japanese. In Miyagawa, S. and Saito, M., editors, *The Oxford handbook of Japanese linguistics*, pages 217–249. Oxford University Press.
- Mohanan, T. (1994). Case OCP: A constraint on word order in Hindi. *Theoretical perspectives on word order in South Asian languages*, 185:216.
- Mosel, U. and Hovdhaugen, E. (1992). *Samoan reference grammar*. Scandinavian University Press.
- Mulder, J. G. (1994). *Ergativity in Coast Tsimshian (Sm'algyax)*, volume 124. Univ of California Press.
- Nevins, A., Dillon, B., Malhotra, S., and Phillips, C. (2007). *Brain Research*, 1164:81–94.
- Nichols, J. (1993). Ergativity and linguistic geography. *Australian Journal of Linguistics*, 13:39–89.
- Otsuka, Y. (2000). *Ergativity in Tongan*. PhD thesis, University of Oxford.
- Penke, M., Weyerts, H., Gross, M., Zander, E., Münte, T. F., and Clahsen, H. (1997). How the brain processes complex words: an event-related potential study of German verb inflections. *Cognitive Brain Research*, 6:37–52.

- Polich, J. (2007). Updating P300: an integrative theory of P3a and P3b. *Clinical neurophysiology*, 118:2128–2148.
- Polinsky, M. (to appear). *Deconstructing Ergativity*. Oxford University Press.
- Polinsky, M. (to appearb). Syntactic ergativity. In *The Blackwell Companion to Syntax*, 2 edition.
- Polinsky, M., Gallo, C. G., Graff, P., and Kravtchenko, E. (2012). Subject preference and ergativity. *Lingua*, 122:267–277.
- Potsdam, E. and Polinsky, M. (2011). Questions and word order in Polynesian. In Moysse-Faurie, C. and Sabel, J., editors, *Topics in Oceanic morphosyntax*, pages 121–153.
- Preminger, O. (2009). Breaking agreements: Distinguishing agreement and clitic doubling by their failures. *Linguistic Inquiry*, 40:619–666.
- Preminger, O. (2011). Asymmetries between person and number in syntax: a commentary on Bakers SCOPA. *Natural Language & Linguistic Theory*, pages 917–937.
- Rezac, M., Albizu, P., and Etxepare, R. (2011). The structural ergative of Basque and the theory of Case. *Natural Language & Linguistic Theory*, pages 1–58.
- Silverstein, M. (1986). Hierarchy of features and ergativity. *Features and projections*, 25:163.
- Skopeteas, S., Fanselow, G., and Asatiani, R. (2012). Case inversion in Georgian: Syntactic properties and sentence processing. In Lamers, M. and de Swart, H., editors, *Case, Word Order and Prominence*, pages 145–171. Springer.
- Tsunoda, T. (1981). Split case-marking patterns in verb-types and tense/aspect/mood. *Linguistics*, 19:389–438.
- Ueno, M. and Garnsey, S. M. (2008). An ERP study of the processing of subject and object relative clauses in Japanese. *Language and Cognitive Processes*, 23:646–688.

- van de Visser, M. (2006). *The marked status of ergativity*. LOT Publications.
- Van Everbroeck, E. (2003). Language type frequency and learnability from a connectionist perspective. *Linguistic Typology*, 7:1–50.
- Wagers, M., Borja, M., and Chung, S. (2015). The real-time comprehension of wh-dependencies in a Wh-Agreement language. *Language*, 91:88–101.
- Wagers, M. W. and Phillips, C. (2009). Multiple dependencies and the role of the grammar in real-time comprehension. *Journal of Linguistics*, 45:395–433.
- Zawiszewski, A., Gutiérrez, E., Fernández, B., and Laka, I. (2011). Language distance and non-native syntactic processing: Evidence from event-related potentials. *Bilingualism: Language and Cognition*, 14:400–411.