ELSEVIER

Conceptual accessibility and sentence production in a free word order language (Odawa)

Kiel Christianson[a,b,*], Fernanda Ferreira[c,d]

[a]Department of Educational Psychology, University of Illinois, Urbana-Champaign, USA
[b]Beckman Institute for Advanced Science and Technology, University of Illinois, 226 Education Building, 1310 South Sixth Street, Champaign, IL 61820-6990, Urbana-Champaign, USA
[c]Department of Psychology, Michigan State University, East Lansing, MI, USA
[d]Cognitive Science Program, Michigan State University, East Lansing, MI, USA

Abstract

The study reported here was conducted in the Algonquian language of Odawa (a.k.a. Ottawa), with the goal of gaining new insight into the ways that conceptual accessibility affects human sentence production. The linguistic characteristics of Odawa are quite different from those found in the languages most often examined by psycholinguists. The data obtained from the sentence production experiment reported here are thus relevant to production in a heretofore unexamined language. Moreover, the data inform broader theoretical issues, such as the extent to which sentence production can be considered as an incremental process, and the interaction of the various factors affecting conceptual accessibility. In addition, the study stands as evidence that experimental psycholinguistic research can and should be carried out in typologically diverse languages.
© 2005 Elsevier B.V. All rights reserved.

---

* Corresponding author. Address: Department of Educational Psychology, University of Illinois, 226 Education Building, 1310 South Sixth Street, Champaign, IL 61820-6990, Urbana-Champaign, USA. Tel.: +1 11 217 265 6558; fax: +1 11 217 244 7620.
  E-mail address: kiel@uiuc.edu (K. Christianson).

1. Introduction

In any human language, speakers have at their disposal a number of linguistic means by which they can highlight the importance of certain information relative to other information in the message. A central issue in the study of language production is how the ease with which the component concepts of a message can be accessed affects the linguistic form of the message. Bock (1986a) proposed the *conceptual accessibility hypothesis* to explain results from an extensive series of sentence production experiments that explored the interaction of conceptual prominence and linguistic form (Bock, 1986b; Bock, 1987; Bock & Levelt, 1994, Bock & Irwin, 1980; Bock & Warren, 1985). According to the hypothesis, the process of assigning grammatical functions (e.g. subject, direct object) to words in a sentence is determined at least in part by the relative ease with which lexical entries for various concepts included in the intended message can be accessed. More specifically, the lemma (representations for words which encode their semantic and syntactic features) associated with the most accessible concept will be assigned the highest grammatical function, or, in standard syntactic theory, the grammatical function associated with the left-most available node in a syntactic tree structure. Thus, in a language with canonical subject-before-object word order (SVO, SOV, or VSO), subject status is assigned first, direct object next, indirect object next, oblique object next, and so on.

2. Background

2.1. Conceptual accessibility

Work by Bock (1986a,b), Bock and Warren (1985) and Carroll (1958), and others has shown that in English, when a noun phrase (NP) is made accessible by showing someone a picture of a semantically related item, asking a focusing question, or establishing a context, speakers tend to begin their sentences with that same introduced NP. Bock and Warren's (1985) work on the production of passives in English led to the conclusion that the most accessible entity claims not only an early position in the string, but also the most prominent syntactic function (i.e. subject, or non-oblique dative in ditransitive structures). For example, if participants read the word *worship*, and then were shown a picture of lightning striking a church, they were more likely to use a passive sentence to describe the picture (*The church is being struck by lightning*) than if they were shown an unrelated prime.

As straightforward as these results appear, there are complications. Foremost among these is that in English the syntactic subject nearly always serves as the string-initial NP. It also nearly always serves as the discourse topic. Levelt (1989) points out that separating subject from topic in English, with its rather inflexible word order, is more difficult than it is in, for example, German, which has more relaxed word order. The task is in fact tricky in most human languages, however. Across languages, syntactic subjects tend to be 'unmarked topics,' or default topics (Reinhart, 1982), lacking overt morphological or prosodic specification as topics. Syntactic subjects also appear before

syntactic objects in over 80% of the world's languages (Hawkins, 1983). It is thus quite difficult to know, based only on English data (and data from many Indo-European languages), if conceptual accessibility has the effect of leading speakers to make the lemma associated with the accessible concept the subject, or the topic, or simply the first element in the string.

As is clear from this discussion, English is not the ideal language in which to study the effects of conceptual accessibility on sentence production, and most Indo-European languages fare little better. In these languages, word order constraints, case marking, and inventories of verb forms that differ little within the language family conspire to obscure the effects of conceptual accessibility on the surface features of an utterance. The goal of the study reported in this article was to use the Algonquian language of Odawa (a.k.a. Ottawa) to tease apart the various separate but related factors in order to better understand the way in which accessibility affects sentence production. Odawa contains some very different linguistic properties from the Indo-European languages psycholinguists generally work with. We discuss those features after a review of the rather small body of relevant recent cross-linguistic literature.

2.2. Previous cross-linguistic research

A further complication encountered when investigating conceptual accessibility in language production is the fact that a given concept might be accessible for one or more of a variety of reasons, including its animacy relative to that of other concepts in the message, the relative discourse status of a concept (topic (given information) versus focus (new information)), and the role the concept plays in the message (agent, patient, instrument, etc.). Establishing what bearing any one or some combination of these factors has on the accessibility of a concept, and consequently on the linguistic form of the message, is crucial in understanding language production. Psycholinguists have fairly recently begun to investigate the issue in languages containing word orders and syntactic structures that differ significantly from those found in English. Japanese has proven especially informative in this regard. Japanese is a verb-final (SOV) language with quite flexible pre-verbal word order. V. Ferreira and Yoshita (2003) investigated the effect of given versus new information on pre-verbal NP ordering in Japanese. They found that the discourse status (given versus new) of non-subject NPs affected their order of mention. In a long-term sentence recall task, participants memorized a list of dative target sentences (i.e. sentences with three-place argument structures, such as the Japanese equivalent of *The housewife gave the maid a present*). They then had to recall the sentences based on a series of eliciting sequences, some of which contained the exact NPs used in the target sentences, while others contained synonyms. V. Ferreira and Yoshita's experiment yielded several interesting results. First, given constituents were produced (i.e. recalled) more often before new constituents when recalling both canonical and scrambled word orders. Second, the given-before-new production preference was strongest when the eliciting sequence contained the exact NP used in the target sentence, but was still significant when the NP was only synonymous. V. Ferreira and Yoshita interpreted this result as suggestive of a conceptual accessibility effect on constituent-integration, and consequently, surface word order.

Tanaka (2003) also used a sentence-recall task to examine the effect of animacy on the ordering of pre-verbal NPs in Japanese production. Participants in this study again memorized sentences and were asked to recall them eight seconds later. Tanaka's results showed no effect of NP animacy on canonical SOV orders. There was however a significant effect on OSV orders, where participants were more likely to invert (mis-recall) animate subjects (and thematic agents) before inanimate objects (and thematic patients) than they were to invert inanimate subjects before animate objects. In other words, there was a subject-before-object and agent-before-patient preference across the board, which was boosted when the subject/agent was also animate.

Yamashita and Chang (2001) conducted two online experiments to determine if Japanese speakers ordered longer NP elements before shorter NP elements. A 'long before short' preference for ordering elements is attested by corpus data cited by Yamashita and Chang. This Japanese preference is opposite the 'short before long' preference for ordering elements observed in English (Stallings, McDonald, & O'Seaghdha, 1998). The results of Yamashita and Chang's experiments demonstrated a clear 'long before short' preference for Japanese. Yamashita and Chang interpreted their results in the context of an incremental production model, proposing that the semantic richness of longer elements makes them more salient, and thus conceptually more accessible. The free pre-verbal word order of Japanese, they claim, allows the relative accessibility of longer phrases to drive their earlier production. Under their view, the incremental production system weighs the relative accessibility of longer non-subject/topic elements with that of shorter subject/topic elements. The more accessible element wins out and occurs in an earlier linear position. Interestingly, the proposal predicts that in some contexts, the accessibility of the longer non-subject should be greater and it should thus occur first. But in other contexts, the accessibility of the shorter subject should be greater, and it should occur first. Yamashita and Chang do not elaborate on how the choice between the two 'delicately balanced biases' (p. B53) of subject-first versus longer-first might be settled, however.

Prat-Sala and Branigan (2000) exploited the occurrence of the 'dislocated active structure' (OSV) in Spanish to examine the interaction of 'inherent' conceptual accessibility (animacy) and 'derived' accessibility (given-new status) in two picture description experiments. Furthermore, they compared production in Spanish to production in English, which lacks the dislocated active structure. Prat-Sala and Branigan observed a significant interaction of animacy and discourse status, such that speakers in both languages were more likely to produce sentences with more salient (equated with accessibility by the authors) entities in higher syntactic positions than less salient entities. In Spanish, speakers also utilized the dislocated active structure as an alternative to passive constructions, which allowed them to place inherently accessible (animate) objects/patients sentence-initially without changing their syntactic function. Prat-Sala and Branigan interpreted these results as evidence of additive effects of inherent and derived accessibility on production.

Finally, van Nice and Dietrich (2003) explored the role of animacy on word order in German production in a series of three picture description experiments

(written picture description from memory, oral descriptions with pictures in view, and oral descriptions from memory). They found an effect of agent and patient animacy on verb form choice such that there were more passives used in animate-inanimate pairs than in inanimate-animate pairs, but no interaction between the two thematic role conditions in the writing task or the picture description task with pictures in view. In the oral description from memory task, van Nice and Dietrich obtained a significant interaction between animacy and thematic role, with no increased passivization when the agent was animate, contrary to their previous two experiments. The authors interpreted these results in terms of task-dependency: When a task requires accessing elements in memory (e.g. sentence recall, establishing a context, or picture description from memory), 'overlapping' processing of referents occurs, whereby elements are planned in advance and word order is less affected. In tasks that allow for 'sequential' processing of referents (such as viewing a picture in the absence of context and describing it while it is still in view), the inherent accessibility features of the referents affect word order independently of thematic role or linguistic properties of the message (such as verb argument structure). What is not clear from the van Nice and Dietrich experiments, however, is how production proceeds in more natural contexts. Rarely in normal conversation is memory not involved, given the fundamental roles of topic-focus structure in discourse and syntax (Kiss, 1995; Lambrecht, 1994).

2.3. Conceptual accessibility and incremental production

Under some interpretations of effects such as those observed in English by Bock and Warren (1985), the assumption is that the passive form is not chosen directly; instead, it emerges from the speaker's attempt to place the accessible concept in the most prominent syntactic position. If that concept happens to be a theme or patient, then, in a relatively fixed word order language such as English, a passive structure will need to be produced to accommodate a thematic patient in string-initial position (and thus in subject position). Under this view of human sentence production, which we classify as *radically incremental* (F. Ferreira & Swets, 2002), the lemmas associated with the most accessible concepts automatically grab the earliest positions in utterances. The syntactic processes which incorporate these lemmas into grammatical sentences are taken to apply on the fly, as a sort of bootstrapping mechanism (Roelofs, 1998; Schriefers, Teruel, & Meinshousen, 1998; Wheeldon & Lahiri, 1997).

Bock (1986a) dismissed the radical version of incrementality: 'Typically, speakers do not simply produce words in the order in which they come to mind…Rather, the syntactic forms of sentences seem to be changed so as to accommodate word order variations without altering the intended meaning' (p. 359). Nevertheless, a radically incremental model of production is consistent with the English data, especially given that control structures separating grammatical function from string prominence are rare in English (Bock &Warren, 1985; Levelt & Maassen, 1981; Levelt, 1989). A radically incremental model is assumed, for example, by van Nice and Dietrich (2003), who interpret their German data as supporting the view that 'the first-conceptualized referent will continue

onward as the first-lexicalized and, ultimately, as the first in word order.' This view, they point out, is also held by De Smedt (1990) and Kempen and Hoenkamp (1987). In the General Discussion, we contrast radical incrementality with a more *weakly incremental* view of language production, which appears to be better able to account for the Odawa data reported below.

The linguistic properties of Odawa, the language in which the experiment reported here was carried out, allow for an integrated investigation of the effects of (in the terminology of Prat-Sala and Branigan (2000)) accessibility due to the inherent salience of animacy and accessibility due to the derived salience of discourse status and thematic role. In addition, Odawa also presents a test of the ability of a radically incremental production model to account for production in a language that is different in many ways from those heretofore considered by psycholinguists. In the following section, we outline the relevant characteristics of Odawa. Then we describe our study, including certain issues that arise when undertaking 'field psycholinguistics' research. The experiment reported here is, to the best of our knowledge, the first psycholinguistic experiment undertaken in the field in one of the indigenous languages of North America. As such, certain issues arose while conducting research outside of the laboratory and within a population unaccustomed to the practices of experimental psychologists. After reporting the results, we consider in more detail the process by which conceptual accessibility appears to determine how a speaker of such a language decides how to syntactically encode a given message in a given context. We then extend this account to more 'configurational' languages such as English.

3. Odawa syntax

A general description of the syntax and morphology of Odawa is beyond the scope of this article; however, number of features of the language must be grasped if one is to make theoretical sense of the empirical data obtained here. Of primary concern in this context are the following characteristics of the language: the word order, the verbal system (direct, inverse, passive), the discourse information encoded in the nominal (and verbal) morphology, and the pro-drop of arguments. We briefly describe each of these characteristics and their significance with respect to sentence production.

3.1. Word order

Odawa allows major constituents to be freely ordered within the clause.[1] An NP bearing any grammatical function (subject, direct object, indirect object) can

---

[1] The word order flexibility is actually more extreme. Phrasal constituents can be separated from each other by intervening phrases. Thus, quantifiers and demonstratives may be separated from the NPs they modify by intervening VPs, NPs, or adjunct phrases.

occur sentence-initially without forcing the speaker to resort to extremely infrequent intonational patterns (as in English topicalization, e.g. *Fish, Bill likes*). For a single-clause transitive declarative sentence, all logical word orders are thus possible: VSO, VOS, SVO, OVS, SOV, OSV. Moreover, as demonstrated in the present experiment, all are used. Despite this variability, however, the preponderance of recent syntactic work argues strongly for a completely configurational account of Odawa (and other Algonquian languages). Bruening (2001) offers a detailed account of the Algonquian language Maliseet–Passamaquoddy, making the case for a canonical SVO word order in clauses containing a direct verb, but canonical OSV word order in clauses containing an inverse verb (see the following subsection for descriptions of these verb forms). Christianson (2002b) presented syntactic and psycholinguistic Odawa evidence consistent with Bruening's proposal for Maliseet–Passamaquoddy.

The flexibility of word order in Odawa is different from that seen in Japanese, as the verb position in Odawa is not fixed. It is also different from both Japanese and German in that Odawa contains no overt case markings, and thus no unambiguous clue for listener (or speaker) as to the syntactic function of any given NP until the verb has been encountered (again, see the next section for details).

3.2. Verb forms and 'direction' system

Odawa contains a rich inventory of verb forms that prove to be helpful in examining production. The most frequent transitive verb form (the *direct*) is used when the subject (and thematic agent) is designated as the topic. A less frequent verb form (the *inverse*) is used when the object (and thematic patient) serves as topic. Yet another verb form (the *passive*) is used when the patient serves as both topic and subject.[2] We believe this three-way verbal split makes it possible to separate topic-related phenomena from subject-related phenomena, which, as pointed out by Levelt (1989), can be difficult in Indo-European languages where such verbal systems are not attested. The distinction between the direct and inverse forms is referred to as a 'direction system,' which allows speakers and listeners to mark and track relevant thematic and syntactic information in order to determine 'who's doing what to whom.' Direction systems such as these are not uncommon in the world's languages, and can be considered as alternatives to 'voice systems' (i.e. active versus passive) in Indo-European languages. As discussed below, it has been proposed (e.g. Aissen, 1997) that direction systems are functionally equivalent to voice systems, though the syntax of the two may differ.

Odawa's free word order gives speakers extreme flexibility in the ways in which they can produce sentences, and this flexibility is independent of verb form used. For example, an Odawa speaker can describe a situation where a boy is pinching a girl using any one of

---

[2] In fact, Odawa contains two distinct passive forms, only one of which was observed in use by speakers in the experiment reported here. This fact becomes relevant in the General Discussion, and is discussed in more detail there.

the six orders illustrated in (1), using the *direct* verb form, or the six orders illustrated in (2), using the inverse verb form

---

(1) Direct Forms for: *A/The boy is pinching a/the girl*[a,b,c]

a. gwiizens Ø-jiismabin-aa-n kwezens-an	**SVO**
boy 3-pinch.3 > 3′(**Direct**)-Obviative	
girl- Obviative	
b. kwezens-an Ø-jiismabin-aa-n gwiizens	**OVS**
c. gwiizens kwezens-an Ø-jiismabin-aa-n	**SOV**
d. kwezens-an gwiizens Ø-jiismabin-aa-n	**OSV**
e. Ø-jiismabin-aa-n gwiizens kwezens-an	**VSO**
f. Ø-jiismabin-aa-n kwezens-an gwiizens	**VOS**

(2) Inverse Forms for: *A/The boy is pinching a/the girl*

a. gwiizens-an Ø-jiismabin-igoo-n kwezens	**SVO**
boy-Obviative 3-pinch.3′ > 3(**Inverse**)	
-Obviative girl	
b. kwezens Ø-jiismabin-igoo-n gwiizens-an	**OVS**
c. gwiizens-an kwezens Ø-jiismabin-igoo-n	**SOV**
d. kwezens gwiizens-an Ø-jiismabin-igoo-n	**OSV**
e. Ø-jiismabin-igoo-n gwiizens-an kwezens	**VSO**
f. Ø-jiismabin-igoo-n kwezens gwiizen-ans	**VOS**

---

[a] Odawa contains no definite or indefinite articles.

[b] Abbreviations: 3, third person, proximate; 3′, third person; obviative; 3 > 3′, third person, proximate agent & third person, obviative patient; 3′ > 3, third person, obviative agent & third person proximate patient. The terms proximate, obviative, Direct, and Inverse will be defined below. Ø, third person prefix, null due to a regular phonological process of unstressed vowel deletion (Valentine, 2001).

[c] We limit discussion here to sentences involving two third person singular NPs.

The free word order of Odawa allows speakers to begin any sentence with whatever concept is most accessible. Any NP can be assigned to sentence-initial position without deviating from an active structure. No overt case markings are required, and intonational phrasing is unaffected. Speakers do not even have to resort to a less frequent verb form: They may use the direct form, which is the most common in Odawa (and Algonquian languages in general, see Christianson, 2002b). This, of course, is different from what English speakers must do when they elect to use the passive to deal with an accessible thematic patient.

The inverse form, like the direct, is generally believed by Algonquinists to be both active and transitive (Aissen, 1997; Artstein, 1999; Bruening, 2001; Richards, 2000; but see Rhodes, 1994 for a contrary position). The major difference between the direct verb and the inverse is the relative 'centrality' (Richards, 2000) of the two NPs in the clause (and sometimes outside of the clause (cf. Aissen, 1997; Valentine, 2001)). Central NPs tend to be thematic agents, to be human, and to be more topical in the discourse context. The Algonquian notion of centrality thus appears to be not too different from the notion of salience in the psycholinguistic literature (Levelt, 1989; Prat-Sala & Branigan, 2000; van Nice & Dietrich, 2003). In both direct and inverse forms, the more central NP is morphologically unmarked and is termed 'proximate' (in (1), the proximate NP in all sentences is *gwiizens* 'boy'). The less central (or 'peripheral') NP is morphologically marked and termed 'obviative' (in (1), the obviative NP, marked with the suffix -(*a*)*n* is

a. direct   b. inverse   c. passive

central   peripheral   central   peripheral   central   ~~peripheral~~
(prox)   (obv)   (prox)   (obv)   (prox)

   | | \   / | |
                              \   /
                               \ /
                                \/
                                /\
                               / \
   | | /   \ | |
SUBJ   OBJ   SUBJ   OBJ   SUBJ   ~~OBJ~~
   | | | | \   /
                                                       \   /
                                                        \   /
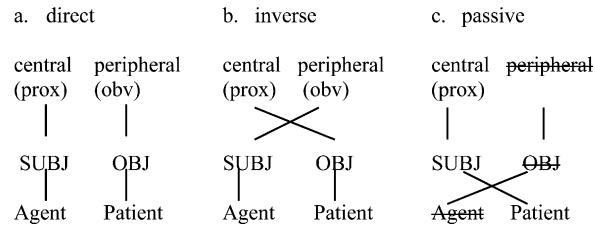Agent   Patient   Agent   Patient   ~~Agent~~   Patient

Fig. 1. Syntactic, thematic, discourse and morphological relations in Odawa direct, inverse, and passive constructions (adapted from Aissen, 1997; strikethrough font signifies obligatorily absent object/agent argument in the passive).

kwezens 'girl'). If the thematic agent is more central, the direct form is used, and the verbal obviation suffix (-*n*) agrees with the nominal obviation morpheme on the thematic patient NP. If the thematic patient is more central, the inverse form is used, and the verbal obviation morpheme agrees with the nominal obviation morpheme on the agent NP. The dependence of the verb form on the relative centrality of the two arguments is referred to as the Algonquian 'direction' system.

As mentioned above, despite the apparent nonconfigurationality of the language, we assume a completely configurational version of Odawa syntax here (Branigan & MacKenzie, 2002; Bruening, 2001; Christianson, 2002b). Under this view, the proximate NP in the direct form is the syntactic subject and thematic agent, while the syntactic object and thematic patient is morphologically marked as obviative. In the inverse, the proximate NP is the thematic patient and the *inverted* object (so-called due to the syntactic movement of the object NP posited by Bruening (2001) for this verb form), while the obviative NP is the syntactic subject and thematic agent (see Fig. 1). The choice of which verb form to use, and (in independent clauses, at least) which NP to mark as proximate and which to mark as obviative, depend on factors such as the thematic role, the relative discourse prominence, and the relative animacy (discussed below) of each argument. Taken together, these factors determine the relative centrality of each NP, with the more central NP always assigned proximate status. One of the main findings in Christianson (2002b) was that Odawa speakers had difficulty comprehending sentences where the proximate NP was overt and the obviative NP had been omitted (i.e. pro-dropped, see the following subsection). Christianson argued that this result supports the idea that the proximate-obviative distinction essentially encodes the discourse status of the NPs, with the proximate NP more topical (or 'given' (Chafe, 1976)) and the obviative NP less topical (or 'new') (see also Givón, 1994).

As such, the inverse—in which the object and thematic patient is the most discourse-prominent argument—represents a sentence type not found in any language examined to date by psycholinguists interested in sentence production. The inverse differs from an English passive, for example, in both the flexibility of its word order and, more importantly, the morphological marking of the discourse status of both its arguments. Along with the direct and passive sentence types found in Odawa, the inverse provides an opportunity to examine the interaction of syntax, discourse, and conceptual accessibility in sentence production.

Odawa also contains a passive form (Valentine, 2001) illustrated in (3). It will be assumed here that the syntax of this passive is analogous to its English counterpart except

as follows: As in English, the passive does not assign an external thematic role, i.e. the passive does not directly assign a role corresponding to the agent of the action. Since the language contains no oblique case or thematic role assigners, no external NP may be included in the passive (for a full discussion see Bailin & Grafstein, 1991; Christianson, 2002b; Rhodes, 1990; Valentine, 2001). In other words, there is no Odawa equivalent of the agentive *by* found in the English passive. Therefore, all Odawa passives are 'truncated' or 'agent-less' (see Fig. 1).

---

(3) Passive: *A/The girl is being pinched*

a. kwezens Ø-jiismabin-igaazo   **SV**
   girl 3-pinch-**Passive**

b. gii-jiismabinigaazo kwezens   **VS**

The interaction of subject/object, agent/patient, and central/peripheral argument in the direct and inverse forms has led some to translate inverse clauses as passives. The facts of Odawa, however, support transitive, active readings of both direct and inverse sentences, with their respective argument statuses as represented in Fig. 1, both being distinct from the passive.

If this characterization of the functional parallel between the inverse and passive is correct, we should see some parallels between the inverse and passive in Odawa production. Importantly, the contrast between direct and inverse verb forms can be analyzed as a grammaticalization of topicality (or givenness), as argued by Cooreman (1994) and Givón (1994). In cases where the patient is more topical than the agent, an inverse verb highlights this state of affairs without changing the grammatical functions of the arguments, which is different from what happens in passive sentences.

3.3. Pro-drop

Verb form change is not the only possible way that topicality can be manifested. Imagine a context in which the arguments maintain their respective statuses as 'central' and 'peripheral' but, for example, the more central argument is new rather than given information (i.e. it is central for some other reason). In such a context, the topical constituent can be placed sentence-initially or dropped altogether, a phenomenon known as pro-drop (Chomsky, 1986; Huang, 1984). In this case, the direct verb form is maintained while word order and/or NP elision encode the relative topicality of the arguments. Pro-drop is 'rampant' (Bruening & Rackowski, 2001) in all Algonquian languages, including Odawa. Any argument NP can be left unsaid if its referent can be identified in the either the physical, conceptual, or linguistic context. Thus, a perfectly grammatical version of any of the sentences in (1) would be just the verbal complex, as in (4)

---

(4) *A/the boy is pinching a/the girl*
   pro Ø-jiismabin-aa-n *pro*
   pro 3-pinch-3 > 3' (**Direct**)-Obviative pro

3.4. Grammatical and notional animacy

In a great number of the world's languages, the relative animacy of subject and object appear to affect both the form of the grammar and the operations of the sentence production system (F. Ferreira, 1994; Minkoff, 1994, 2000, 2001). Odawa distinguishes grammatically in certain ways between humans and animals, even though both are animate according to the grammatical gender system of the language (Corbett, 1991; Valentine, 2001). Note that the typical distinction between animate and inanimate entities used in Indo-European languages (e.g. *man* versus, say, *tree*) could not be used, since in Odawa certain notionally inanimate nouns (such as *mtig* 'tree') are grammatically animate. An extremely interesting question, which is unfortunately beyond the scope of this work, is whether grammatical animacy affects the salience/accessibility of an NP in the same way that notional animacy does. For example, given two notionally inanimate Odawa NPs that differ in grammatical animacy, would the grammatical animate tend to be assigned subject status more often than the grammatical inanimate similarly to the way that notionally animate NPs have been observed to be preferred as subjects over notionally inanimate NPs (Prat-Sala & Branigan, 2000; Sridhar, 1988; Tanaka, 2003)? The issue of notional animacy versus grammatical animacy plays a small but pivotal role in the experiment reported below.

The particular constellation of linguistic phenomena that exists in Odawa offers a new window through which we can scrutinize certain architectural issues in language production, particularly concerning the incrementality of syntactic encoding. In particular, they allow us to investigate the effects of accessibility on the interaction of animacy, thematic role, topicality, syntactic function, and order of mention.

4. Experiment

4.1. Participants

Twenty-one native speakers of Odawa (sixteen women and five men) took part in the experiment. All participants were between the ages of 35 and 75; five were over the age of 65. Odawa is an endangered language, and the remaining population of speakers is generally elderly and rather small (approximately 1000 in the reserve in which the present experiment was run). Participants lived in or adjacent to the First Nations Reserve of Wikwemikong, Manitoulin Island, Ontario, and all described themselves as native speakers of Odawa as established by the following criteria: (1) Odawa was the language they had used in the home they lived in as children and adolescents. (2) Their first (and only) exposure to English as a pre-teen was at school or elsewhere outside of the home. (3) Odawa was their language of choice when speaking with others in the community who also spoke the language. (4) All participants were deemed 'native speakers' by the native-speaking Odawa language teacher who conducted the experimental interviews. In addition, the first author is a linguist with expertise in the language, and he monitored participants' comprehension and fluency during each test session to be certain that all participants exhibited full control of both grammar and vocabulary. Each participant was

Fig. 2. Example line drawing from Odawa Production Experiment.

paid $20 Canadian for their participation. The experiment lasted an average of 45 min. Experimental sessions took place in a variety of locations, including the homes of the participants as well as in a community center.

4.2. Materials

Participants were shown 153 black and white line drawings of various actions and of depictions of everyday objects in various spatial configurations. Of these drawings, 33 were of experimental interest and the remaining 120 were fillers. The 33 experimental drawings represented transitive actions for which a common verb was available in the language (as determined beforehand with the help of native speaker consultants who did not participate in the experiment). The drawings were done on $8.5'' \times 11''$ white paper, and each was inserted into a clear plastic sleeve in a large three-ring binder. An example of the line drawings is provided in Fig. 2.

Descriptions of each of the 33 test drawings were elicited with one of the three questions in (5). The questions were asked at the same time each page was turned in the binder, such that the question and the drawing were presented more or less simultaneously. These questions served as the three experimental conditions. It should also be noted that Odawa is not a written language. Although the Roman alphabet has been adapted to write Odawa, very few native speakers in Wikwemikong can read in the language. Therefore, the questions were given orally by the native speaker assistant working with the first author

(5) a. Aaniish e-zhiwebag zhinda? General Question (GQ)
    what PRES.Conj-happening here *What is happening here?*

b. Aaniish e-nanikiid gwiizens? Agent Question (AQ)
    what PRES.Conj-doing boy *What is the boy doing?*

c. Aaniish e-zhiwebizid kwezens? Patient Question (PQ)
    what PRES.Conj-happening.to girl *What is happening to the girl?*

.

Questions such those as in (5) have been used to elicit sentence tokens in production experiments since Carroll (1958). It is a convenient property of Odawa that the three questions have different topicalizing properties but yet do not differ in word order or verb type. The NPs in the agent-topicalizing question (AQ, 5b) and patient-topicalizing question (PQ, 5c) are the last constituents (unlike the English translations), and as a result no potential interfering NP or other type of constituent comes between the prompt NP and response. The verb type is also identical in each question—direct forms with conjunct agreement (the form required for WH-questions).[3] Also noteworthy is the lack of overt case marking in Odawa. In a language such as German, there exists the possibility that elicitation questions of the sort described here could serve to prompt active responses with non-nominative NPs in non-canonical order, primed by a German patient-topicalizing question with the critical NP in non-nominative case. Odawa presents no such confound because the NPs in the Agent-topicalizing and Patient-topicalizing questions display no overt case marking (and, more importantly for Odawa, no obviation marking).

Note that the general question (GQ) condition served as an important baseline for comparison. Frequency data in Odawa are virtually non-existent since the language is not normally written. Written texts and transcriptions of spoken texts tend to be stories and legends, i.e. highly stylized and not necessarily reflective of daily speech. The data collected here in the GQ condition are therefore taken as a baseline frequency for the various verb forms and word orders possible within the language. Consequently, when we speak of frequencies, we do so in an informal, non-rigorous sense because no corpora exist to yield precise counts. All statistical comparisons will thus be made between the baseline GQ condition and the AQ and PQ conditions.

Three stimulus lists were created. Each of the three topicalizing conditions (General Question (GQ), Agent-topicalizing Question (AQ), and Patient-topicalizing Question (PQ)) occurred 11 times on each list. A given item occurred only once in each list, but occurred in all three conditions across the three lists. The experimental drawings and their associated questions were randomized among the fillers with certain constraints: All but two test drawings were separated by at least one filler, usually two or more. The two that occurred sequentially (due to an error on the experimenter's part) did not appear to interact with one another in any significant way.

Finally, the 33 experimental items differed from each other in three ways: For 22 of the pictures, human agents interacted with human patients (H–H); for five, a human agent acted on an animal patient (H–A); and for the remaining six, an animal agent acted on a human patient (A–H). The motivation for including these subgroups of drawings was an intuition on the part of the first author (who has expertise in Odawa) that the relative animacy of the characters in the drawings could affect verb choice, despite the fact that two native speakers independently reported prior to data collection that it should not.

---

[3] In Algonquian languages, verbs in independent clauses display agreements paradigms different from those in subordinate or conjoined clauses (cf. Bloomfield, 1956; Brittain, 2001; Valentine, 2001). Verb forms in WH-questions pattern with verbs in subordinate clauses.

Odawa grammar distinguishes between human and non-human notionally animate referents in several ways, even though the grammatical gender system classifies both as animate. We suspected that this division between human and non-human animates might manifest itself in sentence production.

4.3. Procedure

Each list was administered to seven of the 21 participants, so each drawing was presented with each of the three questions an equal number of times. Instructions were given in either Odawa or English, whichever the participant preferred. An assistant who was a native speaker of Odawa administered the practice trials (generally eight in number) and the elicitation questions exclusively in Odawa. The first author was present at all times to monitor the administration of the questions, appropriateness of the responses, and the functioning of the tape recorder. Participants were instructed to respond as fully as possible 'as if describing the pictures for someone who could not see them.' During the actual experimental trials, sentences were nevertheless often produced with missing constituents (recall that pro-drop occurs frequently in Odawa and is possible for any argument). Because of cultural issues particular to this community, it was deemed more important to let the speakers and the experiment proceed without interruption than to insist that the speakers conform to the instructions.

Data were collected under rather unusual circumstances. The informality of the physical surroundings was of the sort often associated with fieldwork in linguistics, but not generally with psycholinguistics. We note, however, that given the results reported here and in Christianson (2002b), 'field psycholinguistic' experiments deserve consideration in order to access a wider range of languages. Most sessions in the present experiment took place around the kitchen tables in the homes of participants in Wikwemikong. All sessions were recorded on a Marantz PMD222 tape recorder with an external microphone. Due to the varied locations of the sessions, a substantial amount of background noise (dogs, babies, friends, telephones, televisions, etc.) can be heard on the tapes. Fortunately, only a small number of responses had to be discarded as unintelligible. A native speaker who attended approximately one-half of the experimental sessions (but not the interviewer herself) assisted in transcribing the tapes.

4.4. Predictions

Given the fact that this was the first such experiment conducted in a Native American language, and given that Odawa has a set of linguistic properties quite different from those of Indo-European languages, predictions with respect to overall patterns of production during the picture description task were purposely broad. If Odawa speakers utilize word order more than verb form (and the associated direction system-related morphology) to mark topic-focus status of NPs, we would expect to see little change in verb form from one question condition to the next, but widespread variations in word order. If, on the other hand, speakers prefer to alter verb form in response to the discourse contexts imposed by the various questions, word order,

though still likely variable, should be only a secondary means of expressing topic-focus status.

With respect to the relevant animacy of agents and patients in the subsets of pictures, a clear prediction can be made. If humans and animals are not differentiated with respect to animacy, we would expect no difference in results whether the mixed-animacy results are included in the analyses or not. If animacy does affect conceptual accessibility, however, we could find evidence in one or more of several measures, including verb form variation, word order, and frequency of pro-drop.

Odawa's flexible word order and interesting verb form inventory allow for rather more specific predictions with respect to the radical and weak versions of incremental production. Consider the case where conceptual accessibility affects just order of mention. We would expect to see scrambled orders with the direct form used most often irrespective of factors affecting the conceptual accessibility of the arguments. In other words, speakers would be expected to make use of the word order optionality in Odawa to accommodate accessibility of any nominal concept. The language does not force speakers to resort to a less frequent verb form to accommodate a sentence-initial patient NP, as has been argued to be the case with the English passive.

The direct form, the most frequent verb form in the language, is expected to be favored under a strictly incremental view of syntactic encoding, which assumes that all levels of processing within the production system operate in parallel, with any given processor triggered into operation by a minimal amount of input (Levelt, 1989; Wheeldon & Lahiri, 1997). The syntactic encoder need not wait for all the relevant lemmas to be activated; once a lemma becomes highly activated, it may grab the leftmost argument position in the sentence, which in a SVO language with rigid word order (such as English) corresponds to the syntactic subject. According to radically incremental models of syntactic encoding, then, the syntactic form of an utterance results from the processor's attempt to accommodate the different activation levels of lemmas. In English, if a patient is accessible and thus becomes highly available, it grabs sentence-initial position; and because of English word order restrictions, the only way to accommodate this placement (without also imposing extremely marked intonation, e.g. left-dislocation or topicalization) is to make it the subject of a passive sentence. Odawa is much more flexible: The patient may occupy the sentence-initial slot, since even in a direct (active) sentence this slot need not be filled by the subject. Thus, the activation of the patient can be accommodated without resorting to the less frequent passive verb form (or much less frequent inverse form).

Alternatively, if accessibility affects the discourse status (or topicality) of the accessible NP, we should see an increase in inverse use in the condition where the patient is more topical (and accessible) than the agent. In a model of sentence production where the effects of conceptual accessibility bear directly on pragmatics or 'information structure' (Lambrecht, 1994), we would expect speakers of Odawa to use a large proportion of inverse verbs in response to Patient-topicalizing questions. The grammatical functions of the arguments of an inverse verb do not change: The subject is still the agent and the object is still the patient (Aissen, 1997; Aissen, 1999b and references cited therein; but cf. Rhodes, 1994). Nor are Odawa sentences with inverse verbs more limited in terms of word

order options than those with direct verbs. The major difference between direct and inverse, according both to Givón (1994) and also to Odawa comprehension data presented in Christianson (2002b), is that the topic status of the patient is greater than that of the agent. Thus, the patient is realized as the proximate NP. If accessible concepts are initially assigned topic status, we should see an increased number of inverse clauses in the PQ condition. Note that the increased use of passives observed in English when the patient NP is more accessible could just as well follow from a preference on the part of the production system to make accessible NPs topics as from a drive to place accessible NPs in the string. In English, and other Indo-European languages, topics come before non-topics. Thus the fact that topical NPs are produced first could be dependent upon their being topics. In Odawa, the proximate-obviative distinction between topics and non-topics provides a way of marking topics independent of linear order, so discourse status and linear position can be disentangled in a way that is not possible in English.

Finally, if accessibility influences choice of syntactic frame such that the accessible NP is preferably made syntactic subject, we should see more passives used when the patient is more accessible than the agent. The existence of a passive verb in Odawa allows us to observe the full potential range of accessibility effects. The only NP licensed by the passive verb in Odawa is the patient, and, in contrast to the inverse form, the patient in a passive is the syntactic subject as well as the (default) topic. Therefore, if the increased accessibility of an NP influences its syntactic status, above and beyond order of mention or topicality, we should observe a significant bias for passive verbs to occur in the PQ condition. It is this contrast between the passive and the inverse verbs in Odawa (a distinction not found in Indo-European languages) that allows us to observe the manner in which accessibility differentially affects the pragmatic versus syntactic properties of an utterance. One potential complication is that passives license only one argument; a speaker of Odawa who uses the passive can only say roughly that 'the girl is being pinched'. However, the instructions asked participants to 'describe the drawing as you would to someone who cannot see it.' Therefore, any tendency to produce passives in this experiment must actually be stronger than the participants' desire to follow instructions. As will be seen shortly, this was not a major problem: The demands of the syntactic processor were more powerful than those of the experimenters.

4.5. Results

4.5.1. General results

After discarding 10.5% of the descriptions of the experimental drawings for various reasons (unintelligibility, lack of an answer, wrong question asked), 620 tokens were transcribed and translated into English by the first author and a native speaker of Odawa.[4] The total number of responses by verb form and question condition are provided in Table 1.

---

[4] Responses to filler drawings—which depicted transitive, intransitive, ditransitive, and locative situations—have yet to be transcribed and analyzed. The total number of tokens exceeds 3200, a substantial corpus for a gravely endangered language.

Table 1
Number of responses by verb form and question condition

Question	GQ				AQ				PQ			
Verb form	Dir	Inv	Pass	Intr	Dir	Inv	Pass	Intr	Dir	Inv	Pass	Intr
Word Order												
V	5	0	8	14	13	0	4	31	2	0	81	14
SV	6	4	5	8	0	1	0	1	6	16	14	3
VS	3	1	19	20	1	1	2	7	1	9	19	4
OV	8	0	–	–	15	0	–	–	2	0	–	–
VO	13	0	–	–	91	0	–	–	5	0	–	–
VSO	6	1	–	–	3	0	–	–	5	0	–	–
VOS	5	1	–	–	2	0	–	–	0	0	–	–
SVO	63	2	–	–	29	0	–	–	15	2	–	–
OVS	2	3	–	–	0	0	–	–	0	3	–	–
SOV	6	3	–	–	3	0	–	–	1	1	–	–
OSV	4	2	–	–	0	0	–	–	0	1	–	–
Tot.	121	17	32	42	157	2	6	39	37	32	114	21

Dir, direct; Inv, inverse; Pass, passive; Intr, intransitive; GQ, general question; AQ, agent question; PQ, patient question.

Table 2
Verb form used in each condition as a percentage of all responses in that condition

Condition	Direct	Inverse	Passive	Intransitive
GQ	57.5	8.0	15.0	19.8
AQ	77.0	1.0	3.0	19.1
PQ	18.1	15.7	55.9	10.3

The overall results in Table 1 displayed a remarkable variability, even under the controlled conditions of the experiment. At the same time, the responses showed a high degree of systematicity: Verb form varied predictably according to question type, yet one word order (SVO) occurred far more frequently than would be predicted by question type alone. Overall, despite the 'exotic' appearance of Odawa surface syntax, the word order for the sentences elicited in this experiment resembled those elicited in similar experiments in 'configurational' languages.

To determine if the question significantly affected verb form choice, two planned paired t-tests were conducted within each verb form occurring in the responses (direct, inverse, passive, intransitive).[5] All tests compared the responses in the Agent Question (AQ) and Patient Question (PQ) conditions to those in the General Question (GQ) condition, which was considered to be the baseline. One analysis was performed considering participants

---

[5] There is disagreement among statisticians about the appropriateness of applying corrections over planned tests to protect against familywise Type 1 errors (cf. Meyers & Well, 2003). A Bonferonni correction (eight (8) planned comparisons *.05) in the present case would yield a p value of .0065. Although we feel this significance level is overly stringent, we report all p values with enough precision to allow the reader to determine their reliability for him or herself.

as a random effect (*t1*) and one was performed considering items as a random effect (*t2*). Percentages of each verb form used in each condition are given in Table 2.

4.5.2. Results: Verb form

The t-tests revealed a significant effect of question type on the verb form used in the direct, inverse, and passive, but not intransitive (with one exception). Note once again that, in the absence of extant textual frequency counts in Odawa, we take the verb form frequencies (and the word order frequencies discussed below) in the GQ condition as the baseline against which effects of question type are compared. The AQ question inflated responses in the direct form ($t1(20) = -2.45$, $P = .0237$; $t2(32) = -2.91$, $P = .0064$). The AQ question depressed the responses in both the inverse form ($t1(20) = 3.42$, $P = .0027$; $t2(32) = 2.33$, $P = .0263$) and the passive form ($t1(20) = 3.28$, $P = .0037$; $t2(32) = 3.64$, $P = .001$). The AQ question had no effect on the intransitive ($ps > .7$). The PQ question depressed direct responses ($t1(20) = 6.71$, $P < .0001$; $t2(32) = 8.37$, $P < .0001$). The PQ question inflated inverse responses (with an important caveat, discussed below) ($t1(20) = -2.50$, $P = .0212$; $t2(32) = -2.78$, $P = .009$). The PQ question also increased passive responses ($t1(20) = -7.57$, $P < .0001$; $t2(32) = -7.69$, $P < 0001$). Finally, the PQ question depressed intransitive responses ($t1(20) = 2.24$, $P = .037$; $t2(32) = 2.41$, $P = .022$).

Table 2 shows that while the direct form was most frequently used in the GQ and AQ conditions, it was the passive form that dominated the crucial PQ condition, just as it does in English (Bock & Warren, 1985). Whatever the source of this passive preference when the patient NP was more accessible, it is difficult to attribute to a radically incremental process whereby the accessible concept grabs a string-initial position and the syntax of the remaining sentence is adjusted to accommodate a thematic patient in first position (Schriefers, Teruel, & Meinshousen, 1998; van Nice & Dietrich, 2003). The much more common direct verb form would have quite naturally accommodated a patient in string-initial position.

Interestingly, the direct form, the closest counterpart to the English active, was influenced by the AQ question. In English, questions such as the AQ would not be expected to affect the frequency of active responses. In Odawa, though, the direct appears susceptible to discourse factors—the 'centrality' of arguments—in the same way as the inverse and passive, although to a lesser extent. We can only speculate that this difference between the two languages has to do with the availability of a transitive, active alternative to the direct (i.e. the inverse form) in Odawa, but not in English, combined with the overt morphology associated with discourse prominence in Odawa. Additional research is clearly necessary to clarify this finding.

The pattern of data for the inverse verb was similar to that of the passive, although the inverse occurred less frequently. This suggests that the PQ question had the intended effect of topicalizing the patient NP, such that accessibility may have led to the topicalization of the accessible concept. If this were the case, radically incremental production could account for the fact that topical or given information tends to precede focused or new information (Chafe, 1976; Lambrecht, 1994). Such a result would suggest that accessibility thus results in the accessible concept becoming the topic. Since topics usually precede non-topics and subjects tend to precede objects cross-linguistically, under this view accessibility would govern subject choice and linearization indirectly via topicalization (cf. Levelt, 1989, pp. 260–271). This small but reliable effect in the PQ condition for the inverse verb appears, however, to be driven by the descriptions of the eleven drawings included in the test materials that depicted

Table 3
Number of responses by verb type in each picture subgroup (H–H, H–A, A–H) in each condition (GQ, AQ, PQ)

	Direct			Inverse			Passive		
	H–H	H–A	A–H	H–H	H–A	A–H	H–H	H–A	A–H
GQ	73	28	20	2	0	15	24	6	2
AQ	102	22	33	0	1	1	5	0	1
PQ	29	4	4	6	0	26	87	22	5

actors of mixed animacy. Forty-two out of 51 inverse responses occurred in the mixed animacy conditions (which consisted of half as many drawings total as the same-animacy condition). Table 3 gives the number of direct, inverse, and passive responses broken down by the three animacy categories of human-agent/human-patient (H–H), human-agent/animal-patient (H–A), and animal-agent/human-patient (A–H). This effect of animacy on verb form suggests an interaction of 'inherent' accessibility (animacy) with 'derived' accessibility (discourse status) (Prat-Sala & Branigan, 2000), and is discussed in the General Discussion.

4.5.3. Results: animacy

If we remove the descriptions of the mixed animacy (A–H and H–A) drawings from the data set, the effect of question type on verb form between the GQ and PQ conditions disappears for inverse verbs ($ps > .3$). The reliable effects for the direct and passive forms were not altered, and neither was the non-significant effect for the intransitive form. We postpone a discussion of this animacy-driven effect until the General Discussion.

4.5.4. Results: word order

Another characteristic of Odawa is pervasive pro-drop, which refers to the phenomena of an empty, or null, promonimal (*pro*) filling the syntactic position of an overt NPs or pronoun (Chomsky, 1986; Huang, 1984). Odawa allows overt NPs to be elided, or pro-dropped, in either subject position or object position, or in both subject and object position at the same time. This flexibility is one not found in the Indo-European languages most commonly studied by psycholinguists.

Because pro-drop is so common in Algonquian languages in general (Christianson, 2002b) as well as in our Odawa data—despite the instructions in which participants were asked to describe the pictures fully and explicitly—it is difficult to establish with certainty the precise effect the prompt questions had on order of mention. A series of paired t-tests was run to determine how the question type affected the relative order of NPs in descriptions containing two NPs (i.e. agent and patient NPs). The major result of these tests was that an overt subject/agent was more likely to precede an overt object/patient in all three conditions, contrary to the prediction that a purely accessibility-driven model of sentence production would make for a free word-order language such as Odawa. In the GQ condition, the subject/agent preceded the object/patient 83% of the time ($t1(19) = 6.327, P < .001; t2(32) = 7.141, P < .001$).[6] In the AQ condition, the subject/agent preceded the object/patient 95% of the time

---

[6] In the analysis by participants, df = 19 because one participant never included both NPs in his or her responses.

($t1(19)=3.776$, $P=.001$; $t2(32)=5.272$, $P<.001$). And in the PQ condition, the subject/agent preceded the object/patient 86% of the time ($t1(19)=3.684$, $P=.002$; $t2(32)=3.488$, $P=.001$).

4.5.5. Results: pro-drop

Finally, given the ubiquity of pro-drop in Odawa and its clear relation to conceptual accessibility, we examined the data to determine if the nature of the elicitation questions affected the frequency with which speakers elided argument NPs. The results were mixed. First, we counted the number of responses in each condition that included an overt subject NP. Comparing the number of responses in which the AQ question elicited overt subjects to the baseline GQ condition, paired t-tests revealed that the AQ question had no significant effect on subject pro-drop ($t1(20)=0.451$, $P>.6$; $t2(32)=0.566$, $P>.5$), although there were numerically fewer AQ-elicited descriptions containing an overt subject NP than there were GQ-elicited descriptions. The PQ question also had no significant effect on subject pro-drop ($ps >.2$).

Next we counted the number of responses in each condition that included an overt object NP.[7] We found no significant effect on object pro-drop when comparing the AQ question with the GQ question ($ps >.09$), but an inspection of the means showed a numerical trend toward including the overt object NP more often in the AQ condition, when it was by hypothesis less accessible than in the GQ condition. A large effect on object pro-drop was observed when comparing the PQ question to the GQ question, however, ($t1(20)=5.679$, $P<.001$; $t2(32)=6.067$, $P<.001$). Speakers thus had a clear preference for pro-dropping the object argument when its derived discourse salience was high and thus was extremely accessible.

The above analyses were conducted using the full data set, including descriptions of both same-animacy and mixed animacy drawings. In order to determine if accessibility due to inherent salience (animacy) and derived salience (discourse) might have differential effects on the overt expression of argument NPs during production, we eliminated the 11-item set of mixed animacy (A–H, H–A) drawings and analyzed only the descriptions of the same-animacy (H–H) drawings. Restricting the analyses in this way yielded interesting results. First, the overall mean frequency with which speakers included overt subject and object NPs was generally lower in the restricted H–H descriptions compared to the mixed-animacy descriptions, as shown in Table 4.

Significant differences were observed in certain individual comparisons that did not appear in the larger data set. Overt subject NPs were produced more often in the PQ condition than in the GQ condition, though this result was significant only by participants ($t1(20)=2.186$, $P=.04$; $t2(21)=1.611$, $P>.1$). Overt object NPs were produced less frequently in the GQ condition than in the AQ condition, although this difference was significant only by items ($t1(20)=1.706$, $P>.1$; $t2(21)=2.217$, $P=.04$). Significant effects were strengthened in comparisons between the GQ and PQ conditions, with

---

[7] Because all passives in Odawa are truncated, the examination of object pro-drop excluded all passive responses.

Table 4
Mean number of descriptions in which overt NP arguments were produced (participant means) in both the full data set (all items), and the restricted data set (H–H items only)

	GQ		AQ		PQ	
	Subj	Obj	Subj	Obj	Subj	Obj
All items	8.14	6.62	7.86	7.57	8.71	3.29
H–H only	4.86	3.81	5.00	4.76	5.71	1.71

more overt objects occurring in the GQ condition ($t1(20) = 5.648$, $P < .001$; $t2(21) = 4.662$, $P < .001$). Taken together, the pattern of results suggests that the form of the elicitation question affected whether or not discourse-accessible NPs were included overtly in the elicited descriptions. However, this effect was moderated by the animacy of both the discourse-accessible entity and, possibly, the less accessible entity. Speakers were less likely to pro-drop arguments when describing mixed-animacy drawings.

5. General discussion

Because Odawa is different in several respects from the languages with which psycholinguists typically work, it was hoped that an Odawa production experiment might provide insight into certain central issues in sentence production research. Specifically, we sought to examine the extent and manner in which the conceptual accessibility of NPs would affect the linguistic form of picture descriptions. We hypothesized that the linguistic characteristics of Odawa would serve to tease apart factors influencing production that are generally conflated in Indo-European languages. In particular, it was predicted that the language's inventory of verb forms—direct, inverse, and passive—would be useful in distinguishing effects of topicality from syntactic function on word order. The extremely flexible word order was predicted to be useful in evaluating the ability of both radically and weakly incremental models of production to account for Odawa production. The legal pro-drop of both subject and object NPs was predicted to provide insight into the interaction of accessibility due to the inherent versus derived salience of referents. The results proved both descriptively and theoretically informative. The results are of descriptive interest in that they offer novel insight into how speakers of a heretofore unexamined type of language go about producing sentences given the rather uncommon syntactic characteristics of that language. The results are theoretically informative in terms of the insight they offer into the role of conceptual accessibility in determining the linguistic form of a message.

5.1. General observations on odawa production

Even though Odawa speakers have access to any word order arrangement of subject, verb, and object, their descriptions of line drawings elicited in the experiment reported here were in fact quite similar to those observed for English speakers. In the general question (GQ) and agent-topicalizing question (AQ) conditions, direct (active) verbs were most common. In the patient-topicalizing question (PQ) condition, passive verbs were

used substantially more often. There was also an increase in inverse forms in the PQ condition, but this was attributable to two specific subsets of the stimuli—the ones in which the two arguments were not both human.

A question immediately arises as to how much influence English (and/or French) had on the Odawa production of the participants. All participants were at least bilingual (Odawa–English), and a few were multi-lingual (Odawa–English–French/Ojibwa/Pota-watomi). In an analysis of the data presented here, Christianson (2002a) reported age-related effects in Odawa production. Christianson entered age as a continuous between-subjects variable and question type (GQ, AQ, PQ) and animacy (same versus mixed) into a formal hierarchical linear model (HLM) and analyzed the effects with simple correlations. He found a main effect of age ($P < .027$), such that the older the speaker, the less likely he or she was to use a passive ($r^2 = -.54$, $P = .01$). The HLM also yielded a main effect of animacy ($P < .001$), such that speakers were much more likely to use an inverse verb in descriptions of mixed animacy drawings ($r^2 = .601$, $P < .001$). There was no effect of question type on inverse use, nor were there any significant interactions between age and other factors. A number of other exploratory comparisons were made to investigate the source of this age-related difference, and specifically, to seek out hints of English influence on younger speakers. Recall that in our analysis of the Odawa passive, it is assumed to be syntactically similar to the English passive, so it would be logical to ascribe the increased use of passives by younger speakers (and more prevalent use of inverse by older speakers, when passives were removed from the equation, $P < .001$) to English interference.

No signs of English influence were discovered, however. Younger speakers did not avoid using verb forms requiring obviation marking, which does not have any counterpart in English. There was also no correlation between age and use of SVO word order in Odawa. Christianson failed to uncover any interactions at all between other predictors of inverse use when the inverse was compared against 'all other English—like construc-tions,' under the hypothesis that the construction being lost (the inverse) was the only one without an English counterpart. This analysis yielded main effects of age such that older speakers used more inverse forms ($P < .001$), animacy such that A–H drawings were described with more inverse forms ($P < .001$), and question type such that the PQ elicited more inverse forms ($P < .001$), but no interactions. Language change is considered to occur initially in restricted contexts, and the innovation then spreads to contexts that are more remote (e.g. Silva-Corvalán, 1986). The lack of interactions suggests that if English were influencing Odawa inverse use, the change lacked this classic spreading pattern.

As an alternative explanation for the observation that older speakers used more inverse forms and younger speakers used more passives, Christianson proposed a specific language-internal change. He pointed out that there is in fact another passive construction available to Odawa speakers, which was not produced even once in the data collected here. This passive construction, called the 'inflectional passive' by Valentine (2001), is far more common in the closely related language of Ojibwa than the 'lexical passive' which dominates in Odawa. Christianson outlined a number of syntactic similarities between the 'inflectional passive,' which has been largely abandoned in Odawa in favor of the 'lexical passive,' and the inverse. The key commonality between the two constructions is the leftward movement of the object argument in both to a sentence-initial position where the proximate feature can be checked, as proposed by Bruening (2001) for the Passamaquoddy

inverse. Christianson proposed that it was the inflectional passive that was first lost in Odawa, and the loss of the specialized object movement in the passive was in the process of spreading to the inverse. Given the functional overlap between the passive and the inverse, and the low frequency of the inverse as a result of the language-internal change, it makes sense that younger speakers would use the passive more often than the inverse, furthering the change in the language. In short, there is no clear evidence of English influence on the Odawa production reported here.

A second general observation on Odawa production has to do with the distinction made by speakers between humans and animals. Ever since Silverstein (1976), it has been noted that many human languages appear to observe and make distinctions between NP referents' relative ranks on the *animacy hierarchy*. In most previous psycholinguistic research, all animates are considered to be equal, although occasionally differences in 'humanness' are noted (e.g. van Nice & Dietrich, 2003). By examining production in a language such as Odawa, which makes systematic grammatical distinctions between human and non-human animates, we were able to observe a more clear-cut effect of 'humanness' on production than has been, to our knowledge, reported previously. This point is noteworthy, since there is a growing interest in determining whether animacy and/or humanness are distinctions maintained in syntax, the parser, or the larger conceptual-intentional system (Artstein, 1999; Minkoff, 1994, 2000, 2001).

A final general observation regarding production in Odawa has to do with the accommodation of null pronominals (*pro*) in models of language production. To our knowledge, the phenomenon of *omitting* highly accessible concepts has yet to be explicitly addressed. At a purely descriptive level, what happens to result in pro-drop is fairly obvious: because of discourse salience, the speaker assumes the constituent is recoverable and therefore leaves it out of the utterance. But if an item that is salient is also highly accessible, it would seem to follow that it should be more likely to be included, not excluded. In other words, the idea (implicit in radically incremental models) that salience and accessibility are closely connected runs into trouble with pro-drop. A more mildly incremental model which allows for planning over several words and which distinguishes between different kinds of salience would provide a more natural explanation.

5.2. Sources of conceptual accessibility

Prat-Sala and Brannigan (2000) distinguished between inherent salience and derived salience, and equated salience, essentially, with conceptual accessibility (or 'overall conceptual accessibility,' in the words of van Nice and Dietrich (2003)). Prat-Sala and Branigan defined animacy as a source of inherent salience—a feature inherent to the referent of an NP, independent of the linguistic context. In contrast, they defined givenness (topicality in the terms used here) as a source of derived salience, wholly dependent on discourse context. In two experiments on English and Spanish, Prat-Sala and Branigan not only observed effects of both types of salience on the syntactic form and surface order of utterances in both languages, but also observed an additive effect of the two sources of conceptual accessibility on production.

van Nice and Dietrich (2003) also manipulated the inherent saliency factor of animacy and the derived saliency factor of thematic role in three production experiments in

German. They observed an interaction of animacy and thematic role in only two of three experiments. They attributed this interaction to task demands, specifically, sentence production from memory (written and oral descriptions of pictures no longer in view). In the experiment in which participants described a picture still in view, van Nice and Dietrich found no interaction. They attributed these effects to the role of memory in production: only when people had to integrate elements from memory while producing descriptions was there an 'overlapping' of referents whereby there is an earlier processing of later referents, that is, planning beyond the currently most accessible word. They argued that this overlapping processing was not however a natural or necessary feature of language production.

The Odawa data are informative with respect to the nature of the interaction between conceptual accessibility due to inherent versus derived salience. The AQ and PQ conditions used here served to establish the relative derived salience—the discourse salience—of one or the other actors depicted in the drawings. The questions also had the effect of introducing the NP into the discourse, making the lexical item accessible as well (V. Ferreira & Dell, 2000; V Ferreira & Yoshita, 20003). In general, when an AQ increased accessibility of an agent NP, more descriptions using direct verbs were used as compared to the baseline GQ condition. The PQ question increased the number of passive *and* inverse verbs used. However, when the descriptions of mixed-animacy pictures were removed from the analysis, the increase in inverse verb use disappeared. When the data from the mixed-animacy drawings were analyzed separately there was a significant increase in the use of inverse verb. More striking, however, was that there was also a significant decrease in passive use when describing A–H drawings (animal-agent/human-patient). This pattern was exactly the opposite to what was observed in the data set as a whole, which was much higher frequency of the passive over the inverse.

We propose that this result is evidence of a qualitative interaction between inherent and derived salience, rather than the additive effect observed by Prat-Sala and Branigan (2000). An additive effect would have resulted not in a change from passive form to inverse form, but rather a larger increase in passive production in the A–H condition than in the H–H condition. These results are consistent with those observed by van Nice and Dietrich (2003) in German as long as one assumes that the elicitation questions introduced memory demands on the production system while people performed the picture description task, even though the pictures remained in view. If this is a valid assumption, it brings into question the naturalness of production tasks like describing pictures in the absence of any linguistic or environmental context. How often do speakers of any language produce sentences without relying on memory of immediately preceding discourse, recent events, or assumptions about the common ground between interlocutors? It would seem that the normal state of affairs for the production system would be one in which the relative features of various referents are computed in an overlapping manner, as described by van Nice and Dietrich, in order to choose syntactic frames consistent with the preferences of the production system in any given context. We elaborate on this view in the following subsection.

Additional evidence in support of an interaction between inherent and derived salience and their contributions to conceptual accessibility is seen in the results of the analyses of pro-drop. We anticipated that the elicitation questions would have an effect on the

frequency with which overt NPs were produced (and pro-dropped). In general, the effect of question type on the production of overt NPs was not as large as expected, until we removed the descriptions of mixed-animacy drawings from the analysis. When referents were of equal animacy (more precisely humanness), the expected effect of question type on pro-drop was largely observed (although it was much stronger when pro-dropping patients than agents). Thus, whereas discourse salience promoted pro-drop, inherent salience in cases where the two referents differed in their relative humanness inhibited pro-drop. Again, we interpret this pattern of results as indicative of qualitatively different effects of the two sources of conceptual accessibility on language production.

5.3. Incremental production

The grammatical characteristics of Odawa allowed us to explore the extent to which language production can be thought of as incremental. Specifically, given the extreme flexibility in Odawa word order, it would appear to be a language well-suited for *radically incremental* production, in which the most conceptually accessible entity will be the first to be lexicalized and the first produced, without any planning as to the overall syntactic structure (De Smedt, 1990; Kempen & Hoenkamp, 1987; Schriefers, Teruel, & Meinshousen, 1998; van Nice & Dietrich, 2003). Furthermore, the combination of direct, inverse, and passive verb forms available to Odawa speakers in combination with the free word order, allowed us to test whether the effects of conceptual accessibility during production were limited to order of mention, or extended to pragmatics and/or syntax. If the effect of conceptual accessibility were on order of mention alone, and syntactic structure was then driven by lexical retrieval (the radically incremental view), sentences with the common direct verb form were expected to occur throughout the data, irrespective of question condition, and that the questions would affect NP order in the direct clauses. Thus, in the condition in which the patient NP was made accessible via the PQ question, the quick lexical access of the patient NP could simply be accommodated even in the direct form with an OSV/OVS order, since the same accessibility-driven system would tend to choose the frequent direct form over the infrequent inverse or somewhat less frequent passive (use of which also entailed not following instructions). If conceptual accessibility had the effect of topicalizing the accessible NP, rather than simply making it string-initial, Odawa's inverse form would allow for this to happen without the confound of simultaneously making the topical NP the syntactic subject (as usually happens in English). And if an entity's increased conceptual accessibility drove speakers to choose a syntactic structure or frame in which the accessible concept could serve as syntactic subject (in addition to topic and, perhaps, string-initial NP), it was expected that Odawa speakers, like English speakers, would use more passive sentences when a patient NP was made more accessible. This last possible outcome would be consistent with a more *weakly incremental* view of language production (F. Ferreira & Swets, 2002).

The syntactic frame view of sentence production, consistent with the *weakly incremental* model, was strongly supported by the Odawa data obtained here. In the pivotal PQ condition, in which the patient NP was made more accessible via the question, speakers chose to describe the stimulus drawings using passive sentences significantly more often than either direct or inverse sentences. In addition, when three-constituent

direct or inverse sentences were used in the PQ condition, the relative accessibility of
the patient NP did not result in a higher number of OS order sentences; SO orders were still
significantly more frequent.

Taken together, the Odawa data failed to support radically incremental, lexically
driven sentence production. Instead, the data were consistent with conclusions drawn by
V. Ferreira & Dell (2000), who suggested that 'high activation of a patient argument may
influence syntactic mechanisms to produce a passive structure…' (p. 327). V. Ferreira &
Dell based this conclusion on a series of experiments in which participants were faced with
a choice between producing or omitting the optional complementizer *that* in sentences
such as *The coach knew (that) you missed practice*. They found, among other things, that
mention of the complementizer was 'sensitive to the availability of the material that is
spoken' (p. 326). However, since purely functional elements, such as complementizers are
arguably not produced in the same way as lexical elements, such as pronouns or full NPs
(see Garrett, 1988; also data on aphasic production, e.g. Menn & Obler, 1989), V. Ferreira
& Dell argued that the lexically driven picture of production—in which the most
accessible lexical item wins a figurative 'race' out of the mouth—might not be sufficient to
accurately describe their results. Instead, they proposed that speakers choose a syntactic
structure without necessarily first deciding between alternative lexical items. The
structure, then, is what is really primed by pictures, sentences, and questions, and there is
an interplay between the lexical item—mainly in the present case the speakers' desire to
make the accessible NP a syntactic subject–and the structure or syntactic frame that
allows them to accomplish this goal. As suggested by Bock (1986a), then, the incremental
left-to-rightness implied by her results occurs in the filling of available NP nodes in the
primed structure.

The small but significant increase in inverse forms in the PQ condition when the
animacy of the depicted agent and patient were mixed (A–H and H–A) suggests an
extension of the V. Ferreira & Dell view of production, as follows. A number of
syntactic and non-syntactic features organized on various hierarchies (Christianson
(2001a, b) are compared against each other. The syntactic frame ultimately chosen to
encode a message is the one that allows for the highest degree of congruency between
the rankings of NPs from one hierarchy to the next. Research by Flores d'Arcais,
(1986), Osgood and Bock (1977), Sridhar (1988), and Tomlin (1995) have
demonstrated a broad cross-linguistic preference for more salient NPs to grab more
prominent syntactic positions (and string-prominent positions). As discussed above, a
number of factors contribute to determining the relative saliency of a given NP.
Thematic agents (which are most highly ranked on a *thematic hierarchy*) tend to be
syntactic subjects; topics (most highly ranked on a *discourse hierarchy*) tend to be
syntactic subjects (Reinhart, 1982) and thus also thematic topics; NPs with more
human characteristics (most highly ranked on an *animacy hierarchy*) tend to be topics,
which tend to be agents, which tend to be subjects.

In the Odawa data, the increased use of the passive in the PQ condition demonstrates
that Odawa speakers prefer to produce sentences for which NPs were maximally
hierarchically congruent. Despite the option of describing every single drawing using a
direct sentence, and in violation of our instructions to be maximally informative (recall
that passives in Odawa may only include the patient/theme, and we asked participants to

fully describe the drawings), Odawa speakers chose to use a much higher number of passive sentences in the PQ condition, such that the topic could serve as the syntactic subject. In the passive, the subject/topic is still the thematic patient—a mismatch between grammatical/discourse hierarchies on one hand and the thematic hierarchy on the other hand. But because in Odawa the patient is the only NP syntactically present, its *relative* position on the thematic hierarchy as the highest-ranking NP in the sentence allows for maximum congruence with the other high-ranking features. In the inverse, the topic/object/patient NP and the non-topic/subject/agent NP both represent incongruence between hierarchies of the sort generally avoided cross-linguistically. The same is true of the direct as a response to the PQ question, with its non-topic/subject/agent NP and topic/object/patient NP.

When the animacy (more precisely humanness) of the NPs was varied in the drawings, however, the likelihood of an inverse description increased significantly when the agent was an animal and the patient was a human. In this case, speakers appeared to be willing to suspend their aversion to aligning non-topics with subject/agents in order to encode the alignment of the feature more-human with that of topic. Inclusion of animal agents may have been promoted by the unexpectedness of animal agent NPs (in combination with human patients). Chafe (1976) and Clark and Clark (1977) demonstrated that unexpectedness can add to the overall salience of a concept. Since more salient NPs are less likely to be omitted, the inverse represented the best option for both including the unexpected NP and at the same time maximizing the congruency or alignment between the rankings of the NPs on the various relevant hierarchies. Interpreted in this way, the Odawa data allow for some concrete predictions about the way in which various factors contributing to accessibility might be weighed against one another in deciding the ultimate linguistic form of the utterance (Yamashita & Chang, 2001).

An alternative interpretation of the Odawa production data can be imagined, which would be consistent with a radically incremental view of production. Under this account, when prompted by a PQ question, speakers produced the most accessible NP, namely the patient. They then proceeded to search for and produce the verb form which occurs most frequently when the patient is in subject position, namely the passive (as opposed to producing the direct, the most frequent verb form overall). In other words, frequency information used by a radically incremental system could be hypothesized to access the contextually relative frequencies of, e.g. verb forms or syntactic structures, rather than absolute frequencies.[8]

The reliable increase in inverse use when describing the mixed animacy drawings argues against this radically incremental explanation of the data. Animacy in concert with the topicality and thematic role of the NPs in mixed animacy conditions increased inverse use and, in drawings with animal agents and human patients, decreased passive use. This result suggests that features of *both* relevant NPs are taken into account by Odawa speakers, and these features drive the production of verb forms that best accommodate the preferred featural alignments. The features of both NP referents must be accessed prior to the point at which they are produced, since often the verbs are produced before one or both NPs, upon whose features the verb form is dependent. A radically incremental production

---

[8] We thank an anonymous reviewer for suggesting this argument.

system should, however, not be concerned with the features of an NP that will not be produced until several words further downstream.

When considered from the point of view of weakly incremental production, the data suggest that the human sentence production system strives to encode messages such that conceptually accessible NPs are ranked more highly across the board on syntactic, thematic, discourse, and animacy hierarchies. This picture of the effects of conceptual accessibility is consistent with the results of F. Ferreira (1994), who found that the conceptual accessibility of thematic patients resulted in an increased production of passives, but that this increase was modulated by the animacy of the accessible entity as well as the syntactic frame of the verb used. The Odawa results thus allow a more fine-grained articulation of the model of production proposed by Bock and Warren (1985), who interpreted the results they obtained in English as consistent with the so-called *relational hierarchy* proposed by Keenan and Comrie (1977). This hierarchy ranks the subject over the direct object, the direct object over the indirect object, and so on (schematically: subject > direct object > indirect object). Bock and Warren proposed that the lemma associated with the most conceptually accessible entity grabs the highest grammatical role (i.e. subject) on this hierarchy. The complex interplay of hierarchies and features proposed in our discussion here extends Bock and Warren's thesis. The Odawa data suggest that conceptual accessibility primes a syntactic frame that not only allows the accessible NP to serve as syntactic subject, but moreover allows the accessible NP to rank as highly as possible on a number of relevant hierarchies: relational hierarchy, thematic hierarchy (agent > patient), discourse hierarchy (topic > focus), and animacy hierarchy (more human > less human) (see Christianson, 2001a–c, for a detailed discussion of how these hierarchies might be preferably aligned in Odawa). These various alignment considerations result in verb choice and, ultimately, surface linearization of utterances. The Odawa data, taken with the results of previous research, thus provide evidence for a degree of planning in sentence production that is inconsistent with a radically incremental view of language production.

6. Summary

The experiment reported here was to our knowledge the first psycholinguistic experiment conducted in 'the field' in an indigenous North American language. One goal of this research, then, was to demonstrate the feasibility of conducting this sort of research in similar conditions and languages. Moreover, we feel that the results obtained demonstrate the importance of expanding psycholinguistic research into typologically diverse languages. The data obtained here support the notion that doing so is of potentially great theoretical interest.

The Odawa data yielded several noteworthy results. The combination of flexible word order and a rich inventory of verb forms provided a way to begin to tease apart inherent and derived factors determining the conceptual accessibility of entities. These factors were observed to qualitatively differ in the ways in which they affected the linguistic form of the sentences produced.

The data obtained here are also relevant to the issue of incrementality in language production. The data did not support a radically incremental view of language production, but were compatible with a weaker version of incrementality. Specifically, the production

system appears to prefer to make accessible concepts syntactic subjects, rather than simply place them in sentence-initial position. An extension of this conclusion, given the Odawa data, is that the production system strives to encode agents, topics, and humans as subjects. When this ideal alignment of features cannot be achieved, the production system possesses sufficient planning mechanisms to choose a syntactic frame that will allow for as close as possible to a full alignment of these features to obtain. The inference drawn here is that accessible concepts thus prime entire syntactic frames or verb forms. This conclusion contrasts with a view of production in which speakers begin with accessible concepts with little or no planning as to the verb form that will eventually be used.

Acknowledgements

References

Aissen, J. (1997). On the syntax of obviation. *Language*, *4*, 705–750.

Aissen, J. (1999b). Markedness and subject choice in optimality theory. *Natural Language and Linguistic Theory*, *17*, 673–711.

Artstein, R. (1999). Person animacy and null subjects. *Proceedings of console VII* , 1–15.

Bailin, A., & Grafstein, A. (1991). The assignment of thematic roles in Ojibwa. *Linguistics*, *29*, 397–422.

Bock, J. K. (1986a). Exploring levels of processing in sentence production. In G. Kempen (Ed.), *Natural language generation: New results in artificial intelligence, psychology, and linguistics* (pp. 351–364). Dordrecht, Netherlands: Martinus Nijhoff Publishers.

Bock, J. K. (1986b). Meaning, sound, and syntax: Lexical priming in sentence production. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *12*, 575–586.

Bock, J. K. (1987). An effect of the accessibility of word forms on sentence structures. *Journal of Memory and Language*, *26*, 119–137.

Bock, J. K., & Irwin, D. E. (1980). Syntactic effects of information availability in sentence formulation. *Journal of Verbal Learning and Verbal Behavior*, *19*, 467–484.

Bock, J. K., & Levelt, W. J. M. (1994). Language production: Grammatical encoding. In M. A. Gernsbacher (Ed.), *Handbook of psycholinguistics* (pp. 945–984). San Diego: Academic Press.

Bock, J. K., & Warren, R. K. (1985). Conceptual accessibility and syntactic structure in sentence formulation. *Cognition*, *21*(1), 47–67.

Bloomfield, L. (1956). *Eastern ojibwa: Grammatical sketch, texts, and word list*. Ann Arbor, MI: University of Michigan Press.

Branigan, P., & MacKenzie, M. (2002). Altruism, A-bar movement, and object agreement in Innu-aimûn. *Linguistic Inquiry*, *33*(3), 385–408.

Brittain, J. (2001). *The morphosyntax of the Algonquian conjunct verb*. New York: Garland Publishing.

Bruening, B. (2001). *Syntax at the edge: Cross-clausal phenomena and the syntax of passamaquoddy*. PhD dissertation, MIT.

Bruening, B., & Rackowski, A. (2001). Configurationality and object shift in Algonquian. *University of British Columbia working papers in linsguistics: Proceedings of the fifth workshop on structure and constituency in the languages of the Americas. Vancouver* , 71–83.

Carroll, J. B. (1958). Communication theory, linguistics, and psycholinguistics. *Review of Educational Research*, *28*, 79–88.

Chafe, W. (1976). Giveness, contrastiveness, definiteness, subjects, topics, and point of view. In C. N. Li (Ed.), *Subject and topic*. New York: Academic Press.

Chomsky, N. (1986). *Knowledge of language: It's nature, use, and origins*. New York: Praeger.

Christianson, K. 2001a. Odawa production data: Toward a better understanding of performance *and* competence. Paper presented at the 6th Workshop on the Structure and Constituency of Languages of the Americas, Memorial University, St John's, Newfoundland, March, 23–25, 2001.

Christianson, K. (2001b). An OT approach to variation in Odawa production data. *University of British Columbia Working Papers in Linguistics: Proceedings of WSCLA* , 6.

Christianson, K. (2001c). Optimality theory in language production: The choice between direct and inverse in Odawa. *Linguistica Atlantica*, *23*, 93–126.

Christianson, K. (2002). *The age-related decrease of inverse usage in Odawa: Externally or internally driven?* Paper presented at the seventh Annual Workshop on the Structure and Constituency of Languages of the Americas (WSCLA 7), March 22–24, University of Alberta, Edmonton, Alberta.

Christianson, K. (2002). *Sentence processing in a 'nonconfigurational' language*. Unpublished doctoral dissertation, Michigan State University.

Clark, H. H., & Clark, E. (1977). *Psychology and language: An introduction to psycholinguistics*. New York: Harcourt.

Cooreman, A. (1994). A functional typology of antipassives. In B. Fox, & P. J. Hopper (Eds.), *Voice: Form and function* (pp. 49–88). Amsterdam: John Benjamins Publishing Company.

Corbett, G. G. (1991). *Gender*. New York: Cambridge University Press.

de Smedt, K. J. (1990). IPF: An incremental parallel formulator. In R. Dale, C. Mellish, & M. Zock (Eds.), *Current research in natural language generation* (pp. 167–192). London: Academic Press.

Ferreira, F. (1994). Choice of passive voice is affected by verb type and animacy. *Journal of Memory and Language*, *33*(6), 715–736.

Ferreira, F., & Swets, B. (2002). How incremental is language production? Evidence from the production of utterances requiring the computation of arithmetic sums. *Journal of Memory and Language*, *46*, 57–84.

Ferreira, V., & Yoshita, H. (2003). Given-new ordering effects on the production of scrambled sentences in Japanese. *Journal of Psycholinguistic Research*, *32*, 669–692.

Ferreira, V. S., & Dell, G. S. (2000). Effect of ambiguity and lexical availability on syntactic and lexical production. *Cognitive Psychology*, *40*, 296–340.

Flores d'Arcais, G. B. (1986). Perceptual factors and word order in event descriptions. In G. Kempen (Ed.), *Natural language generation: New results in artificial intelligence, psychology, and linguistics* (pp. 441–452). Dordrecht, Netherlands: Martinus Nijhoff Publishers.

Givón, T. (1994). The pragmatics of detransitive voice: Funtional and typological aspects of inversion. In T. Givón (Ed.), *Voice and inversion* (pp. 3–46). Amsterdam: John Benjamins Publishing Company.

Hawkins, J.A. (1983). Word order universals. New York: Academic Press.

Huang, C.-T.J. (1984). On the distribution and reference of empty pronouns. *Linguistic Inquiry*, *15*, 531–574.

Keenan, E. L., & Comrie, B. (1977). Noun phrase accessibility and universal grammar. *Linguistic Inquiry*, *8*, 63–99.

Kempen, G., & Hoenkamp, E. (1987). An incremental procedural grammar for sentence formulation. *Cognitive Science*, *11*, 201–258.

Kiss, K.É. (1995). NP movement, operator movement, and scrambling in Hungarian. In K. Kiss (Ed.), *Discourse configurational languages* (pp. 207–243). Oxford: Oxford University Press.

Lambrecht, K. (1994). *Information structure and sentence form: Topic, focus, and the mental representation of discourse referents*. Cambridge, MA: Cambridge University Press.

Levelt, W. J. M. (1989). *Speaking*. Cambridge, MA: MIT Press.

Levelt, W. J. M., & Maassen, B. (1981). Lexical search and order of mention in sentence production. In W. Klein, & W. J. M. Levelt (Eds.), *Crossing the boundaries in linguistics* (pp. 221–252). Dordrecht: Reidel.

Menn, L., & Obler, L. K. (1989). *Agrammatic aphasia: Across-language narrative sourcebook*. Amsterdam: John Benjamins.

Meyers, J. L., & Well, A. D. (2003). *Research design and statistical analysis* (second ed). Mahwah, NJ: Lawrence Erlbaum Associates.

Minkoff, S. (1994). How some so-called 'thematic roles' that select animate arguments are generated, and how these roles inform binding and control. PhD dissertation: MIT.

Minkoff, S. (2000). Animacy hierarchies and sentence processing. In A. Carnie, & E. Guilfoyle (Eds.), *The syntax of verb initial languages* (pp. 201–212). Oxford: Oxford University Press.

Minkoff, S. (2001). *Why some objects can't be more animate than some subjects*. Paper presented at the sixth Annual workshop on the structure and constituency of the languages of the Americas (WSCLA 6), March 23–25. Memorial University, St John's, Newfoundland.

Osgood, C. E., & Bock, J. K. (1977). Salience and sentencing: Some production principles. In S. Rosenberg (Ed.), *Sentence production: Developments in research and theory* (pp. 89–140). Hillsdale, NJ: Lawrence Erlbaum.

Prat-Sala, M., & Branigan, H. P. (2000). Discourse constraints on syntactic processing in language production: A cross-linguistic study in English and Spanish. *Journal of Memory and Language*, *42*, 168–182.

Reinhart, T. (1982). Pragmatics and linguistics: An analysis of sentence topics. *Philosophica*, *27*, 53–94.

Rhodes, R. A. (1990). On the passive in ojibwa. In W. Cowan (Ed.), *Papers of twenty-second algonquian conference* (pp. 307–319). Ottawa: Journal Production Centre, Carleton University.

Rhodes, R. A. (1994). *Agency, inversion, and thematic alignment in ojibwe Proceedings of the 16th Annual Meeting of the Berkeley Linguistics Society*. Berkeley: BLS p. 431–446.

Richards, N. (2000). Some notes on conjunct and independent orders in Wampanoag. Paper presented at the 5th annual Workshop on Structure and Constituency of the Languages of the Americas (WSCLA 5), March 24-26, 2000. Toronto, Ontario.

Roelofs, A. (1998). Rightward incrementality in encoding simple phrasal forms in speech production: Verb-particle combinations. *Journal of Experimental Psychology: Learning, Memory, Cognition*, *24*(4), 904–921.

Schriefers, H., Teruel, E., & Meinshousen, R. M. (1998). Producing simple sentences: Results from picture-word interference experiments. *Journal of Memory and Language*, *39*, 609–632.

Silva-Corvalán, C. (1986). Bilingualism and language change: The extension of 'estar' in Los Angeles Spanish. *Language*, *62*, 587–608.

Sridhar, S. N. (1988). *Cognition and sentence production*. New York: Springer-Verlag.

Stallings, L., MacDonald, M. C., & O'Seaghdha, P. G. (1998). Phrasal ordering constraints in sentence production: Phrase length and verb disposition in Heavy-NP shift. *Journal of Memory and Language*, *39*, 392–417.

Tanaka, M. (2003). *Conceptual accessibility and word-order in japanese Proceedings of the Postgraduate Conference*. Edinburgh: University of Edinburgh.

Tomlin, R. S. (1995). Focal attention, voice, and word order: An experimental, cross-linguistic study. In P. Downing, & M. Noonan (Eds.), *Word order in discourse* (pp. 517–554). Amsterdam: John Benjamins Publishing.

Valentine, J. R. (2001). *Nishnaabemwin reference grammar*. Toronto: University of Toronto Press.

Van Nice, K. Y. & Dietrich, R. (2003). Task sensitivity of animacy effects: Evidence from German picture descriptions. Linguistics, 41,825–849.

Wheeldon, L., & Lahiri, A. (1997). Prosodic units in speech production. *Journal of Memory and Language*, *37*, 356–381.

Yamashita, H., & Chang, F. (2001). 'Long before short' preference in the production of a head-final language. *Cognition*, *81*, B45–B55.