

The (non)universality of syntactic selection and functional application

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Nothing beats diversity for finding out what is truly universal about natural languages. But the importance of diversity goes beyond the obvious fact that universality can be recognized only in the face of diversity. Coming to grips with languages that differ in important ways from more familiar languages forces us to recognize implicit analytical assumptions. Rather than assuming a requisite ‘traditional’ way of analyzing certain data, we must instead acknowledge the assumptions our analysis depends upon, assumptions that demand justification. Confronting an ‘exotic’ language (where *exotic* means distinct from what we know) forces us to ask what the empirical basis is for an analysis; it can also drive us to conceive of a new and different organization of the grammatical systems of the languages we already know much about. In short, it can wake us up from a dogmatic slumber. For some, the idea that languages are quite diverse in their grammatical systems is a given (e.g. Evans and Levinson 2009), so drawing attention to the value of diversity is not new. We pose a further question in this paper: What takes the place of features that are often thought to be universal but that we show are only very frequent? To put it another way, we engage in a kind of *reconstruction* of our analytical tools using the rather ‘exotic’ language Oneida, a Northern Iroquoian language.

We will make two bold claims about Oneida that make the description of Oneida look different from most (if not all) descriptions of other languages and that provide the incentive for our reassessment of how to think about possible grammatical systems.¹

Claim 1. *There is no syntactic selection of phrases by verbs (or nouns) in Oneida.*

*We gratefully acknowledge the Oneida speakers from the Oneida Nation of the Thames in Ontario, Canada, who, since 1979, have so willingly and enthusiastically shared their knowledge of the Oneida language and culture with Karin Michelson. Especially valuable as evidence for the claims of this paper are excerpts from recorded ‘stories’ (life histories, ghost stories, hilarious events, conversations about family, etc.); these are identified by speaker, a title, and the year recorded. Unattributed examples are from Norma Jamieson or from Michelson and Doxtator 2002. We thank Rui Chaves, Jeff Good and Hanni Woodbury for comments on a previous version of this paper. We also thank the reviewers, and especially Christopher Piñón, for their comments.

¹Throughout this paper, we will abstract away from important differences among syntacticians and semanticists on how to best account for the generalizations which Oneida challenges, or the importance of these generalizations. But, we believe that something roughly equivalent to syntactic selection and functional application is part and parcel of the model of (most) natural languages in all extant frameworks. For instance, although the constructionist approach presented in Goldberg 1995 does not discuss the relation between verbs and subjects or objects in terms of syntactic selection, her notion of *profiling* of participant roles embodies the bulk of what we mean by *syntactic selection*. Similarly, although Langacker (1987) points out the limits of compositionality and does not adopt lambda-calculus and the concept of functional application to model the compositional aspects of semantic combinatorics, his notions of elaboration and elaboration sites embody the critical aspects of both for our purposes.

Claim 2. *Semantic composition of verb meanings and external NPs in Oneida is a matter of conjunction of predications and co-indexing rather than application of a function to an argument.*

The first claim bears resemblance to other analyses, in particular to the Pronominal Argument Hypothesis proposed in Jelinek 1984 and Mithun 1986, to the analysis put forth in Van Valin 1985, or to the analysis of Mohawk (another Northern Iroquoian language) given in Baker 1996. But our claim is more radical. These other approaches all assume that arguments of verbs in polysynthetic languages and/or non-configurational languages are realized as they are in English; they are just realized in another guise. So Jelinek and Mithun, for example, assume that pronominal clitics or prefixes realize arguments and that they are the equivalent of external phrases in English, and Baker assumes that null *pros* realize arguments. Our claim is bolder: Nothing realizes arguments in Oneida, and heads do not select dependent phrases. To put it another way, syntactic selection, a fundamental concept for modeling the syntax of natural languages since Adjuckiewicz 1935 (and foreshadowed to some degree by Bloomfield 1933), is simply not relevant for Oneida. We call languages like Oneida, in which syntactic selection of dependents by heads plays almost no role, *direct syntax* languages. The second claim challenges an assumption that dates back to an idea attributed to Geach 1972, namely the pairing of lambda-calculus style functional application with syntactic rules.² Given space limitations, we will not be able to fully discuss all of the evidence in favor of either claim. Nor will we be able to address possible alternative analyses. What we do hope to accomplish is convince readers that, when thinking about the universality of syntactic selection and functional application, the evidence we have become accustomed to finding in well-studied languages is missing in Oneida, and that the way things work in Oneida challenges our notions of what is universal across languages.

1. Pronominal prefixes in Oneida

Oneida looks quite different on the surface from English. Semantic arguments³ are morphologically referenced (with one systematic exception, discussed below), but most of the time, arguments are not expressed via independent phrases. Consider the passage in (1).⁴ None of the Oneida verbs in (1) co-occurs with an external NP, in stark contrast to the English translation

²Jeff Good pointed out to us (p.c.) that the work of David Gil on Riau Indonesian (see Gill 1994 and Gill 2008) bears some resemblance to our work. Even though Gil does not discuss the ‘exotic’ nature of Riau in terms of the absence of syntactic selection and functional application and Riau’s ‘excentricity’ is somewhat different from Oneida’s, Gil’s claims and ours are clearly related. We defer a comparison between the two languages and the two approaches to another venue.

³By semantic arguments, we mean the participants in the situation described by the verb that are strongly associated with the meaning of the verb, in the sense of Koenig et al. 2003.

⁴A raised period in the Oneida examples represents vowel length. Λ is a mid, central, nasalized vowel, and u is a high or mid-to-high, back, nasalized vowel. Voicing is not contrastive. Abbreviations for morpheme glosses are: AGT (agent), CAUS(ative), CISLOC(ative), COIN(cident), DU(al), EXCL(usive person), FACT(ual mode), FEM(inine), FUT(ure mode), HAB(itual aspect), JN (joiner vowel), MASC(uline), OPT(ative mode), PART(itive), PAT(ient), PL(ural), PNC (punctual aspect), POSS(essive), REFL(exive), REP(etitive), SG (singular), SRF (semireflexive), STV (stative aspect), TRANSLOC(ative), Z/N (zoic or neuter gender). Zoic gender is used for certain female persons and animals. The symbol $>$ indicates a proto-agent acting on a proto-patient; for example, 3MASC.SG $>$ 1SG should be understood as 3rd person masculine singular acting on first person singular. A colon indicates that in a more abstract phonological analysis, the Oneida string corresponding to the components separated by the colon could be segmented into distinct morphemes. Square brackets correspond to what, in some analyses, are analyzed as zero morphemes.

in (2), which contains several NPs (pronominal or otherwise). Although NPs can co-occur with verbs in Oneida, as (3) shows, they do so infrequently.

- (1) Né=s wí né'n tshiwahu'níse? lon-u?wéskwani-he?
 so it's long time ago 3MASC.PL.PAT-enjoy-HAB
 a-hati-yat-a-kó'n-a? ká', tahnú=s kwí'
 OPT-3MASC.PL.AGT-wood-JN-go.somewhere.to.harvest-PNC eh and=usually link
 kwahotoká'u tsi? wa-hu-nakla'kó' tho
 just for real that FACT-3MASC.PL.AGT-move.away:PNC there
 y-a-hu-náklat-e? tsi? nú'
 TRANSLOC-FACT-3MASC.PL.AGT-settle-PNC where
 ye-hoti-yo?tá-st-a?
 TRANSLOC-3MASC.PL.PAT-work-CAUS-HAB
- (2) 'A long time ago they used to like to go cut wood, and so they would move away and settle wherever they were working.' (Mercy Doxtator, *Some woodcutters get a visitor*, recorded 1996)
- (3) wa-hati-kwe ní' wa-huwá-li-? thiká' atilú
 FACT-3MASC.PL.AGT-able:PNC FACT-3PL>3MASC.SG-kill-PNC that raccoon
 'They were able to kill that raccoon.' (Clifford Cornelius, *A lifetime working*, recorded 1994)

Some of our argumentation will rely on the fact that not all semantic arguments are referenced morphologically, and so we begin with a brief description of so-called pronominal prefixes in Oneida.

Transitive and intransitive prefixes Oneida has transitive (portmanteau-like) prefixes that occur with verbs that denote two- or three-place relations (hereafter, polyadic verbs), as shown in (4). (Pronominal prefixes are bolded in this section for easy identification.) Oneida also has two classes of prefixes, Agent and Patient, that occur with verbs that denote one-place or zero-place relations (hereafter, monadic and medadic verbs), as shown in (5) and (6) with monadic verbs, or in (7) and (8) with medadic verbs. Whether a particular verb occurs with Agent versus Patient prefixes is semantically motivated, but as can be seen from the contrast between (5) and (6), or between (7) and (8), in many cases verbs lexically select either Agent or Patient prefixes.

- (4) wa-**hí**-kwaht-e?
 FACT-**1SG**>**3MASC.SG**-invite-PNC
 'I invited him'
- (5) wa?-t-**k**-ashátho-?
 FACT-DUALIC-**1SG**.AGT-cry-PNC
 'I cried'
- (6) wa?-t-**wak**-hΛ'léht-e?
 FACT-DUALIC-**1SG**.PAT-holler-PNC
 'I hollered, yelled'

- (7) **yo-kʌnol-ú**
3Z/N.SG.PAT-rain-STV
 ‘it’s raining’
- (8) **w-ʌ-té**
3Z/N.SG.AGT-be.light:STV
 ‘it’s daylight, it’s light out’

Only animate arguments are referenced by pronominal prefixes A salient property of pronominal inflection in Oneida (and generally in Iroquoian) is that inanimate semantic arguments are never referenced. As a result, Agent and Patient prefixes, which otherwise occur with monadic and medadic verbs, also occur with polyadic verbs that have only one semantic argument that is animate. For example, the Agent prefix *ha-* is used in (9), despite the fact that sharpening requires two participants, because an axe is inanimate. Examples such as (9) support the hypothesis that inanimate semantic arguments are not referenced *phonologically* on Oneida verbs.

- (9) **kháleʔ ʌ-ha-hyoʔthi:yát-eʔ** **lao-to:káʔ**
 and **FUT-3MASC.SG.AGT-sharpen-PNC** **3MASC.SG.POSS-axe**
 ‘and he will sharpen his axe’ (Clifford Cornelius, *A lifetime working*, recorded 1994)

(All verbs in Oneida must have a pronominal prefix, so if there are no semantic arguments that are animate, the zoic singular prefix is used as a default inflection; the zoic singular is abbreviated *z/n* in the morpheme glosses to reflect the fact that the prefix references zoic arguments and is also used as a default when all semantic arguments are inanimate (or neuter). The verbs in (7) and (8) are examples having this default inflection.)

Aspectually-conditioned Agent/Patient prefix alternation There is strong evidence that semantically dyadic verbs with only one animate argument are not only phonologically like intransitive verbs (in that they occur with Agent and Patient prefixes), they are *inflectionally* like intransitive verbs too. The distribution of Agent and Patient prefixes is partly conditioned by aspect. Monadic and medadic verbs that lexically select Agent prefixes take Agent prefixes only in the habitual and punctual aspects; in the stative aspect they take the corresponding Patient prefixes. For example, the inflected form of the verb *-atukoht-* ‘pass by’ in (10) takes an Agent prefix because it is in the punctual aspect, while the form in (11) takes the corresponding Patient prefix because it is in the stative aspect.

- (10) **wa-h-atu kóht-eʔ**
FACT-3MASC.SG.AGT-pass.by-PNC
 ‘he passed by, he passed on, he died’
- (11) **lo-(a)tukóht-u**
3MASC.SG.PAT-pass.by-STV
 ‘he has gone by, he has passed on, he has died’

Crucially, polyadic verbs with only one animate argument undergo the same prefix alternation as monadic and medadic verbs. For example, *-ʔlholok-* ‘cover’ is a polyadic verb, as seen by the form in (12), which has a transitive prefix because there are two animate arguments. But, the forms in (13) and (14) have only one animate argument, and they have the same distribution

of Agent and Patient prefixes as the forms in (10) and (11) above, i.e., the punctual aspect form in (13) has an Agent prefix while the corresponding stative aspect form in (14) has a Patient prefix.

- (12) waʔ-**khe**-ʔlho·lók-eʔ
 FACT-**1SG**>**3FEM.SG**-cover-PNC
 ‘I covered her up’ (e.g. with a blanket)
- (13) waʔ-**ke**-ʔlho·lók-eʔ
 FACT-**1SG.AGT**.cover-PNC
 ‘I covered (it) up’
- (14) **wake**-ʔlhol-ú
1SG.PAT-cover-STV
 ‘I have covered (it) up’

The fact that semantically dyadic or triadic verbs with *only one* animate argument are subject to the same language-specific, aspectually conditioned, absolutely regular, intransitive prefix class alternation, strongly suggests that inanimate arguments are not part of the morphosyntactic representation (in the sense of Anderson 1992) of Oneida verbs. Morphologically, dyadic or triadic verbs with only one animate argument are *inflectionally* intransitive.

No verb can have three animate arguments Furthermore, there is evidence that the grammatical ‘invisibility’ of inanimate semantic arguments is more than phonological or inflectional. An inkling of this wider ‘invisibility’ is found in an interesting restriction. Oneida has no equivalent of English *introduce someone to someone*, i.e. no underived triadic verb with *three* animate arguments. This restriction amounts to more than a mere lexical gap since, whenever a triadic verb is derived (e.g. via an applicative (benefactive) suffix), one of the two arguments of the base must be inanimate in the *derived* stem, as (15) shows.

- (15) a. -*ahseht*- ‘hide something’, -*yaʔtahseht*- ‘hide someone’ (-*yaʔtahseht*- literally, ‘body-hide’)⁵
 b. -*ahseht-Λ(ni)*- ‘hide something from someone’, *-*yaʔtahseht-Λ(ni)*- *hide someone from someone⁶

(15) shows that the ‘invisibility’ of inanimate semantic arguments is more than inflectional; it affects the range of interpretations of verb stems, derived and underived. In all grammatical respects—phonological, derivational, inflectional—inanimate arguments are simply ‘invisible’ to verbs. Under the widespread assumption that, aside from added arguments (e.g. resultatives) and expletives, syntactic complements and subjects reflect ‘visible’ semantic arguments of verbs, the fact that inanimate arguments are ‘invisible’ to derivational verbal morphology suggests that NPs (*wh*- or not) denoting inanimate entities and CPs (which also denote inanimate entities) are not syntactically selected by a verbal head. And, if NPs whose referents are

⁵That certain verbs require the incorporated root -*yaʔt*- with transitive prefixes was observed first by Woodbury 1975 in her study of noun incorporation in Onondaga, another Northern Iroquoian language.

⁶Woodbury (2003:234) gives the form *waʔshagoyaʔdahséhdεʔ* ‘he hid a [dead] body from her, he hid her body’, showing that, in contrast to Oneida, the *form* is possible in Onondaga, but the *meaning* precludes a third animate argument. A parallel Oneida form, supplied by Ray George, is *Λ-khe-yáʔt-u-ʔ* FUT-1SG>3PL-body-give-PNC ‘I will give them the body’ (e.g. a doll’s body, or a body after someone dies). The stem -*u*- ‘give’ occurs with an inanimate argument below in (36).

Syntactic obligatoriness and word order The most obvious reason to introduce a syntactic level of argument structure is the need to model the obligatory co-occurrence of verbs with phrases as well as the order of phrases. This has been at the root of the first explicit model of such dependencies, the work on syntactic connectivity by Ajdukiewicz (1935), which was the initial impetus for subsequent categorial grammar work. But, as we mentioned before, no external phrase is *required* to co-occur with verbs in Oneida. In fact, between 10% and 25% of ‘sentences’ have one NP; .8% have two NPs in our 4,800+ sentence corpus. Furthermore, there is no syntactically required ordering of NPs when they do occur: NPs are pragmatically ordered (Mithun 1987) (although CPs almost always follow the verb that they correspond to a semantic argument of). So argument structure, subcategorization, or the like is simply not going to be very useful for Oneida.

Furthermore, when NPs occur, the relation between external NPs and verbs is quite different from the relation of selected NPs to verbs in other languages. First, NPs are not necessarily local dependents of verbs; they can be unbounded ‘dependents’. More interestingly, the relation between pronominal prefixes and external phrases is not necessarily one of co-indexing, as one would expect if external phrases were selected by verbs. The relation is something like *referential overlap*. In (21), for example, the referent of the external NP *Mercy* is a *subset* of the set of entities referenced by the pronominal prefix and reciprocally, in (22), the referent of the external phrase *onataːlóː* ‘friends’ is a *superset* of the set of entities referenced by the pronominal prefix. In the end, the relation between verbs and external phrases *does* seem fundamentally different from what it is in languages such as English, and the syntactic mechanisms we use to model this kind of dependency in English are superfluous in Oneida.

- (21) yah thau túː oskánhe usa-yaky-atnutólyaht-e? Mercy
 it cannot occur together OPT:REP-1EXCL.DU.AGT-play-PNC Mercy
 ‘Mercy and I can’t play together anymore, I can’t play together with Mercy anymore.’
 (Norma Jamieson, *A wish comes true*, recorded 1994)
- (22) nː kwíː waʔ-utat-hloːlíː=n on-ataːlóː
 so then FACT-3FEM.SG>3FEM.SG-tell:PNC=DEF 3ZOIC.PL.PAT-friends
 ‘She’s telling her friend...’ (i.e. ‘she is telling her, not ‘she is telling them’) (Mercy Doxtator, *Berries and bellies*, recorded 1994)

Valence alternations Valence alternations of the kind illustrated in (23) involve reordering semantic arguments, or the members of an argument-structure list, or the phrase-structural realization of semantic arguments. This reordering leads to a different order of syntactic expressions (and for many syntacticians, a different syntactic configuration). Valence alternations provide *syntactic* motivation for a syntactic level of argument structure to the extent that the statement of this reordering (whether encoded lexically or phrase-structurally) cannot be reduced to an operation on semantic representations.

- (23) a. Mary gave a book to John.
 b. Mary gave John a book.

Now, there are derivational affixes that affect pronominal inflection in Oneida. There is a reflexive/reciprocal prefix *-atat-* that induces a shift from transitive to intransitive prefix since it affects the number of semantic arguments, as shown in (24). The anticausative use of the semireflexive *-at-* also induces a shift, either from an animate prefix to the default z/n, as shown

in (25), or from transitive to intransitive prefix. But crucially, the reflexive/reciprocal and the semireflexive affect the distribution of pronominal prefixes because they alter the *meaning* or *conceptual structure* of the stems to which they attach. This means that analyses of these prefixes do not require reference to any syntactic representation of argument structure, and they do not provide evidence for that level of representation or for its phrase-structural equivalent in more ‘constructionist’ approaches (such as Goldberg 1995 or Ramchand 2008).

- (24) a. **li**-nut-ú
1SG>3MASC.SG-feed-STV
 ‘I have fed him’
- b. wa?-**k**-atát-nut-e?
FACT-1SG.AGT-REFL-feed-PNC
 ‘I fed myself’
- (25) a. wa?-té-**k**-yahk-e?
FACT-DUALIC-1SG.AGT-break-PNC
 ‘I broke it’
- b. wa?-t-**w**-át-yahk-e?
FACT-DUALIC-3Z/N.SG.AGT-SRF-break-PNC
 ‘It broke’

Oneida also has causative, instrumentals, and benefactive (applicative) suffixes that, conversely, induce a shift from an intransitive to a transitive prefix, or induce restrictions on the animacy of other semantic arguments as per the constraint on expressibility we discussed above. But again, although all these derivational affixes affect inflectional constraints, they do so only indirectly, that is, they do so because they affect the meaning of the stem to which they attach (cf. also Mithun 2006 on the related language Mohawk). In other words, all derivational processes are *morpholexical operations* rather than *morphosyntactic operations* in the sense of Ackerman 1992: They can be modeled as operations on conceptual structure/meaning. Crucially, there are no passives, middles, or other inverse constructions whose statement would require reference to something more than semantic structure, that is, to a syntactic level of argument structure.

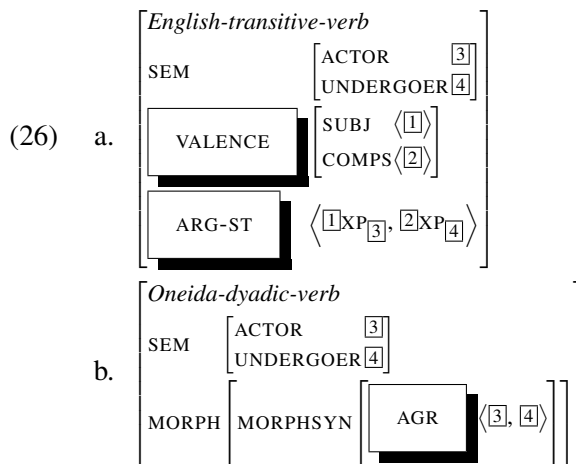
Binding constraints In your typical language, there are grammatical constraints on co-indexing that require an ordering of semantic arguments (so-called subject/object asymmetries). Such constraints also provide evidence for a *syntactic* notion of argument structure. Yet again, there are no such syntactic constraints in Oneida. There are no syntactic anaphors (see Baker 1996 for a similar claim for Mohawk, a closely related Northern Iroquoian language). There are no principle C violations that involve two nominals (Baker 1996), and there is no clear evidence that principle C plays a role in Oneida (*contra* Baker 1996). There are no infinitives with controlled unexpressed subjects (Baker 1996) or *syntactic* control in general. There are no VP anaphors, VP reduction, or VP ellipsis (*contra* Baker 1996). There are no consistent Condition on Extraction Domains effects in Oneida (*contra* Baker 1996). The systematic absence of such constraints confirms what the ‘loose,’ infrequent, and unbounded relation between verbs and external phrases suggests. There is something fundamentally different in how verbs and external phrases are related in Oneida.

3. Direct syntax versus selectional syntax

What we suggested in the previous section is that there are no behavioural reflexes of selectional syntax in Oneida (again, space limitations prevented us from doing much more than sketching the evidence for our claim). Now, the absence of behavioural reflexes of syntactic selection does not mean it is not there. However, given that the semantic relation between external phrases and verbs is not one of co-indexing, but instead one of referential overlap, it is unclear what the use would be for syntactic selection or for a syntactic level of argument structure. Of course, one can nevertheless model the syntax of Oneida using a syntactic level of argument structure. That is to say, since there are also no facts that contradict a syntactic level of argument structure, there is no impediment to imposing on Oneida the structure of a language such as English. No facts threaten to prove the analysis wrong. Modern syntactic frameworks have a rich enough toolkit to take care of languages even as recalcitrant as Oneida. Syntactic argument structure would be ‘universal’, because there is no fact that violates the assumption too much. But there are consequences of positing such a structure for Oneida. It would severely weaken the empirical bite of the notion of syntactic universal. The universality of argument structure would not be a discovery about languages or language, it would simply follow from an a priori descriptive bias. As such, treating Oneida and English alike would seriously undermine the quest for syntactic universals. Perhaps a greater consequence of clinging to the view that Oneida syntax is selectional after all, is that it would result in losing sight of *why* Oneida behaves so differently from languages like English. In contrast, the hypothesis that syntactic selection is only one (the most common) method for building up sentences but that another method also exists, what we call *direct syntax*, accounts for the cluster of properties that separates Oneida and English.

So, from here on, we take the kind of evidence we sketched in the previous section to suggest that how words and phrases are put together in Oneida departs radically from traditional assumptions about syntactic structure. Oneida is an example of *direct syntax*, where by *direct syntax* we mean a relation between phrases that is not mediated by syntactic argument structure or its equivalent. Verbs (and nouns) have no argument structure, no valence (subcategorization) information, nor features that license head movement into various projections à la Ramchand 2008 or any such mechanism. Oneida verbs include only agreement information relevant for inflectional morphology. The relation between a verb and phrases that specify one of its semantic arguments can be stated informally (and simplifying somewhat for now) as follows: The index of dislocated phrases that co-occur with a verb overlap with a semantic argument of that verb. The ‘bonding’ of the two co-occurring expressions reduces to a semantic relation between the two expressions, namely overlap of the referent of indices. (For ease of exposition, from now on we will talk in terms of co-indexing when what we mean is index overlap.)

(26) illustrates the difference between an English-style lexical entry and an Oneida-style lexical entry. We use a (simplified) Head-driven Phrase Structure Grammar representation for illustrative purposes. Although in an HPSG approach syntactic selection is lexically encoded, nothing crucial for our point hinges on that lexical bent. What is critical is that the mechanisms responsible for syntactic selection — the (syntactic) ARG-ST and VALENCE attributes in (26a), are absent from the Oneida entry in (26b). All that the Oneida entry includes is agreement information (encoded in a morphological AGR attribute) that serves as input to the inflectional realizational rules of morphology.



4. A conjunctive mode of semantic composition

Traditional models of semantic composition are well-suited to selectional syntax. To each syntactic selector-selected pair we can associate a semantic functor-argument pair. Semantic composition, then, takes on a simple form (at least in general; of course matters are complex in practice): As one syntactically combines heads and selected dependents one applies the meaning of those heads to the meaning of those selected dependents. Although one needs more complex modes of composition than functional application (see Chung and Ladusaw 2004, and discussion in von Stechow and Matthewson 2008), functional application remains the building block of semantic composition for languages whose syntax relies on syntactic selection. In this section, we discuss what the interface between syntax and semantics looks like in a language whose syntax is direct rather than selectional. If the typical model of semantic composition assumes a relation of syntactic selection between a head and a dependent, what are the consequences for semantics (in particular for semantic composition) of having a direct syntax? How shall we think of semantic composition if functional application is not an available tool? Our informal description of what direct syntax means for the relation between verbs and external NPs gives a flavor of our answer: The combination of NPs and verbs involves a mere co-indexing of the NP with a semantic argument of the verb (and as we will see, a conjunction of the predicates associated with the noun and verb meanings). We call the mode of semantic composition, which is the flip-side of direct syntax, a *conjunctive mode of semantic composition* or *conjunction cum co-indexing*.

Before examining in some detail how conjunction cum co-indexing works, we first compare it informally to functional application. The traditional lock-step building of syntactic phrases and functionally reduced meanings is illustrated in Figure 1.

Of course, this lock-step procedure applies more widely than to the combination of verbs and proper names. It applies also within NPs (and all the way down, in the ideal case), as shown in Figure 2. We informally represent the difference between the two modes of semantic composition—functional application and conjunction cum co-indexing—in Figure 3.

That all that is required for composing meanings is identification of variables (x_1 in Figure 3) and conjunction of predications is not as new as it may seem. In his musings on the true role of (bound) variables in logic, Quine (1976:304) already said as much: ‘[T]he essential services of the variable are the permutation of predicate places and the linking of predicate places by identity.’

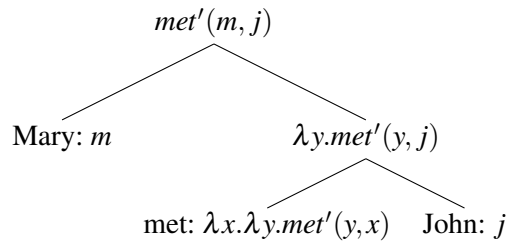


Figure 1: Syntactic selection and semantic composition in vanilla lambda-calculus

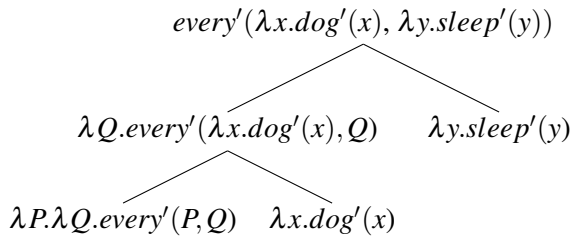


Figure 2: It's syntactic selection and functional application all the way down

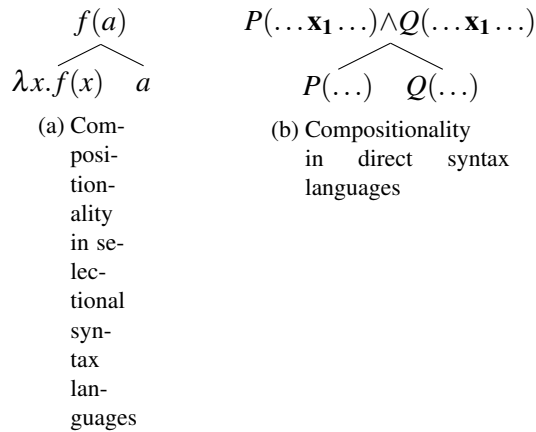


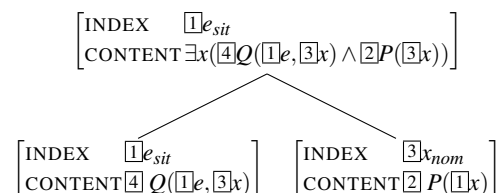
Figure 3: An informal comparison of the 'basic' modes of composition in selectional and direct syntax languages

Abstracting away from the particulars of the various algebraic logics that Quine proposes as possible substitutes for a more traditional first-order predicate logic, three critical aspects of how complex formulas are built are relevant for our purposes: (i) conjunction of atomic formulas, (ii) identification of variables within conjuncts and across conjuncts, and (iii) selection of a variable for ‘outside composition,’ that is, selection of a variable within a formula which will be targeted by an operator that outscopes that formula. As we now show, all three features of Quine’s reanalysis play an essential role in our model of the syntax/semantics interface of Oneida. We focus in this paper on three of the five major constructions we have identified in Oneida. For considerations of space, the description is informal or semi-formal, and we focus on the semantic effect of the syntactic combination, in particular on the conjunctive mode of semantic composition (see Koenig and Michelson 2012 for details on the syntactic component of these constructions).

4.1. How a conjunctive mode of semantic composition works

We discuss the most frequent construction first, the combination of a verb and an external NP. The semantic content of words and phrases is represented through the values of two attributes, INDEX and CONTENT. The value of the INDEX attribute stands for the (discourse) referent of an expression; the value of the CONTENT attribute for the semantic content of a word or phrase. We assume that values of the INDEX attribute are sorted so as to distinguish between nominal and situational indices. We illustrate our use of these attributes on the first of the three constructions we discuss, namely, the construction responsible for combining a verb and an NP, informally described in (27a). As is traditional in HPSG, identically numbered tags represent shared information. Thus, the presence of the two tags $\boxed{1}$ ensures that the meanings of the two daughters share a variable.

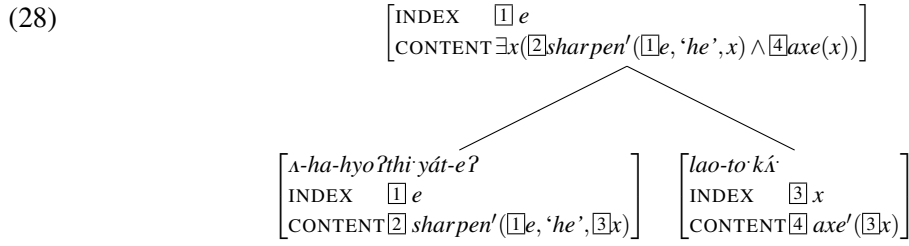
- (27) a. A phrase with a nominal index i and a phrase with a situational index j , one of whose participants is i , can form a phrase with index j .
 b. *nominal-dislocation* \Rightarrow



In (27), the left daughter corresponds to the verb, and the right daughter to the NP. For ease of exposition, we describe the construction as the local combination of a verb (a situation-denoting phrase) with an NP. As mentioned before, in reality the dependency between the NP and the verb can be unbounded. Note also that the order of the two daughters is not a matter of grammar. The *nominal dislocation* construction says that the content of the combination of an NP and a verb will include the conjunction of the content of the NP together with that of the verb (or sentence) it is adjoined to.⁷ Aside from existential closure, the construction says that the content of the mother node is the conjunction of the contents of the daughters (with identically numbered tags $\boxed{2}$ and $\boxed{4}$ indicating, as usual, shared information).

⁷Our informal statement of the construction is loosely based on Lexical Resource Semantics, see Richter and Sailer 2004. We simplify the representation and include existential closure of co-indexed variables so as to make our semantic contents look more familiar to readers. We treat semantic arguments of verbs as definite by default (represented here, informally, as pronouns). We also omit issues having to do with the underspecification of semantic scope, as they are not relevant to the main purpose of this paper.

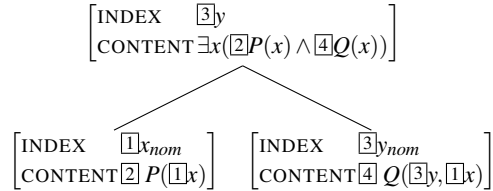
(28) illustrates the effect of this construction on the sentence in (3) (simplifying somewhat for expository purposes).



4.2. The importance of index selection when doing semantic composition

The second of the three constructions we discuss is the nominal equivalent of the first construction. This construction licenses the adjunction of a nominal that further specifies properties of one of the arguments of the head noun. We distinguish this construction from the previous construction, since adjunction of nominal phrases to nominal phrases is strictly local.

- (29) a. A phrase with a nominal index i and a phrase with a nominal index j , both of which are related by a relation R , can form a phrase denoting j .
 b. *nominal-adjunction* \Rightarrow



This construction, which is stated informally in (29a), is interesting because it illustrates the importance of the INDEX attribute in performing semantic composition. Recall that Quine had ‘permutation of predicate places’ as one of the two essential functions of variables. This formulation may seem rather odd to readers. One reason permutation of predicate places is so important in Quine’s algebraic logic is that it allows a particular predicate place to be ‘visible’ to external combinators. In our approach, this ‘service’ of variables is assigned to the index of the mother node. The index of the mother node determines which argument is ‘visible’ to larger constructions in which a particular construction is embedded. For example, in (29) the index of the right daughter is selected as the index of the phrase, as indicated by the tag $\boxed{3}$.

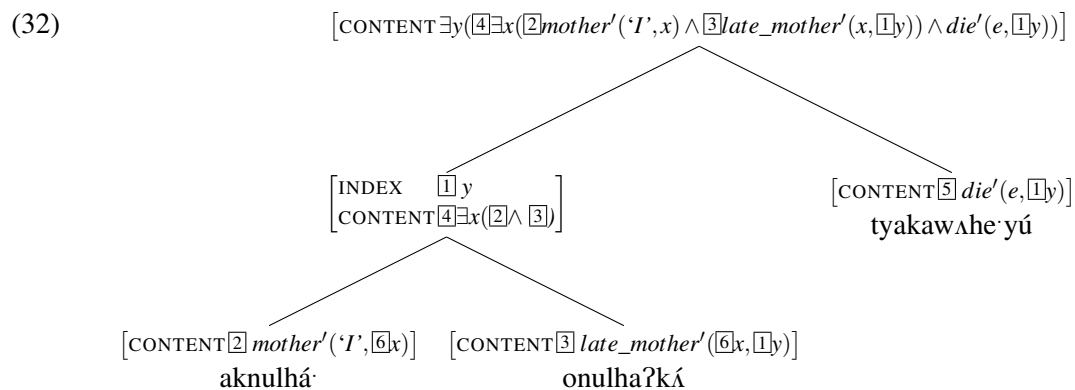
The point of our introducing (29) here is that we need not only identify the argument positions of two predicates in our semantic representations, we need also to select one argument position for the purpose of external composition. We illustrate the importance of specifying which daughter contributes its index to the whole phrase with the complex kinship expression in (30).

- (30) Tahnú· aknulhá· onulha?ká tsha-h-anáklat-e? Bill
 and my mother her late mother COIN-3MASC.SG.AGT-be.born-PNC Bill
 ne? thó ne? né· t-yakaw-Λhe y-ú.
 at that time it’s CISLOC-3FEM.SG.PAT-die-STV
 ‘And my mother’s mother died when Bill was born.’ (Olive Elm, *Visits to my auntie’s*, recorded 1993)

As shown by the statement of the nominal dislocation and nominal adjunction constructions in (27) and (29), respectively, the combination of the contents of each subexpression is conjunctive in nature. Simplifying somewhat, the net effect of the use of these two constructions is a semantic content equivalent to the formula in (31). The semantic composition of the contents of the two NPs ensures the identification of the \boxed{y} variable, and ensures that the daughter of x is the mother of z . What the conjunction of the contents of these two NPs does not indicate is which of the three variables (whose values correspond to the three kins) will serve as argument of the predicate *died*. In other words, we need a way of indicating which of the kin expressions will be the variable identified with one of the arguments of the verb. This is the purpose of the INDEX attribute. The specification of the mother node's CONTENT attribute specifies how to combine the meaning of the two subexpressions: in our essentially conjunctive mode of composition, variable identification and predicate conjunction. The INDEX attribute specifies which subexpression's variable will be targeted by the construction in which this subexpression participates.

$$(31) \quad \exists x, y, e(\text{mother}'(x, \boxed{y}) \wedge \text{late_mother}'(\boxed{y}, z) \wedge \text{died}'(e, ?))$$

Now, index selection can be done lexically (as for kinship terms, see Koenig and Michelson 2010), but it is also one of the functions of syntactic constructions. As semanticists, we typically take this role for granted because the mode of composition we think of is functional application. When syntactic constructions involve selection, we can use the order (and type) of lambda operators to make sure the right variable is 'visible' for composition with an external functor. So, if we combine a syntactic expression S , whose meaning is of the form $\lambda x.P$, with another syntactic expression E , the lambda operator tells us which argument of P is 'visible' for semantic composition, that is, the variable that is abstracted by the lambda operator. In our conjunctive mode of composition for (non-syntactically-selective) Oneida, this job is done by specifying the index of the phrase (which is roughly equivalent to specifying what the phrase describes/denotes). We illustrate this use of the value of the INDEX semantic attribute for the sentence in (30) in (32).⁸



A conjunctive mode of composition can do quite a lot, especially if we avail ourselves of the equivalence between $\forall x(P \rightarrow Q)$ and $\neg \exists x(P \wedge \neg Q)$. However, it cannot do all that is needed to model the semantics of natural languages, at least under standard assumptions about what is universally expressed in natural languages. In particular, it does not seem to be able to model

⁸The conjunctive mode of semantic composition we are proposing to pair with our non-selective syntax will probably remind readers of DRT-style composition rules (see Kamp and Reyle 1993 and van Eijck and Kamp 1997).

the full panoply of natural language quantificational expressions. Since Barwise and Cooper 1981, quantification over entities has been analyzed as relations between sets (so called $\langle 1,1 \rangle$ quantifiers, see Peters and Westertahl 2006). Typically, the way things work, as we illustrated above in Figure 2, is through functional application: The determiner, which denotes the quantificational relation between two sets, combines (in the simplest case) with a set-denoting nominal expression (e.g. a noun), and the result of this combination combines with the VP, which itself denotes a set. If we are correct in our observations about Oneida, this compositional sequence, involving functional application, is not available in Oneida. So how is quantification expressed in a direct syntax language? We address this question in the next section.

5. How to express quantification without functional application

To present Oneida's quantificational expressions, we need to briefly present the third major Oneida syntactic construction we alluded to above. Semantically, this construction switches a situational index to a nominal index. It is the construction used to model Oneida's internally-headed relative clauses, one of the two ways of forming relative clauses in Oneida. Its semantics is informally stated in (33a).

- (33) a. A phrase with a situational index j can form a phrase with nominal index i provided that index corresponds to a participant in the situation associated with j .

b. $IHRC \Rightarrow$

$$\begin{array}{c} \left[\begin{array}{cc} \text{INDEX} & \boxed{1} \\ \text{CONTENT} & \boxed{2} \end{array} \right] \\ | \\ \left[\begin{array}{cc} \text{INDEX} & e_{sit} \\ \text{CONTENT} & \boxed{2} P(\dots \boxed{1}_{nom} \dots) \end{array} \right] \end{array}$$

The basic answer to the question of how quantification is expressed in Oneida is that it is expressed as it is in mathematics. More specifically, the quantity expression serves as an argument of a relation, not a relation itself. An easy way to highlight the difference is to consider the two ways of representing the meaning of a sentence like (34), namely, the representations in (35a) and (35b). The two 'translations' are equivalent, at least if, as in Landman 1996, we allow predicates to take plural individuals by default and derive atomic event reading through a distributive operator.

(34) Three rabbits hopped.

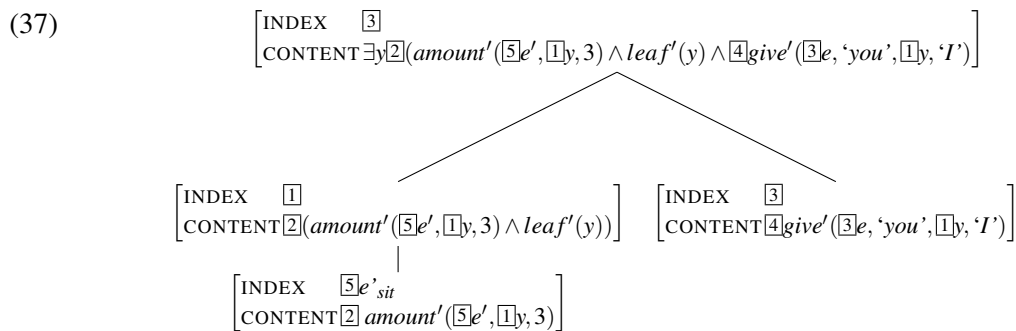
- (35) a. $three'(\lambda x.rabbit'(x), \lambda y.hopped(y))$
 b. $\exists s(rabbit'(s) \wedge cardinality'(s, 3) \wedge hopped'(s))$

The main argument for assuming that (35a) is a better representation of the meaning of (34) for English is that it generalizes to all determiners, including those whose meaning cannot be represented as in (35b). However, the Oneida way of expressing quantification is more like (35b). Quantification expressions in Oneida have three salient structural properties. First, the quantity expression is a clause headed by a (count) verb (meaning, e.g. 'be a certain amount, amount to' or 'be the whole of, be complete'). We call this clause the *count clause*. Second, the count verb for cardinal quantification incorporates a noun stem that indicates what is being counted. Third, the count clause functions like an internally-headed relative clause that is co-indexed with an argument of the main verb (i.e. is related to the main verb via the standard dislocation structure), as indicated by the literal translation of (36).

- (36) $\acute{A}hs\Lambda$ ni-ka-nláht-a-ke Λ -té-sk-u-ʔ
 three PART-3Z/N.SG.AGT-leaf-JN-amount FUT-CISLOC-2SG>1SG-give-PNC
 ‘The [tobacco] leaves that amount to three, you are to hand them to me.’ (Olive Elm,
How I got started working in tobacco, recorded 1998)

In Oneida there are several different ways of expressing quantity, including the use of distinct verb stems, depending on whether the cardinality of what is being counted is one, two, or more than two, whether what is being counted is inanimate or animate, and whether what is being counted is or is not part of a sentence that involves a possession relation. We concentrate on one verb stem here, *-ke* ‘be a certain amount, amount to’, illustrated in (36). Our analysis applies, *mutatis mutandis*, to other count verbs. The stem *-ke* is used for counting two or more entities. The incorporated noun *-nlaht-* ‘leaf’ indicates what is being counted. Thus, the incorporated noun, as is typical of one of the uses of noun incorporation in Oneida, indicates the category of one of the verb’s semantic arguments. With verbs that are used for counting animates, the pronominal prefix on the verb references what is being counted; in (36) what is being counted is inanimate, and so the pronominal prefix is the default z/n prefix. Finally, *áhsΛ* ‘three’, at the beginning of the count clause, indicates how many leaves there are. The count clause can thus be translated as ‘they leaf-amounted to three’.

The count clause is adjoined to the main clause, and the only connection between the count clause and the main clause is semantic: The count verb and the main verb share one semantic argument, the argument that corresponds to the leaves in (36). Of course, this kind of looser semantic connection is what our conjunctive mode of semantic composition is meant to accommodate, in particular, the *nominal dislocation* construction represented in (27). But additionally, as in the case of complex kinship expressions, which argument position (variable) within the count clause is to be co-indexed with a semantic argument of the main verb is critical. Selection of the right variable again falls upon the INDEX attribute, illustrated in the description of the IHRC construction stated in (33b). (37) shows semi-formally how the meaning of (36) arises from the use of the *IHRC* and *nominal dislocation* constructions, respectively. (In addition, we assume that the semantic effect of noun incorporation is to specify, via an additional conjunct, the category of one of the arguments of the verb that the noun incorporates into; this additional conjunct is *leaf’(y)* in (37).)



Our analysis of count clauses of the kind found in (36) illustrates how a conjunctive mode of semantic composition can model quantification in Oneida. Interestingly, nothing special needs to be added to the three main syntactic constructions we have already introduced and which are needed independently to model the rest of Oneida, that is, nominal dislocation, nominal adjunction, and internally-headed relative clauses. ‘Mathematical’ models of quantification (i.e.

models of quantification that resemble those presented in arithmetic) can be expressed through our conjunction cum coindexing and index selection mode of semantic composition, which we claim is appropriate for direct syntax languages such as Oneida.

But the conjunctive semantics we introduced cannot model all types of quantification. The problem is best illustrated by the difference in semantic acceptability of the following two English sentences:

(38) ✓Those rabbits amounted to/numbered three.

(39) #Those rabbits amounted to/numbered most.

The sentence in (38), the closest equivalent to the meaning of Oneida count clauses, is felicitous, but (39) is semantically unacceptable. The crucial difference between the two is that (38) involves cardinal quantification whereas (39) involves proportional quantification. The contrast suggests that the ‘mathematical’ expression of quantification is appropriate for cardinal quantification, but not for proportional quantification. So, if count clauses are the only way to express quantification over entities in Oneida, then the structure that Oneida uses to express quantification has expressive limitations.

We can characterize more precisely Oneida’s predicted expressive deficit: Truly proportional quantification will be absent.⁹ Cardinal quantification can be expressed through count clauses, where the number name is an argument of a predicate which is roughly translatable as *be a certain number, amount to, number*. But proportional quantification cannot be expressed through count clauses, for two reasons. First, because Oneida is a non-selective language, quantifiers cannot select for a syntactically expressed restriction. There cannot be an equivalent of *most rabbits* because *most* cannot select a nominal or NP. Oneida’s non-selectiveness would at most allow a contextual specification of the quantifier’s restriction or a further specification, as an adjunct, of the restriction argument. Second, and more importantly, words expressing a quantity are arguments, not predicates, and it is this that makes (39) infelicitous. *Most* cannot felicitously be an argument of *be a certain amount, amount to, number*. This means that count clauses of the kind we have described are inadequate for expressing truly proportional quantification. The inability of count clauses to express proportional quantification has two possible outcomes. One possibility is that Oneida does not express quantification with a single syntactic structure (such as the Det+Nominal construction of English), and the highly influential approach which allowed a unified treatment of the determiners of English and other languages, specifically the Generalized Quantifiers approach initiated in Barwise and Cooper 1981, is not available in Oneida. Instead, Oneida would have two entirely distinct ways of quantifying over entities: one for cardinal quantification (via the structure described above for count clauses) and another for proportional quantification (although the latter would have to be more restricted than in English because of the non-selective nature of Oneida).

The second possibility is that Oneida does not have truly proportional quantification in the technical sense of the term. It seems this second, more radical possibility, is what is the case; there are no words in Oneida for *most*, or for any other truly proportional quantifier. The best one can do is use a word that means, roughly, ‘often, lots of times,’ *yotká te?*, that is, the best one can do is quantify over eventualities rather than entities (through count clauses). Interestingly, there is a way of expressing *half*. ‘Half’ is expressed with the verb stem *-ahsΛΛ* plus the

⁹By *truly proportional* quantifiers we mean quantifiers that cannot be modelled through first-order means. *All, every, each*, are typically analyzed as proportional quantifiers but they *can* be reanalyzed as first-order quantifiers. In contrast, *most* cannot (see Barwise and Cooper 1981).

coincident and dualic prefixes, meaning ‘half(way), middle’. But this expression, which is the only expression that seems to correspond to proportionality over sets of entities when considering its English translation, actually does not involve a type $\langle 1,1 \rangle$ quantifier but rather a usual quantity as argument expression. Consider a more common spatial use of the verb illustrated in (40). In that use, the verb denotes a relation between two distances. The sentence in (40) is therefore more faithfully glossed as ‘how far we have gone is half (the distance we have to travel)’. In other words, the distances (the quantities in non-spatial uses of the verb) are treated as first-order individuals, not as properties of sets or relations among sets.

- (40) n Λ uhte tshaʔ-te-w-ahs Δ n Δ niyo-lé niyukwe-nú.
 then probably COIN-DUALIC-3Z/N.SG.AGT-half how far we (pl) have gone
 ‘then I guess we had gone halfway (to the store, along the railway tracks) (Barbara Schuyler, *A ghost sighting*, recorded 2008)

The absence of proportional quantifiers is not an accidental lexical gap. It is part of a more general pattern: There is no (quantificational) partitive construction in Oneida that corresponds to English *X of them*. Consider the excerpt in (41) from a dialogue about hockey, produced by Mercy Doxtator in 1998. (41a) sets up a set of boys who all have on skates. (41b), a few lines later, discusses what some of these boys were wearing. Count clauses are used to talk about the two boys wearing black shirts and the three boys wearing white uniforms. These count clauses take exactly the same form as if one were talking about a set of two boys, not a *subset* of the set of boys who put on skates. In other words, the partitive meaning is inferred; it is not grammatically encoded. The general absence of (quantificational) partitive construction may be taken as evidence that the absence of quantifiers corresponding to English *most* is not merely an accidental gap. It reflects a general fact about Oneida structures that express quantifications: Quantities are treated as individuals and serve as arguments of predicates, they are not themselves predicates. And that constructional fact itself reflects the non-selective or direct nature of Oneida syntax.

- (41) a. Kwáh lati-kwekú te-hon-ateʔkhé-tslut-eʔ
 Just 3MASC.PL.AGT-all DUALIC-3MASC.PL.PAT-put.on.skates-STV
 ‘All of them have on skates.’
 b. Te-hni-yáshe o-ʔswá-t-aʔ
 DUALIC-3MASC.DU.AGT-be.together[STV] 3Z/N.SG.PAT-black-NOUN.SUFFIX
 lon-atyaʔtawí-t-u kháleʔ áhs Δ
 3MASC.PL.PAT-put.on.a.shirt-STV and three
 ni-hatí o-wískl-aʔ
 PART.3MASC.PL.AGT[be.that.many.STV] 3Z/N.SG.PAT-white-NOUN.SUFFIX
 ni-hu-hkwanyó-t Λ
 PART-3MASC.PL.AGT-have.on.an.outfit[STV]
 ‘Two of them have on black shirts and three of them have on white uniforms.’

6. Conclusion

In this paper, we have outlined a picture of Oneida that challenges what linguists, implicitly or explicitly, take to be two universals of syntax and the syntax/semantics interface: the syntac-

tic selection of dependent phrases by heads, and the concomitant use of functional application to combine the meanings of heads and selected dependents. If we are correct, the existence of languages like Oneida means we may have to revise our views on what can vary across languages and what is truly universal. Argument realization, for example, in the sense of Levin and Rappaport 1985, would not be a universal component of the syntax/semantics interface of natural languages. At a deeper level, Oneida's direct syntax suggests that what we have been accustomed to thinking are the fundamental phenomena of syntax may be only one of the ways that syntax can look like. Argument realization, binding, control, valence alternations, raising, VP anaphors, constraints on extraction, and so forth are simply not part of Oneida syntax. Consequently, syntax is about more than these phenomena. But what is also interesting is how much one can do with a direct syntax and a conjunctive mode of semantic composition. Most of our communicative needs seem to be met by this 'simpler' kind of syntax and this 'simpler' semantics (as the absence of functional application removes (some of) the need for higher-order types). As mentioned earlier, the fact that a conjunctive mode of composition is good enough for most aspects of the semantics of natural language is nothing new to scholars who adopt a DRT approach to natural language semantics. However, it is news to see a language making so much use of that mode of semantic composition. It is also news that we do not need functional application to model composition (but see footnote 2 for some parallels between Riau Indonesian, as described by Gil, and Oneida). Even more interesting, in some sense, is the fact that the kind of expressive limitations one would expect to find in a language that uses a direct syntax and a conjunctive mode of semantic composition are indeed true of Oneida: Truly proportional quantifiers and quantificational partitive constructions seem to be systematically absent in Oneida. This is not to say Oneida could not have developed constructions to express proportional quantification. The point is that direct syntax is geared towards a 'mathematical' way of expressing quantification, and this way of expressing quantification does not allow for the expression of proportional quantification. How Oneida deals with the absence of proportional quantifiers and partitives in general can be understood in the context of tenseless languages. The absence of tense does not mean event descriptions are not ordered temporally. It just means that temporal ordering is a matter of inference (although defaults play an important role in this respect: see Langacker 1991 and Bohnemeyer and Swift 2004). Similarly the absence of proportional quantifiers or partitives does not mean those concepts are not expressed. The subset-superset relation is merely inferred.

We began this paper by stressing the (rather obvious) importance of 'exotica' when trying to uncover universals. In this concluding paragraph, we go back and consider what Oneida has taught us. First and foremost, it has taught us that the venerable, 75-year-old approach to syntactic combinatorics (or an equivalent approach) is not universally at the core of the grammar of natural languages. It has also taught us that the 40-year-old use of functional application (or an equivalent approach) as the basic method for achieving semantic combinatorics is not universally needed. Finally, it has taught us that the 30-year-old generalized quantifier approach to natural language quantification is but one option and $\langle 1,1 \rangle$ quantifiers are not universally present in natural languages. But 'exotica' not only can help us discover what is or is not universal, they can also help us uncover what we took for granted; in other words, help us reconstruct our analytic tools. An Oneida-centric reconstruction of syntax and the syntax/semantics interface looks eerily like Quine's algebraic dream: Conjunction, variable identification, variable selection for external combinators (in this paper, index selection). The Oneida constructions accomplish that much, but nothing more. This algebraic 'purity' of Oneida's syntax/semantics

raises, of course, the question of why Oneida (and possibly some isolating languages such as Riau Indonesian) is such an odd man out and at one extreme of syntactic selection. We leave an answer to this question to another venue.

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