Scope, Time, and Predicate Restriction in Blackfoot using MC-STAG

Dennis Ryan Storoshenko
University of Calgary
2500 University Dr. NW
Calgary, AB, Canada, T2R 1H4
dstorosh@ucalgary.ca

Abstract

We use STAG to model the interaction between demonstratives and tense found in Blackfoot (Algonquian). In clauses with no tense or aspect marking, past tense can be encoded through a distal demonstrative on either the internal argument (transitives, unaccusatives) or the external argument (unergatives). A fourth class of predicate, semantically transitive but syntactically intransitive with a pseudo-incorporated object, does not allow either argument to mark tense. Using the scope mechanics described in Frank and Storoshenko (2012), we first model the unique scope properties of pseudo-incorporation, following on the Bliss (2013) claim that predicate saturation in these cases derives from the Chung and Ladusaw (2004) operation of predicate restriction, not function application. Modelling the predicate restriction operation within a STAG derivation is shown to correctly predict the scope facts in a way such that the tense facts are also easily captured.

1 Tense and Demonstratives

In this section, we present the basic tense data, and discuss the challenges it presents for a GB/Minimalism-style analysis before moving on to STAG. Blackfoot is an Algonquian language of Southern Alberta and Montana with a largely polysynthetic morphology. While the language has a range of tense and aspect markers, clauses may appear untensed. As described in Lewis (2014), untensed predicates may receive an obligatory temporal interpretation from a demonstrative on one of their arguments:[1]

(1) amo ninaa ispii
DEM.PROX man dance
'This man is dancing/danced.'
(either tense)

(2) oma ninaa ispii
DEM.DIST man dance
'That man danced.'
(past only, Lewis 2014 ex19b)

As shown, while the proximal demonstrative does not fix the tense, a distal demonstrative fixes the interpretation in the past. The task of writing a function which could accomplish this is simply a matter of lambda gymnastics:

(3) $[\![F]\!] = \lambda P \lambda s'.P(s') \wedge DIST(s') \rightarrow s' < s^*$

F, a recursive function of type ⟨⟨s,t⟩,⟨s,t⟩⟩ on the verbal projection inspects its complement for situation variables in the scope of a DIST function (assuming demonstratives to also carry situation variables, see Elbourne (2008)), dictating that such situations be interpreted as prior to the utterance time s^*. The proposal is not that demonstratives themselves carry any temporal interpretation, rather that is built into the verbal projection (and therefore inherently part of the predicate) which interacts with demonstratives in its scope.

The same pattern of past tense following from distal demonstratives has been shown for unaccusative predicates:

(4) amo ninaa o'too
DEM.PROX man arrive
'This man arrives/arrived.'(either tense)

[1] In the interests of space, we will only give the minimal morphemic breakdown necessary to illustrate the facts salient to our discussion. Readers are encouraged to consult the sources cited in this paper to appreciate the complexity of the morphology.

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(5) oma ninaa o'too
DEM.DIST man arrive
'That man arrived.' (past only)

However, in (syntactically) transitive constructions, only the internal argument fixes the tense:

(6) oma ninaa si'kataa amo ninaa
DEM.DIST man kick.TR DEM.PROX man
'That man kick/kicked this man'
(either tense, Lewis 2014 ex20a)

(7) amo ninaa si'kataa oma ninaa
DEM.PROX man kick.TR DEM.DIST man
'This man kicked that man.'
(past only, Lewis 2014 ex20c)

The fact that distal demonstratives do not always trigger a past interpretation is taken as evidence that the demonstratives themselves do not inherently carry tense, and that the F operator must be a part of the predicate, with a narrowly defined scope. The challenge therefore lies in locating the position of this F function on the verbal spine. To account for the transitives and, by extension, unaccusatives, the scope of F must exclude the external argument (specifier of vP); however the unergative cases show that the specifier of vP can also be in the scope of F. An additional complication arises when considering a fourth construction, known in the literature as the Animate Intransitive + Object (AI+O) construction:

(8) amo ninaa ooyi mamii
DEM.PROX man eat.INTR fish
'This man is eating/ate fish.'

(9) oma ninaa ooyi mamii
DEM.DIST man eat.INTR fish
'That man is eating/ate fish.'

In (8) and (9), the predicates are syntactically intransitive, lacking the morphological marking of transitives, though they still take two arguments semantically. According to Bliss (2013), the object (*mamii* in this case) is pseudo-incorporated into the verbal predicate as an NP, not a full DP. As shown in our data, the subject of this type of intransitive does not fix the tense, while the object by definition has no ability to do so as a bare NP.

Assuming that the relevant function which inspects demonstratives is contributed by some functional head on the verbal spine, it would need to be in a flexible position, sometimes above vP (unergatives) and sometimes below vP (all others). This would also imply that in the case of a transitive, the function would not even scope over a fully-saturated predicate, surely an undesirable state of affairs if we want to assume a single operator is responsible for this phenomenon. To solve this, one could adopt a Kratzer (1996)-inspired deconstruction of predicates, in which external arguments are introduced to a fully saturated predicate through event identification. Taking this step, and then defining the position of F as the first opportunity to merge a function of the semantic type $\langle\langle s,t\rangle,\langle s,t\rangle\rangle$ would again correctly capture the subjects of unaccusatives, objects of transitives, and correctly exclude the subject of the AI+O construction saturated by object incorporation, but would miss the unergatives, as the necessary condition for applying the F function would be met before event identification ever took place. The only solution would be to then add a syntactic constraint in the form of some uninterpretable feature requiring the functional head to have at least one nominal (NP or DP) in its scope. While such a move is possible, the necessary syntactic feature is not a natural one in the framework, and the notion of merging a functional head as soon as semantically possible in a derivation, regardless of the syntactic form of the object derived to that point, goes against most notions of functional cartographies. However, the clear judgement particularly in the case of the intransitive subject of AI+O not triggering a past tense interpretation strongly suggests that there is some interplay with the mechanics of argument saturation underlying this phenomenon, and that it should not be downplayed as a spatial metaphor residing in the pragmatics. This paper argues that implementing an STAG analysis of the Blackfoot clause provides a more natural way to characterize the position of F.

In an STAG context, this means we should be looking to define a position for F on the semantic side of the derivation rather than the syntactic one. However, this first requires a semantics for pseudo-incorporation. In the next section we look at the scope differences between canonical transitives with animate agents (so-called TA constructions) and the AI+O construction. This will serve as independent motivation for the STAG account of these predicates which will in turn more easily capture the tense data.

2 Blackfoot Scope

Quantification in Blackfoot can be expressed via a verbal suffix, which is able to associate with either the subject or the object of a transitive predicate:

(10) nit-ohkana-ohpommatoop-innaan-
1ST-all-buy.TR-1PL-
iaawa
PL.OBJ
'We all bought them.' or
'We bought all of them.'
(Weber & Matthewson 2013 ex10)

Following the Constraint on Elementary Tree Minimality defined in Frank (2002), we treat these quantifiers as being part of the verb's elementary tree. This is shown in Figure 1. The only elements of the morphology we take to be part of the verb's elementary tree here are the quantification and the verb root itself including morphological marking of valence. The argument positions are DP substitution sites, and the additional agreement affixes arise as a result of the arguments which substitute in, both φ-feature valued instances of *pro* in the case of (10). A discussion of how this agreement is manifested in an STAG context is orthogonal to the present discussion. However, it is worth noting that the universal quantification can also combine with full DPs:

(11) óm-iksi aakííkoan-iksi
DEM.DIST-PL girl-PL
ik-ohkana-issta-yi-aawa...
DEG-all-want.INTR-3PL-PL.OBJ ...
'Those girls all want...'
(Weber & Matthewson 2013 ex13)

So, while these argument positions may be occupied by *pro* or by overt DPs with determiners, they take on a complex meaning incorporating the meaning of the quantifier that originates in the verbal predicate.

Extending further to the Frank and Storoshenko (2012) treatment of scope, wherein the semantic form of a predicate in STAG is broken into a predicate part and a scope part, we place this quantifier in the scope part. Whereas traditional STAG analyses of scope ambiguity make use of an undetermined order of operations leading to two distinct

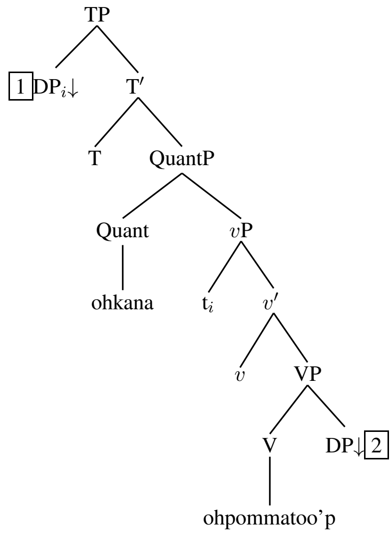

Figure 1: Basic syntactic tree for the predicate in (10)

derivations (Schabes and Shieber, 1994), here we claim that the Blackfoot facts must be captured by two different semantic elementary tree sets for the verbal predicate, shown in Figure 2[2]. Though not strictly necessary for the example in (10) with pronominal arguments, the form presented here is robust enough to accommodate interaction between predicate modifying affixes and DPs with determiners, yielding complex expressions such as *all the men*. For the moment, we assume that definite and demonstrative DPs in this language are of type ⟨e⟩, consisting of definite descriptions closed using the iota operator:

(12) $[\![\text{the man}]\!] = \iota x.\text{man}(x)$

We further assume that forms such as (12) are not specified for number; following Link (1983), the unique x variable here may also denote a plurality of entities. Following the quantification presented in Figure 2, the semantic content of the argument DP substitutes into the restrictor of the quantifier, rather than directly into an argument position. This restrictor contains a simple set membership function, in this case defining all entities that belong to the set defined by the plurality which substitutes in.

Having established the basic mechanics of the verbal quantification, we move on to the interac-

[2]This may be thought of as the output of two distinct elementary tree building operations. The construction of elementary tree sets in STAG remaining a somewhat unexplored realm, we step back from this issue and simply assert the two tree sets.

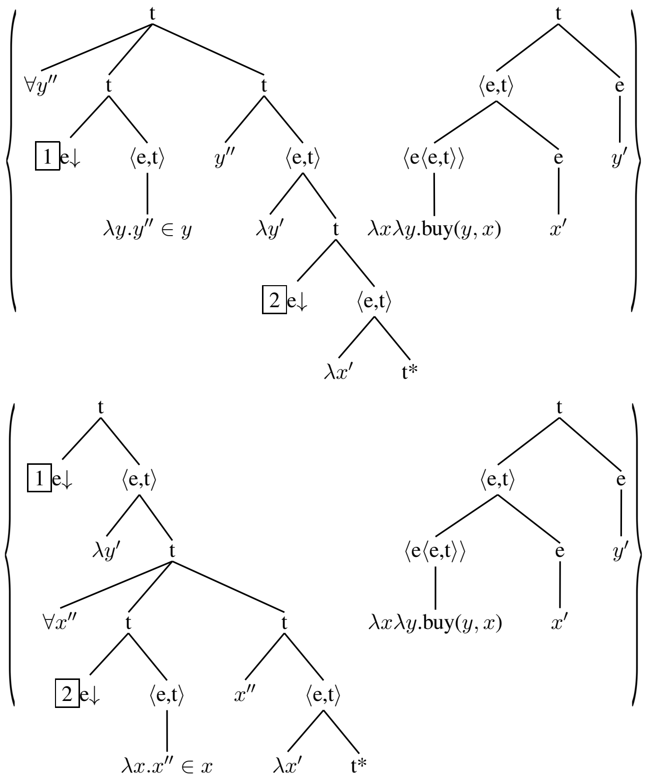

Figure 2: Semantic tree sets for the predicate in (10)

tion with quantified DPs and the AI+O construction. In the following examples, the verbal prefix *iihkana* (a phonological variant of the prefix in (10)) denotes universal quantification, now interacting with another quantified DP in the same clause:

(13) iihkana-inoyiiya anniskey piita
all-see.TR one certain eagle
'They all saw this one eagle'
$1 > \forall$, $*\forall > 1$
(Weber & Matthewson 2013 ex21)

(14) iihkana-yaapiiya piita
all-see.INTR eagle
'They all saw a different eagle'
$*1 > \forall, \forall > 1$
(Weber & Matthewson 2013 ex26)

Weber and Matthewson (2013) note that in examples such as (13), a transitive clause with a quantified object DP, the DP quantifier obligatorily takes wide scope over the verbal prefix quantifier, which in turn associates with the subject. That the objects obligatorily outscope the verb-affixed quantifiers means that in such cases, the affixed quantifier must associate with the subject. In other words, only the upper MCS configuration in Figure 2 is available. We propose that this may be the result of a semantic well-formedness constraint. While the affixal quantifiers may associate with DPs bearing simple determiners or demonstratives (i.e. objects of type ⟨e⟩), the available data show no examples of the affixal quantifier associating with an independently quantified DP. Such quantified DPs, we assume, combine using the typical two-tree semantic multi-component set (MCS) consisting of a type ⟨e⟩ variable substituting at the argument site and a ⟨t⟩-recursive scope tree which must adjoin high enough to bind the variable. This would be the familiar type of quantificational MCS as in Figure 3. A constraint against "overloading" an argument with two quantifiers, essentially preventing a quantified DP from combining into an argument position already part of a verb's quantifier, would block a derivation for (13) using the lower MCS in Figure 2 and creating a clash between the verbal suffix universal and the DP's specific numeral in this case. From here, we turn to the type-shifting operation defined in Storoshenko and Frank (2012) and applying it to the scope tree in the upper MCS, targeting the root node as the adjoining site for the DP's scope, allowing the specific 'one' to scope wide[3] The sub-

[3]Another possibility for blocking the unwanted derivation for (13) may be to invoke a constraint against targeting the

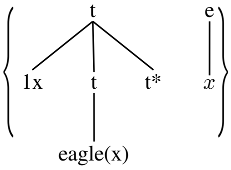

Figure 3: Semantic tree set for DP quantifier as in (13)

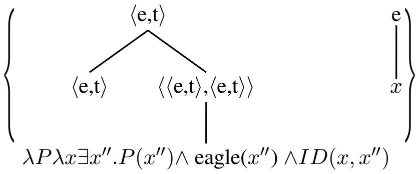

Figure 4: Semantic tree set for incorporated object (first attempt)

ject, again a pronoun, associates with the verbal quantifier by way of set membership. Note this is *contra* Weber and Matthewson who derive the wide scope of the object through a choice function.

In the AI+O case (14), they find that the incorporated singular object obligatorily takes narrow scope, yielding only an interpretation where each person sees a different eagle. Translated into STAG, this means that the object is not composing with the scope tree of the predicate in the same way as a quantified object. Following Bliss (and Weber and Matthewson for this example), the semantic operation is Predicate Restriction (PR). As defined by Chung and Ladusaw (2004), PR is an alternative to Function Application (FA) as a means of saturating the argument position of a given predicate. PR is a two step process: first the argument is taken to be of type ⟨e,t⟩, and acts as a restrictor on the targeted argument position inside the predicate. Then, existential closure binds the argument position. In an STAG context, this will of course be a single operation, a composition of the predicate's MCS with the tree set of the incorporated argument. The key distinction will be that such pseudo-incorporated arguments will have unique tree sets, shown in Figure 4. Again, as with a standard GQ, there is a variable portion of type ⟨e⟩ which will substitute into the relevant argument position of a predicate's scope tree. The difference here is that the recursive "scope part" of the MCS is not recursive on ⟨t⟩, but rather on ⟨e,t⟩. The function from ⟨e,t⟩ to ⟨e,t⟩ within the auxiliary tree accomplishes the operations of restriction and closure in one step. The type ⟨e⟩ component is associated with the restricted and existentially-closed variable by way of an identity function. Adjoining the auxiliary tree into the lowest ⟨e,t⟩ node of scope tree in the upper (subject universal quantifier) MCS in Figure 2, while substituting the type ⟨e⟩ variable into the $\boxed{2}$-linked argument position yields the form in (15), composed up to the ⟨t⟩ node immediately dominating $\boxed{2}$ in the scope tree.

(15) $\exists x''.\text{see}(y', x'') \wedge \text{eagle}(x'') \wedge ID(x, x'')$

Though inelegant, and leaving the x variable free but identified with the existentially bound x'', the method in Figure 4 allows us to retain the same basic predicate tree sets regardless of the type of argument (DP or incorporated object), and to easily derive the obligatory narrow scope of the object.

An alternative approach would be to take more seriously the syntactic differences between not just the objects in (13) and (14), but also the predicates, which do have different morphology, and assume that the predicate trees will be different as well. For (13), we assume the object to be a full DP, combining into predicate trees similar to those in Figures 1 and 2. However, a predicate taking a pseudo-incorporated object may have a distinct semantics, mirroring the fact that on the syntax side it combines with a bare NP rather than a DP. This is the scenario sketched in Figure 5. Here, the scope part of the predicate does not contain an abstraction over the object position; instead, the object position $\boxed{2}$, which would be an NP substitution site in the syntax, is now linked to the ⟨e,⟨e,t⟩⟩ node in the lower predicate part of the semantic tree.

The gain from this method can be seen in Figure 6, where we present the updated semantic trees for the incorporated argument. Here, the only contribution of the nominal is to act as a function over the semantically transitive predicate, and incorporate the restriction on the object. The existential closure is already built into the root of the predicate's lower tree, which will necessarily be under the scope of the subject combining into the scope tree for the same predicate. Simplification of the resulting expression yields (16) as the final denotation of the lower member of the predicate's MCS after the incorporated object adjoins.

(16) $\exists x'.\text{see}(y', x') \wedge \text{eagle}(x')$

$\boxed{2}$ node in the lower MCS from type shifting.

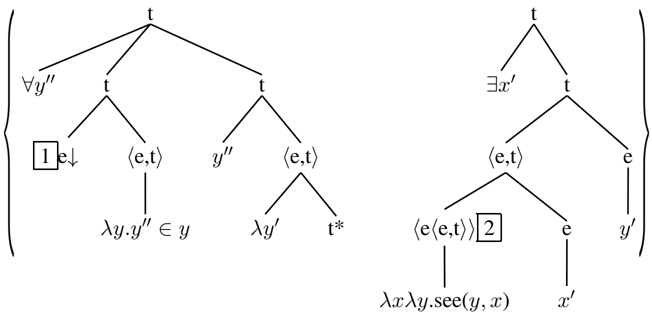

Figure 5: Alternate Predicate for PR (including universal quantifier over subject)

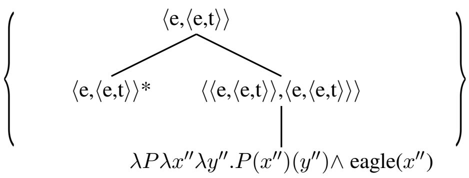

Figure 6: Alternate semantic tree set for incorporated argument

Avoiding the issue of the unbound variable makes this method preferable, and we will adopt it going forward, but it comes at the apparent cost of proposing a different tree set for the predicate. Incidentally, this approach also directly encodes the fact that incorporation is uniquely available for objects but not subjects, which the prior attempt does not. With the basics of handling different types of arguments and quantification settled, we return to the matter of tense in the next section.

3 Accounting for Tense

To get back on track, recall the formula from (1), repeated below as (17):

(17) $[\![F]\!] = \lambda P \lambda s'.P(s') \wedge DIST(s') \rightarrow s' < s*$

What we need to get the temporal interpretation correct is a function which inspects a predicate of type ⟨s,t⟩ from situations to propositions (truth values), and dictates that if the current situation has been taken as the argument of a DISTal function, then the current situation is in the past relative to the present speech time defined as s*. As noted earlier, this calls upon a treatment of demonstratives described in Elbourne (2008) where situation variables proliferate; one place predicates are of type ⟨⟨s,e⟩,⟨s,t⟩⟩, arguments normally taken to be type ⟨e⟩ are ⟨s,e⟩, and so on. Essentially, all entities and propositions are interpreted with respect to situations. Having already motivated a treatment of demonstratives and definite DPs as type ⟨e⟩, the lift to type ⟨s,e⟩ is no great stretch. Revised trees, showing only one argument under the universal quantifier for the sake of brevity, are given in Figure 7.

For a definite DP, the update is quite simple:

(18) [[the man]] = $\lambda s.\iota x.$man(x) in s

Combining this form with our updated universal quantification yields the following (abstracting away from tense and the object position for the time being):

(19) $\lambda s \forall y''[y'' \in \iota x.[\text{man}(x) \text{ in } s] \text{ in } s][\text{kick}(y'', x(s))]$

While there is some redundancy, this gives all y'' who, in the given situation, are part of the plurality defined as being men in the given situation.

The next ingredient of our account for tense will be a form for the distal demonstrative. Again, this is accomplished with a minor simplification of Elbourne's form, here conflating temporal and world variables into the single type ⟨s⟩ for convenience:

(20) [[oma ninaa]] = $\lambda s.[[[\iota x.x \text{ is a man in } s] = z] \wedge DIST(z, a, s)]$

Following Elbourne, the iota operator defines an x as a man, and then associates that x with another variable of the same type (z here). This second variable is passed along as an argument of a second function defined as DIST, here taking three arguments. The first is the associated entity, while the third is the given situation in which x's man-hood is defined. The middle variable a is a contextually-defined indexical, providing the frame of reference for distance. In essence, "z is distant with respect to a in the situation s".

Once this argument has composed into the predicate tree, the function defined in (17) comes into play. The action of this function is to check the

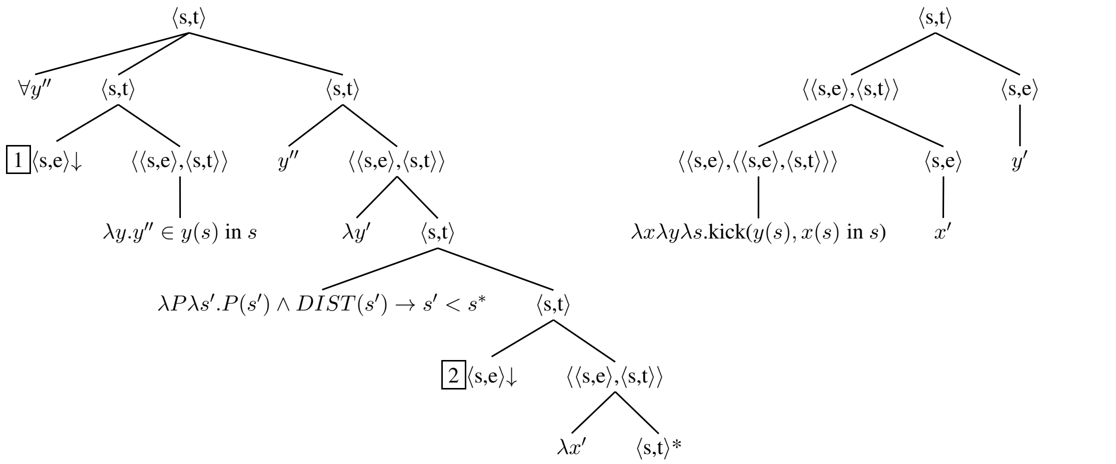

Figure 7: Semantic tree set for the predicate in (10), updated to situations and including F. For (unquantified) unergatives and unaccusatives, F appears at the root, still immediately above the lowest ⟨s,e⟩ substitution site.

object of type ⟨s,t⟩ in its scope for any DIST functions taking the given situation as an argument. The presence of such a function triggers an implication that the given situation is in the past relative to the present situation of utterance. Recalling the facts in Section 1, the relevant syntactic positions triggering this implication were the internal argument of transitives, and the sole argument of unergatives and unaccusatives. The latter two are simplest, as while their arguments may have different positions in the syntax, the semantic tree sets for both will have the same basic shape. For these, we need simply to posit that they will have a scope tree similar to that for the AI+O case in Figure 5, and that this function from ⟨s,t⟩ to ⟨s,t⟩ is generated at the root of the scope tree, being a part of the verb's semantics. For the syntactically transitive case, we must make an uncomfortable stipulation, placing the function immediately above the node marked [2] in Figure 7. This will guarantee scope over the substitution position for the object but not the subject.

The crucial step in the derivation of (7), with the distal demonstrative triggering a past tense interpretation, comes at the stage where F takes its argument. Assuming the object of *kick* to have been *oma ninaa*, the expression would be as in (21):

(21) $\lambda s'.\text{kick}(y'(s'), \iota x.x \text{ is a man in } s' = z \wedge DIST(z,a,s')) \wedge DIST(s') \rightarrow s' < s*$

Crucially, the material implication is calculated immediately, such that in this case the statement that the bound s' is temporally prior to the present $s*$ is coordinated to the expression for the duration of the final computation. If s' is not the argument of a DIST function at this stage, then F takes no action and is inert for the rest of the interpretation.

Turning to the AI+O cases, we capitalize on the conclusion that the best solution to dealing with PR is to say that the semantic elementary trees of the predicates involved are substantially different. It is then not unreasonable to claim that another consequence of this is that the F function is not a part of the Figure 5 tree set. This allows us to claim that for the rest, F is built into the predicate's scope tree immediately above the lowest ⟨s,e⟩ substitution site during the generation of the predicate's elementary tree. Assuming F has a syntactic analogue, the separation of syntax and semantics provided by STAG allows us to define a consistent syntactic position for F which maps to an equally consistent semantic one.

4 Conclusion and Future Work

This paper has dealt with three major challenges arising from an examination of Blackfoot arguments: quantification from the verbal predicate, predicate restriction as a combinatory operation, and the definition of a function for deriving past tense from distal demonstratives. The STAG approach to the first issue is reasonably straightforward, building the quantification into the verbal predicate's scope tree, while having the DP substitute into a position linked to the restrictor inside of a generalized quantifier structure. What is less clear is how the two different elementary tree sets for this quantification are defined. A quantifier on a transitive predicate may bind either the subject or the object; our solution to this has been to stipulate there must be different elementary tree sets for each eventuality. This suggests that there is some room for variability in the mapping between syntax and semantics during the process of elementary tree construction. More work in this area is called for, as the complicated interactions between verbal morphology and argument structure in this language do suggest that a parallel derivational process is also at work before the TAG combinatory operations begin.

This is reinforced by the second issue, that of Predicate Restriction. The ideal solution seems to be to follow the lead of the verb morphology and again assume that there is a fundamentally different semantic tree set for what is essentially the same predicate. Once this leap is made, the implementation of PR is relatively simple, with the two steps split between the two lexical items involved: the verb's semantic MCS provides the existential closure, while the incorporating argument provides the restriction over the argument position by way of a function over the predicate.

The issue of the positioning of the function which determines temporal interpretations from the presence of a demonstrative is where the benefits of the STAG approach to semantics shine though. As discussed above, the expanded scope trees adopted in this paper allow not only for the function to be divorced from a given syntactic position, but they allow for a consistent position above a saturated predicate in the scope trees to be defined. The position unifying the subject of unergatives and unaccusatives, along with the object of transitives is that they are all associated with the lowest λ-abstractor in the scope tree. No such generalization is possible in a mainstream framework. We also now have a principled reason for treating the AI+O cases as distinct. The STAG account may feel somewhat *ad hoc*, but it still seems preferable to conceive of this as a function of syntactic elementary tree building interfacing with a distinct semantic tree than trying to read the semantics off the syntactic tree directly.

Lastly, we must point out that beyond the contributions of derivational morphology to elementary tree building in both the syntax and the semantics, there is a rather intricate agreement system at work in this language which we have made no effort to capture. This remains for future work.

Acknowledgments

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