

# Agreement Between Scylla and Charybdis

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Although Steve, Ivan and I never played in Dead Tongues (n.b.: no definite article) at the same time, we are all Dead Tongues at some level of representation, so it feels somehow natural that I sing the first verse of this tune before Steve takes it away with his solo, while Ivan provides the underlying harmonic structure for it all. In this short introduction, I will briefly summarize the HPSG theory of agreement and its motivations, and try to explain why it is brilliant. This should not replace reading the HPSG book (Pollard and Sag, 1994), which is more of an orchestral masterpiece. If you haven't read it, I highly recommend it, regardless of where you stand on the existence of empty categories. (It was one of the main reasons I wanted to go to Stanford for graduate school.)

The distinctive and powerful thing about the HPSG theory of agreement is that it ties agreement together with reference, hence, with semantics. The theory centers around the notion of an *index*, which can be thought of either as a discourse referent in Discourse Representation Theory or as a parameter ( $\approx$  free variable) in situation semantics (Barwise and Perry, 1983). The idea is that the agreement features person, number and gender are features of *indices*, rather than of syntactic phrases, as was traditionally thought. The indices in question here are the same ones that play a central role in HPSG's non-configurational binding theory, its approach to subcategorization, and its storage-based approach to quantifier scope ambiguity, so the notion of index is importantly tied to multiple aspects of interpretation (and grammar). Making agreement features properties of indices thus results in a tight link between agreement and semantics.

This connection has a number of useful empirical consequences. A purely syntactic theory of agreement would have trouble with the following contrast, illustrating the phenomenon of *reference transfer*:

- (1) a. The hash browns at table nine are/\*is getting cold.
- b. The hash browns at table nine is/\*are getting angry.

*Singular plurals*, which will be discussed in Wechsler's paper, constitute another case that is tough for a purely syntactic theory of agreement:

- (2) Eggs is my favorite breakfast.
- (3) Doing phonology problems and drinking vodka makes me sick.

The singular/plural ambiguity of *collectives*, especially in British English, illustrates another problem for a purely syntactic theory of agreement:

- (4) The faculty are all agreed on this point.

These facts can be accounted for by connecting the agreement features to the semantic index of the noun phrase.

While avoiding the Scylla of a purely syntactic theory of agreement, however, this theory steers clear of the Charybdis of a purely semantic theory. This makes it possible to account for data that does not seem compatible with either extreme.

- (5) a. The faculty is voting itself a raise.  
b. The faculty are voting themselves a raise.  
c. \*The faculty is voting themselves a raise.  
d. \*The faculty are voting itself a raise.
- (6) a. That dog is so ferocious, it even tried to bite itself.  
b. That dog is so ferocious, he even tried to bite himself.  
c. \*That dog is so ferocious, it even tried to bite himself.  
d. \*That dog is so ferocious, he even tried to bit itself.
- (7) a. The ship lurched, and then it righted itself.  
b. The ship lurched, and then she righted herself.  
c. \*The ship lurched, and then it righted herself.  
d. \*The ship lurched, and then she righted itself.

If agreement were purely semantic, then all four variants of these examples should be acceptable. The partly syntactic theory in HPSG accounts for these restrictions, by mediating the agreement relation through indices and requiring that pronouns and their antecedents share an index.

Polite pronouns such as German *Sie* and French *vous* evince another advantage of the HPSG theory over a purely semantic theory. These involve a mismatch between semantic number and grammatical number:

- (8) Vous           êtes           l'amour de ma vie.  
you.FORMAL be.PRES.2PL the:love of my life.  
'You (formal) are the love of my life.'

If agreement were purely semantic, then it should not be possible for a plural verb to agree with a semantically singular subject.<sup>1</sup>

<sup>1</sup>However, as discussed by Pollard and Sag (1994, p. 96) polite pronouns participate in a phenomenon that remained somewhat puzzling under this view, namely *mixed agreement*, exemplified in *Vous êtes belle* 'you.FORMAL be.PRES.2PLpretty.SG'. In this case, the verb displays plural agreement and the adjective displays singular agreement. Evidently, predicative adjectives in French do not reflect the INDEX number feature of the subject but rather the fact that the subject is semantically singular. It is in this connection that Wechsler and Zlatić (2003); Wechsler (2011) made an important contribution using two distinct feature bundles, INDEX and CONCORD.

Let’s consider how the theory captures this data. In HPSG, unlike in many other theories, pronouns and common nouns have the same semantic type. The semantic value of both is essentially a pair consisting of an index and a restriction on that index. The elements of the pair have labels and are standardly represented in AVM format as in (9a), where the semantics of a common noun like *pancake* is shown. The boxed number indicates structure-sharing, which entails token-identity. Removing the labels gives us the pair in (9b), where  $u$  is the object that serves as the value of both the INDEX feature and the INST feature.

$$(9) \quad \text{a.} \quad \left[ \begin{array}{l} \text{INDEX} \\ \text{RESTR} \end{array} \left[ \begin{array}{l} \boxed{1} \left[ \begin{array}{l} \text{PER} \quad 3rd \\ \text{NUM} \quad sg \\ \text{GEND} \quad neut \end{array} \right] \\ \left\{ \left[ \begin{array}{l} \text{RELN} \quad pancake \\ \text{INST} \quad \boxed{1} \end{array} \right] \right\} \end{array} \right] \right]$$

b.  $\langle u, \{pancake(u)\} \rangle$

The semantics of a pronoun is also a pair like this, except that the value of the RESTR feature is the empty set; in pair format, the semantics of a pronoun like *she* is  $\langle u, \{\} \rangle$ . The requirement that  $u$  is female is stated among the constraints on the context. Proper names also have this type, and come with a contextual constraint that  $u$  bears the relevant name.

What is the ontological status of the index  $u$ ? Pollard and Sag tell us that we have at least two options: We can think of it either as a discourse referent or as a parameter in situation semantics. (Given that DRT can be embedded in situation semantics, maybe the latter is more specific than the former.) On the latter view, which is the one developed in more detail in Pollard and Sag (1994), the second member of the pair is a set of parameterized state of affairs (PSOA) as in situation semantics. If we think of  $u$  as a discourse referent, then the second element of the pair should be thought of as the bottom half of a Discourse Representation Structure (DRS) as in Discourse Representation Theory (Kamp and Reyle, 1993), which is a set of *conditions*. So the semantics of a common noun can be seen as a pair consisting of a discourse referent and a set of DRS-conditions. (It’s almost like a DRS; if the first element of the pair were a *set* of discourse referents, then it would be.)<sup>2</sup>

The representation in (9a) says a bit more about the index  $u$  than the representation in (9b) though. (9a) also tells us that  $u$  is 3rd person, singular, and neuter. These features are not mereological parts of the index, of course; they are properties of the index. So another way of thinking about this is that there

<sup>2</sup>Note that if indices are discourse referents, then the semantic value of a word like *pancake* is a pair of terms in a representation language that must then be interpreted with respect to a model and an assignment function. For example if  $g$  is an assignment function and  $M$  is a model and  $g(u) = a$ , then it would be natural to assume that  $\llbracket u \rrbracket^{M,g} = a$ . Semantic values in HPSG thus contain what might be referred to as *representational objects*, i.e., objects that represent the world rather than actual entities in a model.

is some function, call it  $\pi$ , whose domain is the set of indices and whose range is the set of possible person values (e.g. *1st*, *2nd*, and *3rd*), and  $\pi(u) = 3rd$ . Thus the HPSG theory of agreement is a general idea that can be implemented in any framework that has a notion of index and a function that assigns agreement features to indices.<sup>3</sup>

Subject-verb agreement comes about through constraints imposed by inflected verb forms requiring token-identity of indices (hence, of person, number and gender features). A verb like *succeed* will have as its semantic content something which can be thought of either as a PSOA or a DRS-condition, e.g. *succeed(u)*. The index  $u$  must also be the index of the subject. This identity requirement relates to the syntactic information associated with the verb (stored under the CAT features) as illustrated in (10).

$$(10) \left[ \begin{array}{l} \text{CAT} \\ \text{CONT} \end{array} \left[ \begin{array}{l} \text{HEAD} \quad \textit{verb}[\text{FIN}] \\ \text{SUBCAT} \left\langle \begin{array}{l} \text{LOC} \left[ \begin{array}{l} \text{CAT} \left[ \begin{array}{l} \text{HEAD} \quad \textit{noun} \\ \text{SUBCAT} \quad \langle \rangle \end{array} \right] \\ \text{CONT} \left[ \begin{array}{l} \text{INDEX} \quad \boxed{1} \left[ \begin{array}{l} \text{PERS} \quad \textit{3rd} \\ \text{NUM} \quad \textit{sg} \end{array} \right] \end{array} \right] \end{array} \right] \end{array} \right] \end{array} \right] \end{array} \right] \\ \left[ \begin{array}{l} \text{RELN} \quad \textit{succeed} \\ \text{INST} \quad \boxed{1} \end{array} \right] \end{array} \right]$$

The semantic value of the verb is the value of its  $\text{CONT}[\text{ent}]$  feature, and this is a PSOA or DRS-condition which can be rewritten without labels as *succeed(u)*. The index  $u$  serving as the argument of the *succeed* relation must be token-identical to the index of the subject, the first argument of the verb's  $\text{SUBCAT}[\text{egorization}]$  list.

This theory of agreement can be contrasted with the one in for example Kamp and Reyle (1993), which is purely syntactic, despite the availability of discourse referents as part of the theory. There we have involving rules like the following, where  $\alpha$  is a variable over different possible feature values (p. 30):

$$(11) \quad S_{\text{Num}=\alpha} \rightarrow \text{NP}_{\text{Num}=\alpha} \text{VP}_{\text{Num}=\alpha}$$

Notice that number is treated as a feature of a syntactic *phrase* in this framework. Plural nouns are lexically specified as plural via rules like the following:

$$(12) \quad \text{N}_{\text{Num}=\textit{pl}} \rightarrow \textit{books}, \textit{hash browns}, \dots$$

This set-up entails that the reference transfer-type cases will be ruled out as ungrammatical. By treating agreement features as features of indices, which

<sup>3</sup>One would have to be careful when undertaking such an enterprise, as HPSG indices can be non-referential; the English expletives *it* and *there* have non-referential indices and it is not clear whether they introduce discourse referents.

are tied to semantics, the HPSG theory of agreement gets the leeway it needs to deal with reference transfer, singular plurals, and collectives.

Like subject-verb agreement, pronoun-antecedent agreement also relies on indices according to the HPSG binding theory. A reflexive pronoun, for example, must share an index with its antecedent. This explains why the (c) and (d) examples in (5)-(7), in which there is a mismatch between a reflexive pronoun and its antecedent, are unacceptable. A purely semantic theory would allow these kinds of mismatches, since it would allow any pronoun whose features correspond to some possible conceptualization of the referent. In contrast, agreement features are still part of the grammar under the HPSG theory, even though they are connected to semantics. In this way, the HPSG theory navigates the tricky passage between Scylla and Charybdis.

I would like to underline the point that the HPSG theory of agreement is a general idea that can be implemented in any framework that has a notion of index, as one has in every framework that makes use of discourse referents. The sign-based nature of HPSG makes it particularly suited for an implementation of this type of theory, as constraints crossing the border between form and content can easily be stated as constraints on signs. But all one really needs beyond a notion of index is a function that assigns agreement features to indices, and a way to relate these functions to verb forms. Even if you don't do HPSG, if you have these things, then you too can make all of these lovely predictions.

Take it away, Steve.

## References

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