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1 Abstract

This paper has three goals: (a) to account for Tense Harmony (TH) in pseudoclefts as a result of the interaction between the syntax and semantics of pseudoclefts, the syntax and semantics of tense, and principles of variable binding; (b) to provide a formal distinction between the different types of copular sentences (predicational, specificational and identificational); and (c) to account for the relationship between TH and Connectivity.

2 The Problem

Higgins 1973 distinguishes between three types of copular sentences—predicational, specificational and identificational. Example (1) illustrate the first kind; example (2) is, according to Higgins, ambiguous between a specificational and an identificational reading (see also Akmajian 1970):

(1) The girl who knows John _ is brilliant.
(2) The girl who knows John _ is Mary.

Let us adopt the following informal descriptive definitions of the three constructions under discussion. Specificational pseudoclefts (SP's) are copular sentences that express identity (or equation) between the pre- and post-copular phrases. They exhibit TH: if the subject contains a relative clause, the matrix tense and the tense of the relative clause must agree. Predicational pseudoclefts (PrP's) are copular sentences that do not express identity between the pre- and post-copular phrases. They do not exhibit TH (i.e., if the subject contains a relative clause, the matrix and embedded tenses do not have to agree). Identificational pseudoclefts (IdP's) are copular sentences that express identity between the pre- and post-copular phrases, but do not exhibit TH. Additional examples are given below:

SP's (Equation; TH)

(3) a. What John is _ is smart.
    b. What John was _ was smart.

c. *What John is _ was smart.
d. *What John was _ is smart.

PrP's (No equation; no TH)

(4) a. What John saw _ is interesting.
b. What John saw _ was interesting.

IdP's (Equation; no TH)

(5) a. The woman John trusted _ most is Mary.
b. The woman John trusted _ most was Mary.

Take the SP in (3a). Intuitively, the sentence can be paraphrased as follows: "the property which holds of John is the property of being smart". Similarly, the IdP in (5a) can be paraphrased as an equation: "the individual who is a woman that John trusted is the individual Mary." By contrast, the predicational (4a) cannot be paraphrased as an equation (e.g., "the thing John saw is the same as the property of being interesting"), but only as follows: "the thing John saw is in the set of things that are interesting". Despite the semantic similarity between IdP's and SP's, they differ with respect to TH.

This characterization of the three types of copular sentences is not exactly the one Higgins uses, nor is it clear whether it corresponds to the kind of characterization he has in mind. But it is a useful characterization, in that it allows us to ask why and how TH is related to the semantics of the different copular sentences. I will argue that TH is a way of avoiding a violation of a principle of full interpretation.

3 Background Assumptions

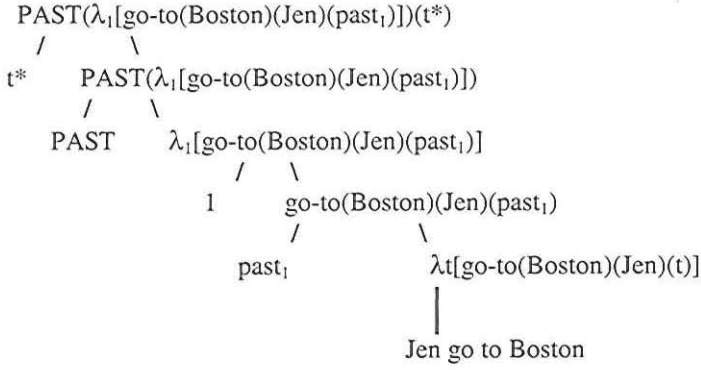
My proposal relies on a series of background assumptions regarding tense, variable binding, the semantics of relative clauses and of copular sentences.

3.1 Assumptions Regarding Tense

I follow Kusumoto 1999 who, building on Stowell 1993, adopts a system of tense according to which the meaning of anteriority associated with the past tense is conveyed by two syntactic elements—a past tense operator (*PAST*), and a past morpheme ($past_j$) which bears an index. The *PAST* operator takes two arguments—a property of times and the speech time. The morpheme $past_j$ is a variable whose interpretation is determined by the assignment function. In addition, Kusumoto assumes that verbs take time arguments, and

that every sentence has a position for *t**, which denotes the speech time. To illustrate, (6) is the LF of *Jen went to Boston*:

(6) [t* [PAST 1 past$_1$ [Jen go to Boston]]][1]



The semantics of *PAST*, *past* and *t** are given below (*c* is a context, *g*—a variable assignment, *p*—a function from times to truth values, *m*—a time-interval):

(7) a. $\|\text{PAST}\|^{g,c}(p)(m)=1$ iff there is a time m' such that m'<m and p(m')=1.[2]

b. $\|\text{past}_j\|^{g,c} = g(j)$

(8) $\|t^*\|^{g,c}$ = the speech time of c.

Accordingly, the truth conditions of *Jen went to Boston* are as specified in (9):

(9) $\|\text{PAST}(\lambda_1[\text{go-to(Boston)(Jen)(past}_1)])(t^*)\|^{g,c}=1$ iff there is a time t such that t precedes the speech time of c and Jen goes to Boston at t.

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[1] An additional assumption here is that the syntax supplies abstraction indices over times as needed. We make a similar assumption with respect to complements of propositional attitude verbs—we assume that the world argument of the embedded verb can be abstracted over (in theories that allow explicit quantification over worlds).

[2] For current purposes only, I assume that *p* is a total function, whose value is 0 for every time *m* in which the presuppositions of *p* are not satisfied.

Similarly, the meaning of simultaneity normally associated with the present tense is conveyed by a *PRES* operator and a $pres_j$ morpheme.

Kusumoto's system is designed to capture Sequence of Tense (SOT) effects in embedded contexts (for relevant discussion see Abusch (1997), Ogihara (1996), von Stechow (1995)). To see how this is done, consider (10):

(10) John believed that Mary was sick.

As is well known, (10) is ambiguous between a "relative past" reading and a "simultaneous" reading. According to Ogihara (1996) and von Stechow (1995), the latter reading is obtained by deleting the embedded past tense at LF. Kusumoto achieves the effects of tense deletion by assuming that a tense morpheme (i.e., *past* or *pres*) can appear alone in a clause (i.e., without a tense operator) provided that it is c-commanded by an agreeing tense operator (where *PAST* agrees with *past*, and *PRES* agrees with *pres*), and there is no intervening non-agreeing tense operator. Accordingly, the "simultaneous" reading and the "relative past" reading are as in (11) and (12) below:

(11) "Simultaneous" reading:

[t* [PAST 1 [$past_1$ [John believe 2 $past_2$ Mary be sick]]]]

$\| \text{PAST}(\lambda_1[\text{believe}(\hat{}\lambda_2[\text{sick}(\text{Mary})(\text{past}_2)])(\text{John})(\text{past}_1)])(t^*) \|^{c,w(c),g}=1$
iff there is a time m before the speech time of c such that for all world-time pairs <w', m'> compatible with what John believes at m in w(c) (the world of c), Mary is sick in w' at m'.

(12) "Relative Past" reading:

[t* [PAST 1 $past_1$ [John believe [PAST 2 $past_2$ Mary be sick]]]]

$\| \text{PAST}(\lambda_1[\text{believe}(\hat{}\text{PAST}(\lambda_2[\text{sick}(\text{Mary})(\text{past}_2)])(\text{John})(\text{past}_1)])(t^*) \|^{c,w(c),g} = 1$
iff there is a time m before the speech time of c such that for all world-time pairs <w', m'> compatible with what John believes at m in w(c) (the world of c), there is a time n before m' s.t. Mary is sick in w' at n.

Similarly, as discussed extensively in the literature on tense cited above, the tense of a relative clause may depend on the matrix tense, or be completely independent of it. (13) illustrates this:

(13) Hillary married a man who _ became the president.

We can understand (13) to mean that the time of the marriage is before, after or simultaneous with the time of becoming the president. The first two readings are accounted for by the assumption that (13) has an LF where each of the two clauses (matrix and embedded) has a tense operator of its own:

(14) [t* PAST 1 $past_1$ Hillary marry [a man who_3 [t* PAST 2 $past_2$ e_3 become the president]]]

The simultaneous reading can be obtained in two ways. It could be read off (14), when the two past times (the time of marriage and the time of becoming the president) happen to coincide. But it could also be read off (15), where the embedded tense operator "deletes" (i.e., the *past* morpheme occurs "alone" and is c-commanded by the agreeing matrix *PAST*), in which case the two past times must coincide:

(15) [t* PAST 1 $past_1$ Hillary marry [a man who_3 $past_1$ e_3 become the president]]

3.2 Assumptions Regarding Relative Clauses

I assume, following Jacobson 1994, that *the* is cross-categorial, and following similar ideas from Heycock & Kroch 1999, and Sharvit 1999, I assume that free relatives contain a hidden *the*. Accordingly, a free relative such as *what John is* has the syntax in (16a) and the semantics in (16b):

(16) a. [the [$what_2$ t* PRES 1 $pres_1$ John be e_2]]
b. the'(λP[P$\in$C & PRES(λ_1[P(John)($pres_1$)])(t*)])
("the property that currently holds of John")

As for headed relatives, I assume that the 'head' optionally reconstructs into the relative clause, either semantically or syntactically. If it reconstructs, the time variable of the head may get bound inside the relative clause, as is the case in (17b). If the head does not reconstruct ((17c)), its time argument may be bound by some higher tense operator:

(17) a. The student I met in college.
b. the'(λx[PAST(λ_2[meet(x)(I)($past_2$) & student(x)($past_2$)])(t*)])
c. λ_5[...the(λx[student(x)(t_5) & PAST(λ_2[meet(x)(I)($past_2$)])(t*)])...]

As a result, we may understand (17a) to imply that the individual I met in college was a student back then when I met him, or that he is a student at

some other time (say, the utterance time), and that he need not have been a student at the time of the meeting.

3.3 Assumptions Regarding 'Be'

With Partee 1986, I assume that *be* is cross-categorial, and that it is always predicational. More specifically, I assume that *be* is of type $\langle\langle\pi\langle i,t\rangle\rangle, \langle\pi,\langle i,t\rangle\rangle\rangle$, where π can be any type, and $\langle i,t\rangle$ is the type of a function from time-intervals to truth values.

When the post-copular phrase is not of type $\langle\pi,\langle i,t\rangle\rangle$, it may be turned into an expression of this type via the type-shifting operation IDENT—an operation which takes an entity and gives back the property of being that entity. (18) illustrates how *be* works in the 'normal' cases (i.e., when the post-copular phrase does not have to be type-shifted), and in the 'not normal' cases (i.e., when the post-copular phrase is type-shifted):

(18) a. John be smart - $\lambda t[\text{smart}(\text{John})(t)]$
b. John be Bill - $\lambda x \lambda t[x=\text{Bill}](\text{John}) \Rightarrow \lambda t[\text{John}=\text{Bill}]$

Note that the expression we get in (18b) involves vacuous binding of a temporal variable. Let us call the constant function (from times to truth values) denoted by such an expression a vacuous property of times. Such properties will prove to be crucial in the analysis of TH, as we will see in section 4.

3.4 Assumptions Regarding Variable Binding

I assume a principle of Full Interpretation (FI) as in (19):

(19) No vacuous binding at the root node.

The principle in (19) says that although vacuous binding is allowed in principle, by the time the computation reaches the root node every operator must bind a variable. In particular, expressions such as $\lambda t[\textit{John=Bill}]$, which denote vacuous properties of times, are allowed in principle, but at the root node, the vacuous binding has to 'disappear'.

With these background assumptions, we can explain the tense patterns we find in copular sentences.

4 TH as LF Tense "Deletion"

I propose that TH (i.e., obligatory agreement between the matrix and embedded tenses) is a by-product of embedded tense 'deletion', which occurs in copular sentences as a means of avoiding violation of FI. We will look first at PrP's, where FI is respected regardless of whether or not the embedded tense undergoes LF tense 'deletion'.

4.1 The Absence of TH in PrP's

In predicational copular sentences, we find the same interpretive options as in (13) above. That is to say, nothing requires the embedded tense to delete:

(20) What John saw _ was interesting.

The sentence in (20) has an LF without any 'deleted' tenses, according to which the time of seeing is independent of the time of being interesting:

(21) t* PAST 1 $past_1$ [the what t* PAST 2 $past_2$ John see] be interesting.

But nothing, of course, prevents the embedded tense operator from deleting, in which case the following LF is obtained (where the embedded tense morpheme is bound by the matrix tense operator):

(22) t* PAST 1 $past_1$ [the what $past_1$ John see] be interesting

In both cases, FI is respected because the matrix tense operator binds some tense morpheme. If no 'deletion' takes place, the two tense operators are independent of each other, and tense agreement is optional:

(23) What John saw/sees was/is interesting
t* PAST/PRES 1 $past_1/pres_1$ [the what t* PAST/PRES 2 $past_2/pres_2$ John see] be interesting.

4.2 TH in SP's

In certain copular sentences, violation of FI is avoided by 'deleting' the embedded tense operator. These are the constructions we call SP's.

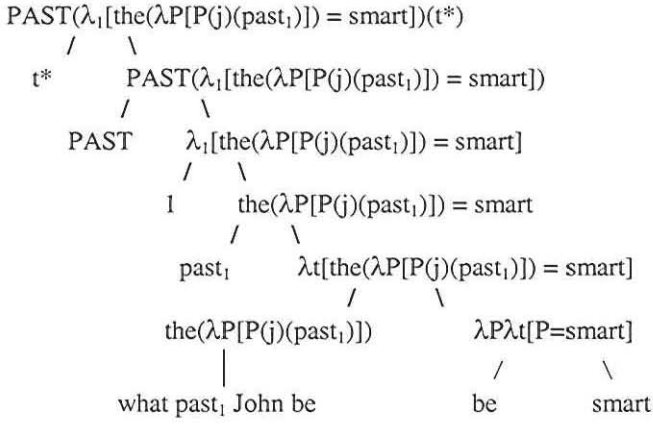
More accurately, the generalization is as follows. TH is attested when (a–d) co-occur: (a) IDENT applies to the post-copular phrase; (b) the derived predicate applies to the subject, and yields a vacuous property of times; (c)

(c) The matrix tense morpheme gets 'eaten up' by that vacuous property, leaving nothing for the matrix tense operator to bind; and (d) The matrix and embedded tenses agree. In such cases, the embedded tense operator may 'delete', thereby allowing the matrix tense operator to bind the embedded tense morpheme. Such conditions are met simultaneously only when the pre- and post-copular phrases are of the same semantic type, because only then is IDENT called into action. The SP below (which may be paraphrased as: "the property that held of John and the property of being smart are one and the same") illustrates this:

(24) What John was _ was smart

(25) [t* [PAST 1 [$past_1$ [the what $past_1$ John be] be [smart]]]]
$PAST(\lambda_1[the'(\lambda P[P(j)(past_1)]) = \lambda x \lambda t[smart(x)(t)]])(t^*)$
"There is a time t before the speech time such that the property that holds of John at t is the property of being smart"

(26)



FI is respected in this structure because the embedded *PAST* is 'deleted', and the embedded *past* morpheme gets bound by the matrix *PAST*. The crucial thing to observe in (26) is that the matrix *PAST* cannot bind the matrix *past*, because the latter "disappears into" $\lambda t[the(\lambda P(P(j)(past_1))] = smart]$—a vacuous property of times.

Notice that without embedded tense 'deletion', (i.e., if we allow the free relative to contain a *PAST* operator), the structure would violate FI:

(27) t* PRES 1 $pres_1$ [what t* PAST 2 $past_2$ John be] smart
$PRES(\lambda_1[the'(\lambda P[PAST(\lambda_2[P(j)(past_2)])(t^*)]) = smart])(t^*)$

(27) violates FI because the matrix *PRES* does not bind anything. This is because the embedded *past* is already bound by the embedded *PAST*, and the matrix *pres* gets 'eaten up' by the vacuous property of times which is its sister.

In sum, whenever we apply IDENT to a post copular phrase, we may end up with a situation where the matrix tense morpheme gets 'eaten up' by a vacuous property of times, and face a potential violation of FI. If the subject contains a relative clause, and the matrix and embedded tenses agree, violation of FI can be avoided by deleting the embedded tense operator and abstracting over the embedded tense morpheme, thus deriving a non-vacuous property of times which serves as an argument of the matrix tense operator.

There are other ways, however, to avoid violation of FI in the circumstances described above. For example, if either the pre- or post-copular phrases provide some free temporal variable which can be abstracted over, FI will be respected even without tense 'deletion'. This is what happens in IdP's.

4.3 The Absence of TH in IdP's

I briefly present two different ways to account for the absence of TH in IdP's, without presenting any arguments in favor of either of them.

The first theory says that the matrix tense operator may bind the time-variable of the 'head' (if the latter does not reconstruct). (29) would be the relevant interpretation of the IdP *The student I saw is Mary*:

(28) t* PRES 1 $pres_1$ [the student(t_1) t* PAST 2 $past_2$ I see] be Mary

(29) PRES(λt[the'(λx[student'(x)(t) &
PAST(λ_2[see'(x)(I)($past_2$)])(t*)])= Mary])(t*)

FI is respected because the matrix tense operator binds the time-argument of the head, and the embedded operator binds the embedded tense morpheme.[3]

The second theory says that the matrix tense operator may bind the time-variable of the post-copular phrase. This theory presupposes quantification over stages (temporal slices of individuals), and assumes that the interpretation of names is relativized to stages. For example, *Mary(t_1)* denotes the stage of Mary at the time denoted by t_1. (31) is the relevant interpretation of

[3] Due to space limitations, I cannot discuss the relative oddity of *The student who is now a professor was John*. This would require an extensive discussion of the temporal interpretation of nouns (see Enç 1981, Musan 1995, and Kusumoto 1999).

the IdP under discussion ('x' and 'y' range over stages, and '$\angle$' means 'is a stage of'):

(30) t* PRES 1 $pres_1$ [the student t* PAST 2 $past_2$ I see] be Mary(t_1)

(31) PRES(λt[the'(λx[PAST($\lambda_2\exists$y[y$\angle$x & see'(y)(I)($past_2$) & student'(x)($past_2$)])(t*)])= Mary(t)])(t*)

We can distinguish now between three types of copular sentences as follows:

A. Specificational: A copular sentence whose matrix tense morpheme saturates a vacuous property of times, and whose matrix tense operator binds a free variable inside the subject (e.g., the embedded tense morpheme).
B. Predicational: A copular sentence whose matrix tense operator binds the matrix tense morpheme.
C. Identificational: A copular sentence whose matrix tense morpheme saturates a vacuous property of times, and whose matrix tense operator binds a time-variable outside the relative clause (but *not* an embedded tense morpheme).

5 The Relation between TH and Connectivity

We saw that the presence/absence of TH in a given copular sentence depends on its semantics. The same is true of Connectivity (for more discussion, see Partee 1986, Jacobson 1994, Heycock and Kroch 1999, and Sharvit 1999).

I assume, with Bach and Partee 1980, Reinhart and Reuland 1993 and others, that *himself* is a reflexivizing operator. Following ideas from Jacobson 1994, Pollard & Sag 1992, and Sharvit 1999, I assume that *himself* denotes the identity function on (male) individuals (λy$\in$MALE[y]). When a relation such as *nuisance-to* is a syntactic sister of *himself*, it needs to be type-shifted in order to be able to take *himself* as its argument:

(32) nuisance-to $\rightarrow$ $\lambda f_{<e,e>}\lambda x\lambda t$[nuisance-to(f(x))(x)(t)]

Himself is of type <e,e> and as such, it is a suitable argument for the output of the derived predicate, and can be 'fed' into it to yield a reflexive predicate:

(33) $\lambda f\lambda x\lambda t$[nuisance-to(f(x))(x)(t)](λy[y]) $\rightarrow$ $\lambda x\lambda t$[nuisance-to(x)(x)(t)]

We saw above that an SP can express identity between two properties, as in *What John was was smart*. But the post-copular phrase can also be reflexive:

(34) What John was _ was a nuisance to himself.

As the reader can see, in this theory Principle A effects arise from the semantics of the reflexive pronoun, rather than from its need to be bound in its governing category. So there is no need to assume that the post-copular material is copied into the gap in order to account for Connectivity. Notice that (34) cannot be read as a PrP, because under such a reading it would mean that the property that held of John (say, being a perfectionist) was at some point a member of {x:x is a nuisance to x and x is male}. This reading is, of course, absurd. In sum, because of their different semantic properties, we expect to find Connectivity in SP's but not in PrP's. In these constructions Connectivity correlates with TH.

What about IdP's? It is often thought that they do not exhibit Connectivity, due to the existence of examples such as (36), which contrasts with the grammatical SP in (35). I assume that both sentences contain a functional dependency in the sense of Engdahl 1986 and Chierchia 1993, and that (35) roughly means "the function which maps the referent of *she* to the student she saw in the mirror is the identity function on female individuals" (see Jacobson 1994 and Sharvit 1999):

(35) The student she saw in the mirror was herself.
t* PAST 1 past$_1$ the Op$_5$ past$_1$ she$_6$ see $e_{5/6}$ student(t_1) be herself.

(36) ??The student she saw in the mirror is herself.
t* PRES 1 pres$_1$ the Op$_5$ t* PAST past$_2$ she$_6$ see $e_{5/6}$ student(t_1) be herself.

However, if IdP's do not exhibit Principle A Connectivity, we expect them not to exhibit Principle C Connectivity either. But this is not so. In the IdP in (37), coreference between *she* and *Rachel* is not possible:

(37) The student *she* saw in the mirror isn't *Rachel*.

I suggest that Principle C indeed must be obeyed in (37) (whatever theory of Principle C we entertain). (35) and (36) both have well-formed LF's, where FI is respected. However, (36) is relatively odd (despite its well-formed LF) because the most salient reading of (35)/(36) (out of the blue, at least) presupposes that the individual seen by the referent of *she* was a student while the seeing took place. Therefore, there is a tendency to interpret the time-

argument of [student] as bound by the same tense operator which binds the embedded tense morpheme, and to delete the embedded *PAST* in order to avoid FI violation. But such deletion happens only under agreement (as is the case in the SP in (35)).

6 Conclusion

This paper argued for an analysis of TH according to which this sort of tense agreement results from the necessity to obey Full Interpretation. One way to obey FI is via a process of LF tense 'deletion', which has been argued to occur in various kinds of embedded clauses. Copular constructions that use LF tense 'deletion' as their means of respecting FI are the constructions we have been accustomed to refer to as "specificational pseudoclefts".

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Department of Linguistics
University of Connecticut
U-1145
Storrs, CT 06269-1145
sharvit@uconn.edu