

# Propositional Attitude Verbs and Embedded Tense in Greek and English

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## 1. Introduction

A considerable number of anaphoric tense theories suggest that embedded tense under propositional attitude verbs (PAVs)<sup>1</sup> such as *think*, *say*, *believe* etc. should be interpreted with respect to the time of the matrix sentence, and assume that embedded tense is anaphoric to (Partee 1973, 1984) therefore substitutable by (Abusch 1988, 1991, 1997a; Ogihara 1989, 1994b, 1995b, 1996, 2003a; among others) the tense in the main clause. In this paper<sup>2</sup>, I challenge this view by examining cross-linguistic variation in the distribution and interpretation of embedded tense in Greek and English. Contrary to the main arguments of anaphoric tense theories, I argue that embedded tense is underspecified in its temporal relation with the time of PAVs in the matrix sentence. Tenses, I argue, are descriptive terms which can be interpreted referentially or attributively to an interval, and they are not genuine cases of anaphoricity. Moreover, I claim that there is an intersentential relation of intervals (matrix and embedded) the temporal location (or the temporal ordering) of which can be determined by context information. The relation of matrix and embedded tense is envisioned as an interpretation-context shift and not as a semantic (Ogihara 1996; Abusch 1997; Sharvit 2003; a.o.), syntactic (Stowell 2004; Kratzer 1998; a.o.) or lexical ambiguity (Gennari 2003, a.o.). After introducing the relevant background on temporal interpretation of embedded tense in section 2, I point to the problems of the traditional analyses in section 3. In section 4 I present data that show that the interpretation of embedded tense is best explained as depending on context rather syntactic or semantic mechanisms. I develop a novel semantic analysis that accounts for the variation on the basis of temporal relation between a matrix and an embedded tense determined by

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<sup>1</sup> (P)NP = (Perfective) Non-past, PP = Perfective Past, INP = Imperfective Past, IP = Imperfective Past, pl = plural, sg = singular

<sup>2</sup> I would like to thank the audience of Chronos 10 for inspiring discussion. I am especially grateful to Cleo Condoravdi and Daniel Altshuler for their valuable feedback and constructive comments. All errors are my sole responsibility.

variadic functions which feed on contextual information in section 5. Section 6 concludes the paper.

## 2. Background: Anaphoricity and Interpretation of Embedded Tense

A puzzle that has drawn considerable attention in the field of tense theory is the temporal interpretation of embedded tense, or, in other words, how an embedded tense can find its temporal location under a propositional attitude verb (PAV) such as *consider*, *think*, *believe*, etc. Consider the following examples and the interpretation that embedded tense receives:

- (1) Mary thought that euro was strong
  - a. simple past (overlapping with past in main clause)
  - b. pluperfect (preceding the past interval of the main clause)
  
- (2) Mary thought that euro is strong
  - a. simple past (overlapping with past in main clause)
  - b. simple present (overlapping with UT)

The first and the second example contain an embedded interval that in the first case is interpreted as ambiguous between a simple past and pluperfect interpretation, and in the second case, the embedded interval overlaps with both past in the main clause and with utterance time (UT) producing the Double Access reading (DAR).

The interpretation of embedded tense has not been an easy task. One dimension of complication has to do with the special status of PAVs that are considered as an opaque context (Quine 1969; Lewis 1979) meaning that we cannot interpret the features of an embedded tense unless we relate them to the features of the main tense via a syntactic or semantic mechanism (see Ogiwara 1996; von Stechow 1995; Abusch 1997a). Abusch (1988, 1991, 1997a) argues that there is a systematic ambiguity in the interpretation of embedded tense which is resolved via an acquaintance relation that causally or perceptually relates the PA holder's now with the time of the embedded predicate, and which consequently provides the temporal interpretation of the embedded tense. This, as we will see later, does not sound right, as it presupposes a causal or perceptual relation in order to determine the temporal location of an embedded tense with regard to the tense in the main clause. The data that I discuss in this paper point to an analysis in which the context has a crucial role in determining the interpretation of embedded tense.

Another fact related to the interpretation of embedded tense is finding the evaluation time relative to which the embedded tense should be interpreted. In order to resolve the ambiguity two schemes have been

proposed; first, the embedded tense should be interpreted relative to the UT – the indexical view, second, the embedded tense should be interpreted relative to the time of the PAV of the main sentence – the anaphoric view. Ogihara (1989, 1994b, 1995b, 1996, 2003a) suggests that the evaluation time is found on the main clause, because embedded clause is considered as tenseless. However, data from English and Greek support the view that embedded tense is not void of its temporal features, and that these can be interpretable. Moreover, Ogihara's account fails to explain examples in which there are more than one embedded tenses. We will examine data that contrary to the accepted view, languages like English and Greek, typologically different languages, present a richer interpretation of embedded tense under PAVs.

### 3. Anaphoric Theories of Embedded Tense: Questions Raised

The temporal interpretation issue is widely debatable, and many theories have been proposed to resolve the question how embedded tense under PAVs receives its interpretation. There are four main approaches to embedded tense interpretation: semantic, syntactic, event, and lexical theories. These theories vary in terms of analysis and what they define as their subject of matter. Here, I will only focus against semantic and syntactic theories (see Staraki, in preparation for an argumentation against event and lexical tense theories as well), due to limited space, and point to their drawbacks.

Abusch (1988, 1991, 1997a) argues that an embedded tense is defined in terms of constraints on temporal relations provided by PAVs. PAVs functioning as operators introduce a set of temporal relations which are transmitted by a feature mechanism to the intensional arguments, the embedded tense. According to Abusch a past node does not have the obvious interpretation (temporal precedence), but is somehow licensed by the presence of an embedding past tense node. Consider the following example:

(3) John believed that Mary was pregnant

Abusch's transmission theory predicts systematic ambiguity of embedded past tense; it is interpreted as overlapping with the past tense in the main clause (simple past interpretation), and as preceding the past interval of the main clause (pluperfect interpretation). Mary's pregnancy is both overlapping and preceding the tense of the belief. However, the overlapping and the pluperfect interpretation are not clearly distinct from each other. Eventualities in main and embedded sentence are in the past tense but without specific information on their temporal ordering.

For DAR phenomena, Abusch proposes an acquaintance relation causally or perceptually relating the PA holder's now with the embedded predicate's time. Acquaintance relation picks out a time (*de re* interpretation) that is ascribed to the interval with which the PA holder is acquainted with, for example (cited from Abusch 1997a):

- (4) The defendant **was<sub>2</sub>** actually at home watching “The Simpsons” **at the time of the crime<sub>2</sub>**. But after hearing the testimony of the first eye-witness, the jurors clearly believed<sub>3</sub> that he **was<sub>2</sub>** in the laboratory building.

$\lambda t \lambda x_{\text{self}} \lambda t_{\text{now}} \lambda w$  [t is a time when the eyewitness (who  $x_{\text{self}}$  heard testify in w shortly before  $t_{\text{now}}$ ) experienced such and such events and  $t < t_{\text{now}}$ ]

For Abusch (1997a) the jurors are acquainted with the time of the crime *res* through the acquaintance relation which associated the time of the embedded predicate with the time believed by the believers, the jurors. However, this analysis, I think, is wrong on two counts. First, it establishes a causal relation - the acquaintance relation of the believer to the embedded predicate - on which it grounds the temporal relation between main and embedded tense. This wrongly implies that if there was not an acquaintance relation, causal or perceptual, a temporal relation between the “time of the crime” and the period of time when the defendant was in the lab” would not exist. Second, we do not need to rely on acquaintance relation since the contextual information that the crime precedes a testimony about a crime is enough to determine the temporal location of the embedded tense (the time of the crime and the time where the defendant was precede the time of juror's belief), without relying on a causal relation. The model of PAVs, as I argue later, has to be based on the speaker – the ascriber of a cognitive content, who determines the relation between the believer and the object clause.

Ogihara (1989, 1994b, 1995b, 1996, 2003a) accounts for the SOT phenomenon by offering a deletion of tense morpheme rule, which applies at LF, before the syntactic structure, defined as follows:

- (5) *Ogihara's (optional) Tense Deletion rule*

A tense morpheme  $\alpha$  can be deleted iff  $\alpha$  is locally c-commanded by a tenses morpheme  $\beta$ , and  $\alpha$  and  $\beta$  are occurrences of the past tense morpheme.

I will illustrate the point Ogihara makes using one of his examples:

- (6) a. John said that Mary was sick.  
b. John Past-say that Mary Past-be sick.

c. John Past-say that Mary  $\emptyset$  be sick.

The embedded clause, according to Ogihara, can be thought of as tenseless sentence. The embedded past tense is not an absolute past tense; or, in other terms, embedded past tense is not a past tense, because it is c-commanded by a matrix past tense. Adopting a *de se* analysis (Ogihara crediting Castañada 1968 and Lewis 1979), Ogihara assumes that the intension of the tenseless sentence is a set of times-world pairs and that propositional attitudes involve the subject's self-ascribing properties and not the actual temporal precedence of the past tense. This analysis yields the right truth conditions, since when the deletion rule in (number) applies, a simultaneous reading results; as stated by Ogihara, there is a past time at which John talked as if he self-ascribed the property of being located at a time at which Mary is sick. Accordingly, when the deletion rule does not apply, a shifted interpretation yields; the time at which Mary's being sick is prior to the time of John's saying. Nevertheless, Ogihara's analysis is engaged in the same conceptual disadvantages as Abusch's analysis. Ogihara (1996) forces a *de re* via a *de se* interpretation. This approach is misleading, I believe, because, as we saw earlier in our discussion, PAVs are ascriptions of cognitive content on speaker's part. A *de se* interpretation wrongly assumes that the subject of the ascription determines the temporal ordering of embedded tense. The subject of the ascription does not ascribe a belief or a thought; rather, she is the assignee, the individual to whom a cognitive content has been ascribed. Moreover, as proved above, a *de re* interpretation closely relating an interval with a definite time from the context is misleading in two counts. First, there is more than one reading for the embedded interval ranging from a *de re* (referential) to a *de dicto* (attributive) interpretation. Crucially though, these readings do not mean that PAVs contribute information with respect to the temporal location between main and embedded tense. Therefore, a *de se* and a *de re* interpretation solely cannot account for the interpretational variability of embedded tense.

Contrary to a semantic and a syntactic treatment of content – report mismatches, Gennari (1999b, 2003) presents a pragmatic way of explanation in which the content – report mismatch is due to the speaker's attribution of a belief. According to Gennari (1999b, 2003) the speaker interprets the embedded tense as somehow mirroring an interval which the believer himself would accept. Believer is not committed to any particular temporal content since speaker's report is viewed as a report of an implicit attitude (Gennari (2003) crediting Stalnaker 1999) or a way of representation. From a methodological point of view, Gennari (2003) grounds her pragmatic explanation on the assumption that the holder of a PA has access to speaker's point of view. Let us consider an example:

- (7) a. John believed that Mary is pregnant  
 b. In 1950 John told that Mary is pregnant  
 c. To 1950 o Janis ipe oti i Maria ine-NP engios

According to Gennari (2003), example in (7) represents content – report mismatch, meaning that a past should have been embedded instead of a non-past tense. Be that as it may, Gennari (2003) explains the mismatch by assuming that the believer has the typical assumption about the duration of a pregnancy, which was held at a past time and might also hold for a while; beyond that past point and extending to an interval *i* into the future. This is what typically is assumed for pregnancies. However, Gennari (2003) considers, and that is where the problem starts, that the interval *i* is overlapping with a future time *t'*, which is the speaker's point of view expressed in a non-past tense – the speaker's now is the future of the believer. However, there is no evidence of association between the believer's assumption and knowledge with the speaker's point of view. In (7b - c), we also have an embedded non-past tense but this time the sentence refers to the year 1950. If we were to assume that pregnancies hold for a while, how long should we consider that “for a while” interval *i*, overlapping with a future time *t'*, which is the speaker's point of view expressed in a non-past tense, which is defined with respect to UT? Clearly, believer's typical knowledge of pregnancy duration cannot be associated with speaker's view, because the believer cannot access the world of the speaker.

#### 4. Embedded Tense: The Role of Context and Belief Ascriber

In this section I present data that show the interpretation of embedded tense is best explained as depending on context rather syntactic or semantic mechanisms that substitute embedded tense features with those by main tense. First, some background on Greek and English embedded tense.

##### 4.1 Background on Embedded Tense in Greek and English

Temporal interpretation of embedded tense (past and non-past) comes into two schemes: present (non-past) under-past and past-under-past. English and Greek, have past and non-past tenses<sup>3</sup>. In the examples in (8) – (9) I illustrate the past and non-past tenses of English and Greek in matrix clauses. In examples in (8), both English and Greek non-past indicate events, actions

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<sup>3</sup> I use the term “non-past” tenses since these tenses are compatible with both present and future time reference in both languages (see Enç 1996; and Werner 2003, 2006 for English and Giannakidou 2009 for Greek)

or situations which are true in the present period of time and which for all we know may continue indefinitely. Non-past can be used to refer to habitual actions, and express future reference<sup>4</sup>:

- (8) a. O Alexis taksidevi tora / avrio / siχna / \*χtes  
 The Alex travel-3sg.INP  
 Alex is travelling now / ~ travels tomorrow / ~ travels often / \*  
 ~ travels yesterday  
 b. Alex travels tomorrow / \* yesterday

In examples in (9), past tense denotes events, actions or situations which occurred prior to a time reference (given or understood by the context) and are now finished. Past tense in English and Greek are compatible with temporal adverbials that point to a past reference time, i.e. χtes (yesterday):

- (9) a. O Alexis taksidese χtes / \* avrio / \* tora  
 The Alex traveled-3sg.PP (yesterday/\*tomorrow)  
 Alex traveled yesterday / ~ \*traveled tomorrow  
 b. Alex traveled yesterday / \* tomorrow / \* now

Both past and non-past can be found under PAVs. In (10), the embedded tense is non-past. The generally accepted view is that embedded non-past under PAVs eventuality is true not only when said at a time in the past that Alexi's was tired and that time overlaps with Irene's saying (overlapping interpretation), but that the time of Alexi's being tired also includes the speech time. This is the so-called Double-Access Reading (DAR).

- (10) a. I Irini ipe oti o Alexis ine kurasmenos tora / \*χtes / \* avrio  
 The Irene said-3sg.PP that the Alex is-tired-3sg.INP now  
 \*yesterday / \* tomorrow  
 Irene said that Alex is tired now / \* yesterday / \* tomorrow  
 b. Irene said that Alex is tired now / \* yesterday / tomorrow

Nevertheless, embedded non-past tenses do not always receive the DAR interpretation, and this is what the next set of sentences in (4) illustrates:

- (11) a. I Irini ipe oti o Alexis taksidevi tora / avrio / siχna / \* χtes

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<sup>4</sup> Depending on the type of the eventuality (Aktionsart) the non-past in English and Greek will be interpreted differently. However, I will ignore these differences here since I intend to talk about the temporal interpretation of tenses under PAVs.

The Irene said-3sg.PP that the Alex travel-3sg.INP  
 Irene said that Alex is travelling now/ ~ travels tomorrow  
 / ~ travels often / \* ~ travels yesterday

- b. Irene said that Alex travels now/ tomorrow / often / \* yesterday

In (11) the embedded non-past eventuality does not have to include both a past and a present time of reference for its interpretation. As I will show later in the paper this implies that DAR is not a generalizable phenomenon, and should be considered as by-product of interpretation with respect to the type of the embedded eventuality.

PAVs also embed past tense both in Greek and English. According to the mainstream literature (Abusch 1997a), English embedded past in (5) is ambiguous between an interpretation where the time of Alexi's being tired precedes the time of Irene's saying (the "back-shifted" or "pluperfect" interpretation) and an interpretation where the time of Alexi's being tired overlaps with the time of Irene's saying (the 'overlapping' interpretation). Embedded past tense in Greek and English is compatible with past oriented adverbials, i.e. *χτες* (yesterday) and incompatible with temporal adverbial that point to a future reference time.

- (12) a. I Irini ipe oti o Alexis itan kurasmaenos (*χτες/\*avrio*)  
 The Irene said-3sg.PP that the Alex was-tired-3sg.IP  
 (yesterday/\*tomorrow)  
 Irene said that Alex was tired yesterday / \* tomorrow  
 b. Irene said that Alex was tired yesterday / \* tomorrow

#### 4.2 Embedded Tense's Features

The most important observation when we consider a wider set of embedded tense cases in two typologically different languages, English and Greek, is variation with respect to the interpretation of the embedded tense, and lack of semantic, syntactic or lexical information which will determine the temporal location between main and embedded tense. In the example (13), part of the embedded predication holds in the past domain and part of it holds now, and it might hold in the future. In the same examples, the embedded tense can denote just an interval that overlaps with the UT.

- (13) a. I Maria ipe oti o fakelos vriskete sto ghrafio su (tora / apo perisi)  
 The Maria said-3sg.PP that the envelope is-3sg.INP at-the desk  
 your (now / from last year)

Maria said that the envelope is / has been sitting at your desk (now / since / last year)

- b. Paul said that his father works in a bank

In the next examples, the embedded non-past tense is not interpreted relative to the past time in the main clause. On the contrary, the embedded tense express future time reference; consider the following:

- (14) a. I Maria nomise oti o Janis fevji stis 11 to proi  
The Maria thought-3sg.PP that the John leaves-3sg.INP at 11 a.m  
Maria thought that John leaves at 11 a.m.  
b. Paul thought that we leave tomorrow at 11a.m.

A case that is scarcely mentioned is embedded tense that expresses a generic time; meaning that the interpretation of an embedded tense does not depend on any evaluation time, UT (indexical) or PAVs (anaphoric). Consider the following example in (15). The embedded predication does not hold at any particular time. It rather expresses a habitual action or an eventuality that happens repeatedly. This is true for English and Greek examples. Greek example can also denote a present or future oriented interval when temporal adverbs are used like *now* (tora) and *tomorrow* (avrio) respectively. The embedded present does not locate the interval as overlapping with UT or with the time of the main clause. Thus, the main clause cannot determine the range of the interval of the present ( $t, \infty$ ) that is the interval of the present up to  $n$  (now).

- (15) a. I Maria ipe oti ta eghrafa katastrefonte (tora / avrio)  
The Maria said-3sg.PP that the documents are.destroyed-3pl.INP  
(now / tomorrow)  
Maria said that the documents are shredded  
b. Paul believed that Mary smokes forty cigarettes per day

Thus, we observe that neither the indexical nor the anaphoric theories can truly explain the variation in the interpretation of embedded tense. Likewise, none of the theories suggested can account for the variation of past – under – past embedded tense. Let us consider the next examples in (16) where the embedded tense carries an inchoative meaning. In this case, the embedded past tense can neither be interpreted as preceding nor as overlapping with the past time of the main sentence. This is true for Greek and English examples, as follows:

- (16) a. O Janis pistepse oti i Maria ton aghapise

- The John believed-3sg.PP that the Mary him loved-3sg.PP  
 John believed that Mary loved him
- b. Irene believed that Paul caught cold

In (17), the embedded past tense is interpreted as either preceding or overlapping with the past tense of the main tense, for example:

- (17) a. O Janis ipe oti i Maria kurastike  
 The John said that the Maria was.tired  
 John said that Maria was tired
- b. Irene said that Paul was tired

Another interesting variation is when embedded tense expresses a habitual action at a past time with general, timeless validity. In the next examples, time is generic and there is no specific evaluation time relative to which we interpret embedded tense. Consider the following cases in Greek and English:

- (18) a. O Janis ipe oti  $\chi$ athike an ton vrun  
 The John said-3sg.PP that lost-3sg.PP if him find-3pl.PNP  
 John said that he's done for if they find him
- b. Irene said that Paul smoked forty cigarettes a day

Interesting cases are the next English sentences which illustrate cases of pretense mental representation, for example:

- (19) a. Irene believed that we would win.  
 b. Mary believed that she got up tomorrow and she had wonderful teachers.

Obviously, the past embedded eventuality is interpreted as holding in the future, and definitely not in the past.

As a last case I present the following set of Greek and English examples which indicate that there is no sequence of tense (SOT), and the use of tenses is mostly driven by the choice to report a statement using tenses that match the speakers viewpoint based on the facts of the situation as he sees them at the time of speaking, for example:

- (20) a. O Ghalileos **ipe**-3sg.PP oti o ilios **ine**-3sg.INP to kendro tu iliaku sistimatos
- b. Galileo **claimed** that the sun **is** the center of the solar system

- c. O Ghalileos **ipe**-3sg.PP oti o ilios **itan**-3sg.PP to kendro tu iliaku sistimatos  
 c. Galileo **claimed** that the sun **was** the center of the solar system

The truth of the embedded sentence is unquestionable – nevertheless the choice of tense in the embedded clause (non-past or past) illustrates the point of view of the speaker without denying the truth of the embedded predicate.

From the examples in Greek and English we notice that embedded tenses do not discount their temporal features in all cases – they still refer to an interval (non-past or past), and that the missing component, which cannot be found by accepting either indexical or anaphoric view of embedded tense, is the temporal relation between main and embedded clause. In fact, PAVs do not affect the interpretability of embedded tense due to opacity; rather they are used to ascribe a thought, a belief, a statement, etc. Moreover, the embedded predicate of an attitude verb does not contain both past and present temporal properties – accepting this would mean that embedded past and present are ambiguous (which is not the case), and the interval they refer to bears multiple interpretations. Instead, I contend, there is a distinct case of temporal reference: the one of the belief (PAVs) (interval of the main sentence) and one of the embedded predicate (interval of the embedded predicate); we need to find the temporal location between those two. I argue that embedded past and non-past tense are not ambiguous, as argued in Ogihara (1996) and Abusch (1997) (among others) but underspecified for temporal location in relation to the main clause. We are not dealing with ambiguity of embedded tense, but with an intersentential relation of intervals (main and embedded) the temporal location (or the temporal ordering) of which can be determined by context information. In what follows, I lay out the arguments of a novel analysis of embedded tense in **English and Greek embedded tense**.

#### 4.3 Interpretation of Embedded Tense: context and the role of the ascriber

Greek and English examples in (21) – (23) are not ambiguous but underspecified. The ordering of the eventualities is clarified when contextual information is provided. Consider the following example in Greek and English:

- (21) a. O Janis **pistepse**-PAST oti o Vasilis **itan**-PAST eftixismenos  
       sta 40a jenethlia  
       b. John **believed** that Bill **was** happy on his 40th birthday.

- (22) a. O Janis **pistepse-PAST** oti o Vasilis **itan-PAST** eftixismenos  
sta 40a jenethlia, otan ton iðe na çamojelai.  
b. John **believed** that Bill **was** happy on his 40th birthday *when he saw him smiling*.
- (23) a. O Janis **pistepse-PAST** oti o Vasilis **itan-PAST** eftixismenos  
sta 40a jenethlia tu otan emaθe oti o Vasilis çamojeluse.  
b. John **believed** that Bill **was** happy on his 40th birthday *when he found out he was smiling*.

Unless we have contextual information, we cannot determine whether the time of believing overlaps with the time of Bill being happy (22), or believing time follows the time of Bill being happy for his 40<sup>th</sup> birthday (23). Hence, contextual information compensates for the lack of information about temporal ordering.

In the next examples from Greek and English, I show that embedded present has been the source of misconceptions in the tense theory literature. If we stay close to Ogihara (1989) and von Stechow (1995), the example in (24) that contains embedded non-past should be deleted and interpreted as follows: John believed that Mary was coming at a time overlapping with John's subjective now. Nevertheless, this interpretation is not the only one. Example in (24) can also mean that John believed that Mary is planning on coming at a time that does not overlap with John's subjective now, but at a time in the future:

- (24) O Janis pistepse oti i Maria erçete / çtizi spiti  
The John believe-PP that Maria come-NP / build-a-house-NP  
John believed that Mary is coming / comes / is building / builds a house

The interpretation is similar for the predicate *build*, as well. First, John believed that Mary is building a house at a time that does not overlap with John's subjective now, but it is the case that it started in the past and continues in the future. Second, John believed that Mary was coming at a time overlapping with John's subjective now. Thus, present tense deletion in embedded contexts does not guarantee the correct interpretation. For a correct interpretation of embedded clauses the aspectual information also has to be taken into account, although I will not make the strong statement, as Gennari (2003), that tense is dependent on aspectual information (see Staraki, in preparation).

Be that as it may, both syntactic-semantic and pragmatic approaches suffer from methodological and conceptual faults. From a conceptual point of view, Abusch (1997a), Ogihara (1996) and Gennari (2003) by default accept

that embedded tense is similar to anaphoric pronouns; its interpretation always depends on an explicit referred time specified from the matrix clause. This assumption, which is the essential argument of anaphoric theories, has a sort of unwelcome consequences. First, it implicitly commits us that the temporal location of an embedded interval should always be determined with respect to a definite point in time, specifically UT. However, in the example in (25) the assimilation of tense to anaphoric pronouns does not make the right predictions, for example:

(25) Sheila had a party last night and Sam got drunk

The concept that a tense is always anaphoric and relative to a definite time is misleading and problematic in analyzing embedded tense (see Staraki, in preparation). Second, the supposedly indexical nature of tenses that defines a tense with respect to UT is not comparable in kind for all temporal dimensions. Among languages and within a language itself there are varieties of tenses that UT does not play any role in determining the temporal dimension of an interval (see Staraki, in preparation). Consider Greek non-past tense, which means that nonpast interval instantiates a property that lacks temporal orientation and it does not give the UT as its value, for example:

(26)  $[[nonpast]] = \lambda P \lambda t P((t, \infty))$  Giannakidou (2009)

In the definition for non-past of Greek a contextually given time will determine the temporal location of the non-past. Otherwise, the Greek non-past tense's orientation is underspecified. Moreover, consider the English non-past tense which instantiates an interval in which UT is selectively part of the temporal dimensions it determines, for instance:

(27) a. Cats like milk (generalization)  
 b. He never forgets his wallet (habitual or repeated action)  
 c. He needs help right now (something happening now)

In (27a) and (27b) UT is not part of the temporal location of the eventuality, contrary to (27c). Opposite to anaphoric theories, I assume, as argued earlier in the discussion, that tenses are descriptive terms that can have either a referential or an attributive use. Tenses do not always depend on UT, and they do not denote inherently the temporal location of an eventuality with respect to another eventuality (see Staraki, in preparation).

## 5. Analysis: Variadic Functions and Interpretation of Embedded Tense

In the previous sections we established that propositional attitude complements (PACs) do not contribute any information on their temporal location between the matrix and the embedded eventuality. Now, my goal is to show that PAVs puzzle has two components (Staraki, in preparation) for both Greek and English, and argue against the current literature on the interpretation of embedded tense which is based on the following assumption: embedded tense is anaphoric to (Partee 1973, 1984) therefore substitutable from (Abusch 1988, 1991, 1997a; Ogihara 1989, 1994b, 1995b, 1996, 2003a; among others) the tense in the main clause because of the special status of PAVs (opaque context). I argue that embedded tense is not a genuine case of anaphoricity and I examine embedded tense in Greek and English based on the following arguments: (a) Contextual shifts, and (b) The role of the belief ascriber.

### 5.1 Contextual Shifts

Contextual shifts determine the extension of presumably identical terms. Likewise, embedded tense is another case of contextual shift like indexicals and proper names whose extension is determined by change of context. Let us take the case of indexicals:

- (28) a. **You** get allergies with Alpha medicine  
 b. According to physicians research **you** get allergies with Alpha medicine

If one utters the first statement it will express a singular proposition about the person that it is addressed to, for example, when I address my friend Paul. However, if the second statement is uttered, then it will not express the same proposition as the first one. Instead, the indexical *you* will be associated with any person that will be suitable in the context of which is part of.

The case of proper names is another argument in favor of how contextual shifts affect the extension of a term, for example:

- (29) a. Pandora is a moon  
 b. John believes that Pandora is a moon

Imagine this circumstance. In a web site about movies there is a description of the movie “Avatar” where Pandora is characterized as a lush moon in the Alpha Centauri. John knows about the lush moon, but he has

hardly ever heard about Pandora, one of the natural satellites of Saturn. Then, if one were to utter the first statement, he would express a singular proposition about Pandora. However, if one utters the second statement the same proposition, now under the belief report one would not express the satellite of Saturn called ‘Pandora’, but he would refer to a lush moon in Alpha Centauri. Therefore, we are not licensed to associate expressions to be freely interchangeable unless they have the same extension in a shifted circumstance (see Recanati 2000). Consider now an example with tense embedded under a PAV:

- (30) a. John: Maria is pregnant  
 b. Paul: John said that Maria was pregnant

John asserts the pregnancy of Maria and he uses non-past tense to register an eventuality that is current to the time he utters it. On the other hand, Paul’s report is in past tense as he described an eventuality that according to his point of view happened in a time anterior to the time he communicated his utterance. John’s assertion in non-past tense and Paul’s report in past tense cannot be interchangeable because PAVs, as I propose here, are context shifters. This means that PAVs change the context of evaluation, thus, altering the extension of the embedded tense. Anticipating the discussion, embedded tense cannot be semantically or syntactically substituted by any kind of temporal interval (in the case at hand, non-past), unless the belief ascriber determines how an embedded tense should be conveyed in relation with the context. I will elaborate on this later in the discussion.

For those that still insist that a past tense is semantically and/or syntactically equivalent to or substitutable by non-past, I present the following examples:

- (31) a. John: Mary’s son has blue eyes  
 b. Paul: John thought that Mary’s son has / had blue eyes  
 c. O Janis nomise-PAST oti o jos tis Meris ehi-NP / ihe-PAST ble matja

Semantic or syntactic substitution of past by non-past does not always result in grammatical sentences. John has just glanced Mary’s son and he then uttered *Mary’s son has blue eyes*. Faithful to the mainstream interpretation of embedded tense Paul’s report should normally be in a past tense *John thinks that Mary’s son had blue eyes*. However, both versions of embedded tense, past and non-past, are acceptable by native speakers of English, and the same is true for the Greek example in (31c). One possible explanation is that, in the first version, non-past tense is used to express a

potential relation between the reporter of John's thought and the subject of the embedded sentence, the boy. In analogy with the first interpretation, past in the second version might be used when the reporter of the thought is not related to the subject of the embedded tense, the boy.

Another example, that follows, illustrates a case in which non-past cannot substitute semantically or syntactically the preceding past tense, either in English or Greek. In this circumstance, the non-past cannot possibly surface and be associated with an eventuality located at a past time:

- (32) a. John: I just shot a bird.  
 b. Paul: ?? The bird you just shot is a robin, but it is dead now.  
 c. ?? To puli pu molis skotoses ine.3sg.NP enas kokinolemis, ala ine.3sg.NP nekro tora

The above-mentioned examples strongly indicate that contextual shift determines the interpretation and the association of an embedded tense. Thus, I claim, the temporal interpretation of an embedded tense under PAVs should be grounded in the interpretation of context shift, and from the utterer of a proposition to the ascriber of a belief (for belief ascription see Recanati 2000). As a result, we are not licensed to interchangeably substitute embedded tense with a tense of an assertion due to contextual shift. This finding brings me to the third assumption of the theory I suggest: the point of view of an ascribed belief and the many readings that embedded tense might have under PAVs.

Temporal interpretation of embedded tense crucially depends on defining the type of the embedded term. By doing so, we determine the range of readings of the embedded term. By analogy, before we proceed in any analysis of embedded tense, we need to decide how we treat tense when embedded. Two main approaches have been proposed for the interpretation of tense: the quantificational (Prior 1967, 1968; Montague 1973; Dowty 1979; Stump 1985; a.o.), and the referential (Partee 1973, 1984; Enç 1986; Hinrichs 1986; Abusch 1997a; Ogihara 1996; a.o.). With respect to the first approach, tense is a quantified expression. Tense is interpreted to be indefinite, and it is described by existential quantification over intervals. With respect to the second approach, tense is interpreted to be an anaphoric expression, in a similar way to pronouns, carrying a free variable that anchors to a salient local evaluation time contextually supplied. Contrary to the above-mentioned approaches, I argue that we cannot be faithful to either approach if we want to account for the interpretational variance of tense in both main and embedded clauses (see Staraki, in preparation). Tense, I argue, should be treated as an **indefinite** description (see for details Staraki, in preparation).

## 5.2 The role of the belief ascriber

In the previous sections I showed that embedded tense is not a genuine case of substitution therefore anaphoricity, because of contextual shifts. In this section, I aim to show that embedded tense is referential or attributive to a temporal dimension, but void of any information about its temporal location with respect to another eventuality. There is no contradiction to this claim with what I have just argued against substitution and anaphoricity. Consider the following example cited by Partee (1984:245):

(33) Sheila had a party last night and Sam got drunk

According to Partee (1984) past tense refers to a definite past time which is understood as an anaphoric element the specification of which is provided by a (non-)linguistic context. In the example (33), the time that Sam got drunk is understood as overlapping with the time that Sheila had a party. In Partee's (1984) interpretation there is a contextually provided temporal framework (antecedent) in which tense is anaphoric to. However, the sentence offers another interpretation in which there is no temporal connection whatsoever; *Sheila had a party* and *Sam got drunk*. In this interpretation the eventualities denoted in each sentence are independent. We observe two important things; first, tense does not refer to any particular interval, definite or indefinite, until under contextual resolution, second, describing a temporal dimension (past or non-past) is quite different from arguing that tense inherently conveys information about the temporal location of each eventuality it modifies. Temporal dimension does not presuppose temporal location and vice versa. Thus, I consider embedded tense as a description of a temporal dimension (past or non-past) with the temporal location (before, after, overlapping, etc.) being underspecified. My claim that tense is a descriptive expression has important consequences on its interpretation when embedding under PAVs.

Adopting the sharp classification that Recanati (1997) introduced for the readings of belief sentences, I argue that embedded tense is a descriptive term and as such returns transparent, opaque and mixed readings (Staraki, in preparation). The distinctive feature of these readings of embedded tense under PAVs, I argue, is the point of view of the speaker which is surprisingly ignored in the temporal interpretation of embedded tense. In the model of analysis I propose for embedding under PAVs the model of the speaker (the ascriber of a belief) is relevant (Staraki, in preparation). The speaker's role is crucial because the temporal interpretation of the embedded tense is up to the speaker's interpretation and/or the ascription that's being made by the

speaker to the believer. For this claim I propose a novel definition of propositional attitude model:

(34) Speaker's Attitude Model

A speaker's attitude model  $M_B(x)(y)$  is a set of worlds associated with an individual  $x$ , the ascriber of a cognitive content and an assignee  $y$  of a cognitive content, representing worlds compatible with what  $x$  ascribes to  $y$ .

$M_B(x)(y)(w) = \{w' : \forall p [x \text{ ascribes } y \text{ that } p(w) \rightarrow p(w')]\}$ , where  $w$  is a world of evaluation, and  $x$  is an individual ascribing  $p(w)$  to  $y$ .

The most notable exception about the role of the speaker in belief reports comes from Gennari (1999b, 2003). Gennari (2003) employs, crediting Stalnaker (1999), the concept of implicit beliefs to explain the content-report mismatches, i.e., present – under – past belief reports. Although, my proposal about the role of the speaker resembles to Gennari (2003), I do not claim, contra Gennari (2003) that embedded tenses are indexical, or that the role of the speaker is limited in explaining cases of content-report mismatches (see Gennari 2003 and her explanation about present – under – past cases). Instead, I argue that the role of the speaker is a systematic feature of an attitude model which we have to account for when we consider the case of embedded tense under PAVs.

The role of the speaker - the ascriber of a cognitive content - cannot be discounted. Indeed, embedding under PAVs tense involves crucially the point of view of the speaker that ascribes a concept to the believer. I distinguish three classes of readings mainly inspired by Recanati (1997), *exercised de dicto* and *de re belief* by the speaker, *ascribed de dicto* and *de re belief* by the speaker, and finally the mixed belief model, *exercised* and *ascribed de dicto* and *de re* by the speaker. In the first type of ascription, the speaker the cognitive content is exercised by the speaker. In the second type, the believer is the assignee, the individual to whom a cognitive content has been ascribed by the speaker. In the third type, the speaker exercises a cognitive content and at the same time the speaker ascribes content to the believer. Let us consider a classic example which under the new interpretation of embedded tense I provide here will resolve the misleading syncretic views of anaphoric theories:

- (35) a. O Janis pistepse-PP oti i Maria itan-PP engios  
 b. John believed that Mary was pregnant

The speaker's belief model gives us the next readings of the embedded tense.

**Exercised de dicto:** The interpretation of embedded tense is descriptive. The speaker does not specify the interval's temporal location. The speaker says that a past interval (no matter its temporal location in relation to the main tense or the UT) is such that John believed Mary was pregnant in a past interval.

**Exercised de re:** The interpretation of embedded tense is referential. The speaker specifies the interval's temporal location. The speaker says that a particular past interval is such that John believed Mary was pregnant in that past interval.

**Ascribed de dicto:** The interpretation of embedded tense is descriptive, and it is ascribed to the believer. The believer is ascribed to believe that a past interval (no matter its temporal location in relation to the main tense or the UT) is such that Mary was pregnant in a past interval.

**Ascribed de re:** The interpretation of embedded tense is referential, and it is ascribed to the believer. The believer is ascribed to believe that a particular past interval is such that Mary was pregnant in that past interval.

**Exercised and Ascribed de dicto:** The speaker exercises the belief in a descriptive way, but he ascribes a de dicto belief to the believer. The believer is ascribed to believe that a past interval is such that Mary was pregnant in that past interval.

**Ascribed and Ascribed de re:** The speaker exercises the belief in a referential way, but he also ascribes a de re belief to the believer. The believer is ascribed to believe that a past interval is such that Mary was pregnant in that past interval.

The illustration of the several interpretations that embedded tense can have indicates two important things for the analysis proposed here. First, there are more than *de re* readings of embedded tense at play (contra Abusch 1997a, Ogihara 1996). Second, temporal location does not depend on the type of the belief ascription (*de re* or *de dicto*) but it provides information that feed the contextual function for temporal location which I introduce in the next section.

### 5.3 Variadic Functions

In contrast with temporal sentences that define a temporal relation between main and embedded tense, "that" for English / "oti" for Greek – clauses cannot determine the temporal location between eventualities stated in the main and the embedded clause (see Staraki, in preparation). Therefore, I propose a function that will operate as a temporal connective between main and embedded clause contributing information on the temporal location of main and embedded tense. Temporal interpretation of a tense under PAVs

depends crucially on contextual information. Thus, I propose, inspired by Recanati (2002c), that context contributes a variadic function. This variadic function will increase the valence between main and embedded sentences, and it will provide information for the temporal accommodation between main and embedded tense.

Specifically, Recanati proposed the variadic functions which create contextual predicates. As Recanati puts it (2002c): “A variadic function is a function from relations to relations, where the output relation differs from the input relation only by its decreased or increased adicity”. Adding a predicate modifier (adverb or prepositional phrase, etc.) to a predicate expressing a  $n$ -ary relation  $R^n$  thus results in a complex predicate expressing an  $n + 1$ -ary (unary) relation, in which the  $n^{\text{th}} + 1$  argument is a circumstance: a time, a location, a manner, or what not.

My proposal supports and extends Recanati (2002c) line. In a nutshell, my analysis is driven by the following: (a) PAVs and embedded sentences are not referentially synonymous; (b) temporal location of embedded tense is retrieved from context and not from syntax or logical structure. Main and embedded sentence have distinct content in a sentence, and they both provide an interval. Temporal interpretation of embedded tense is determined by context at the intersentential level in conjunction with pragmatic inferences.

Taking these into account, I propose that the temporal interpretation of a tense under PAVs is contextually determined, and I treat it as an  $n$ -order predicate denoting an augmented relation  $R$ . I define an augmented intersentential relation of intervals as follows:

(36) Definition of Augmented Relation

Let  $Q$  and  $P$  be propositional intervals that translate in an  $n$ -place predicate denoting an  $n$ -ary relation  $R$ . Then  $(Q, P)^+$  is an admissible augmentation of  $(Q, P)$  iff  $(Q, P)^+$  translates into an  $n / n+1$  order predicate denoting an augmented relation which is defined as the union of a relation and a contextually provided temporal location:  $R^+ \stackrel{\text{def}}{=} R \cup C_{\text{TR}}$ , where  $C_{\text{TR}}$  is the contextual temporal relation. The contextually defined temporal location is an element of the set of temporal relations:  $\text{TR} \in \{<_{\text{TR}}, >_{\text{TR}}, O_{\text{TR}}, \text{GEN}_T\}$

The Increase Temporal Location ( $\text{InCr}_{\text{TR}}$ ) is a function from relation to relation where the output relation differs from the input relation by its increased adicity, and I define it as follows:

(37) Increase ( $\text{InCr}_{\text{TR}}$ )

Let  $\text{InCr}_{\text{TR}}$  be a function such that applies to an n-place predicate (Q, P) and produces an n+1 place predicate

$$\begin{aligned} 1^{\text{st}} \text{ Step: } & \text{InCr}_{\text{TR}}((Q, P)) = ((Q, P))_ - \text{InCr}_{\text{TR}}((Q, P), \text{TR}) \\ 2^{\text{nd}} \text{ Step: } & \text{InCr}_{\text{TR}: <_{\text{TR}}}((Q, P)) = ((Q, P))_ - \text{InCr}_{\text{TR}}(Q, P, <_{\text{TR}}) \end{aligned}$$

The Increase relation contains two arguments: the main tense's interval and the embedded tense's interval. In the first step the Increase Temporal locations function applies to Q and P propositional intervals, and returns an 3-place predicate denoting a ternary temporal location relation TR. The variadic function adds one more argument role: the temporal relation (TR) between those two intervals. Thus, the output relation contains the same argument-roles: main and embedded interval as the input relation, plus the extra argument-role contributed by the variadic function: Increase. In the second step, temporal location should now be member of the set of temporal relations  $\text{TR} \in \{<_{\text{TR}}, >_{\text{TR}}, \text{O}_{\text{TR}}, \text{GEN}_{\text{T}}\}$  this information will be fed on contextual information. Let's see an application of the function Increase.

For example, in the statement *O Janis ipe oti i Maria itan poli kurazmeni* (John said that Mary was very tired) the additional information comes from the context. John is describing a tennis ball game in which Maria participated, and he is talking about Maria feeling very tired after the game. However, it is not clear from the statement itself that John's description took place immediately after the end of the tennis ball game. The additional information shows that temporal location between main and embedded tense interacts with contextual information:

- (38) O Janis ipe-PAST oti i Maria itan-PAST poli kurazmeni  
John said that Mary was very tired

The information that the description by John took place after the game contributes Increase function which maps the main tense's interval and the embedded tense's interval onto the dyadic relation  $((Q, P))_ - \text{InCr}_{\text{TR}}((Q, P), \text{TR})$  between two intervals and a temporal location. The Increase function will also contribute the argument  $<_{\text{TR}}$  which fills the extra argument-role for temporal location:

$$\begin{aligned} (39) \text{InCr}_{\text{TR}}((Q, P)) &= ((Q, P))_ - \text{InCr}_{\text{TR}}((Q, P), \text{TR}) \rightarrow \text{InCr}_{\text{TR}: >_{\text{TR}}}((Q, P)) \\ &= ((Q, P))_ - \text{InCr}_{\text{TR}}(Q, P, >_{\text{TR}}) \\ &= \text{CT}: >_{\text{TR}}(\text{Believe}(\text{John}, e, w)) = \exists t (>_{\text{TR}}(t) \wedge Q, P(t)) \end{aligned}$$

## 6. Conclusion

The analysis I presented here is advantageous for a number of reasons. The Greek and English data show that unlike what is often assumed in the tense literature, the SOT and DAR phenomena are not a case of ambiguity or mere anaphoricity and substitution by similarity, but a case of underspecification. Embedded tense is not a genuine case of substitutivity, because of contextual shifts. Thus, embedded tense cannot be substituted by main tense. In this paper, I propose we treat tenses as descriptive terms that can be interpreted referentially or attributively, and consider the temporal interpretation of embedded tense as a case of an intersentential relation of intervals (main and embedded) the temporal location (or the temporal ordering) of which can be determined by context information.

To this end, I developed a semantic-pragmatic analysis of cross-linguistic variation in the interpretation of embedded tenses in Greek *oti*-clauses and English *that*-clauses. Specifically, I showed that structures with PAVs involve the point of view of the reporter<sup>5</sup> of the belief. This indicates we evaluate with respect to the ascriber of the PA. The analysis I proposed implies a resolution of temporal interpretation the components of which can be determined by context. The relation of main and embedded tense is envisioned as an interpretation-context shift and not as semantic, syntactic or lexical ambiguity. The temporal interpretation of embedded (and main) tense has different aspects, and crucially depends on the context and the impression we wish to convey.

The approach advocated here provides a unified way to treat the interpretation of embedded tense. To my knowledge, what I have proposed in this paper is a novel account, but further research is definitely needed to evaluate this.

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<sup>5</sup> Terms such as ascriber of belief, speaker, reporter

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