

# The Lexical Temporal Properties of Nominal Predicates

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Maura O’Leary, UCLA  
mauraoleary@g.ucla.edu

Adrian Brasoveanu, UCSC  
abrsvn@ucsc.edu

## 1. Introduction

- This talk discusses the temporal behavior of nominal predicates.
- §2 gives a very brief background on the evaluation times of nouns.
- §3 discuss the existence of two classes of nouns that show different temporal behavior.
- §4 shows how to arrive at an evaluation time for either class of noun.
- §5 provides experimental data which supports the divide between the two noun classes.
- §6 questions whether there are any linguistic or non-linguistic ways to predict which nouns will fall into each class.

## 2. A brief background

- Enç (1981, 1985, 1986, 1987) showed that nominal predicates do not need to be evaluated at the same time as the *main verbal predicate* of the sentence they are in:

(1) The student *returned* to their 30<sup>th</sup> high school reunion.

Most likely interpretation: “student” was true of the subject 30 years prior to the time of the reunion. The subject does not need to be a student at the time of the reunion.

The nominal predicate has an **evaluation time** that is distinct from the **utterance time** and the **main verbal time**.

- Musan (1995, 1997, 1999), Keshet (2008), and Tonhauser (2002, 2005, 2007, 2008) have added other observations on the topic of nominal tense, regarding the effects of:
  - syntax (Musan),
  - nominal modifiers (Keshet),
  - contextual information (Tonhauser), and
  - the potential of morphologically encoded nominal tense (Tonhauser)

### 3. Nominal classes

- O’Leary (2017) brings up another line of questioning: do all nouns behave the same with regards to their evaluation times?
- The short answer: no.
- There are two classes of nouns that behave differently. Consider the following two examples:

(2) The fugitive *is doing time*.

(3) # The bachelor<sub>i</sub> *is kissing his*<sub>i</sub> *wife*.

- It is logically impossible for the subject of (2) to be simultaneously a fugitive and *doing time*.<sup>1</sup> Therefore, the most natural interpretation of (2) is one in which the subject is a fugitive *prior* to doing time. This interpretation (more or less) means the same thing as (4):

(4) The former fugitive is doing time.

- Similarly, in (3), it is logically impossible for the subject to be simultaneously a bachelor and *kissing his wife*. Our comprehension of the sentence might be saved in the same way we saved (2), by interpreting it as (5):

(5) The former bachelor is kissing his wife.

- While (5) is perfectly acceptable, it does not paraphrase an available reading of (3). The same sort of “back-shifted” reading is not available for bachelor.
- Some nouns, like fugitive, are free to be interpreted at a wide range of times. I will refer to these as “flexible” nouns.

(2) The fugitive *is doing time*. < a flexible noun

- Other nouns, like bachelor, are bound to some other time variable which scopes over them. I call these “inflexible” nouns.<sup>2</sup>

(3) # The bachelor *is kissing his wife*. < an inflexible noun

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<sup>1</sup> Judgements may vary. In this work, I am aiming to describe the (quite common) dialect that matches the facts described here.

<sup>2</sup> I am deliberately choosing not to call these “bound” and “free,” because, in the larger picture, their time variables do not behave exactly like bound and free pronouns.

## 4. Detailed behavior of the two nominal classes

### 4.1 Inflexible nouns

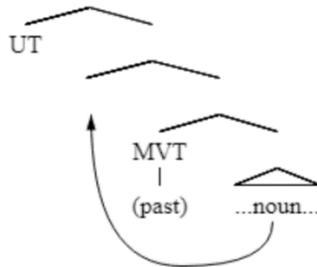
- Let us start with inflexible nouns- those that show a lesser degree of freedom with respect to their evaluation times.
- Inflexible nouns are bound by other time variables in the sentence. That means that in a simple single-clause utterance, inflexible nouns can be evaluated at either the utterance time (UT) or at the evaluation time of the main verb (main verbal time—MVT).

In order to show that both UT and MVT are possible evaluation times, these examples give sentences where only one of those two readings is logically available:

	UT	MVT
(6) The <u>teenager</u> <sub>i</sub> got his <sub>i</sub> license when he <sub>i</sub> turned 16, 20 years ago.	#	✓
(7) The <u>teenager</u> <sub>i</sub> received a toy at his <sub>i</sub> 1 <sup>st</sup> birthday party.	✓	#

[**Note:** Due to time limits, we will be pretending that contexts and discourses longer than one sentence do not exist.]<sup>3</sup>

- Whether these nouns are evaluated at UT or MVT depends on whether they are interpreted de re or de dicto.
- You can think about the noun raising out from under the scope of the verbal tense in order to be evaluated at UT.
  - de dicto => MVT evaluation time
  - de re => UT evaluation time



<sup>3</sup> There are many differences in the behavior of nouns in longer discourses, due to the effects of discourse relations, definiteness, contrastive focus, and narrative progression, among other things.

- But how can we tell that what we are dealing with is a de dicto/de re distinction?  
The time and world variables covary!

- Consider (8):

(8) John believed that a teenager was following him.

- I contend that if we are using the word “teenager” to report that John believes the person is a teenager (de dicto), “teenager” will obligatorily be evaluated at the same time as MVT *was following*.
- However, if we are using the word “teenager” in accordance with the speaker’s beliefs instead of John’s (de re), then “teenager” will be evaluated at UT.
- Consider the following scenarios<sup>4</sup>:

(9)

	de dicto	de re
MVT <i>follow</i>	10 years ago, John saw someone following him around a parking lot. The person was carrying a skateboard, so John assumed it was a teenager. However, we know that it was actually Thomas, an elderly gentleman who happens to like skateboarding.  John believes that a teenager was following him.	10 years ago, John saw someone following him around a parking lot. The person was carrying a briefcase, so John assumed it was an adult. However, we know that it was actually a teenager.  #John believes that a teenager was following him.
UT	10 years ago, John saw someone following him around a parking lot. The person was quite short and wearing brightly colored clothing, so he assumed it was a child. He still thinks about that day, and now assumes that the person in question is a teenager. However, we know that it was actually just a very short adult!  # John believes that a teenager was following him.	10 years ago, John saw someone following him around a parking lot. The person was carrying a briefcase, so John assumed it was an adult. However, we know that it was actually a child playing dress-up and that that same person is now 16.  John believes that a teenager was following him.

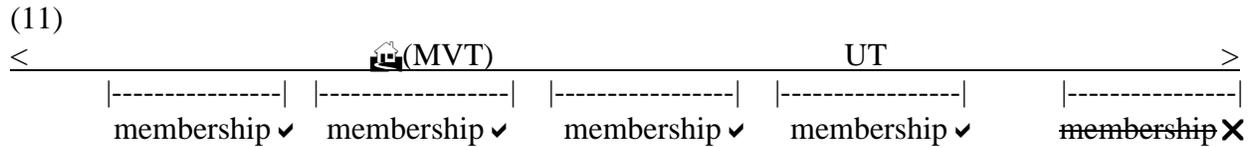
- In summary, flexible nouns take the time variable that most directly scopes over them and are evaluated at exactly that time.

<sup>4</sup> Judgments seem to vary here. If you have especially clear ones, I welcome them, whether they match the ones presented here or not. Please talk to me during the break.

## 4.2 Flexible nouns

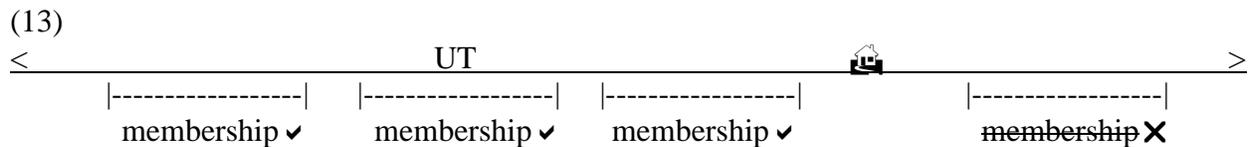
- Inflexible nouns are bound by other time variables in a very transparent way. The relationship between flexible nouns and other time variables is not quite as apparent.
- For instance, in a simple past tense sentence, a flexible noun can receive any evaluation time *up to* the UT.

- (10) A member of our investment club *bought* a house.<sup>5</sup>
- subject can refer to past or present member, but not future



- Similarly, in a future tense sentence, the noun can be evaluated at any time *up to* the MVT.

- (12) A member of our investment club *will buy* a house.
- subject can refer to a past, present, or future member
  - cannot refer to someone who buys a house in the future and *then* becomes a member



- I propose that, just like inflexible nouns, flexible nouns inherit a time variable from elsewhere in the utterance (UT, MVT). However, instead of being evaluated *at* that time, flexible nouns use their inherited time as an *upper limit* (O’Leary 2017).<sup>6,7</sup>

(14)

	INFLEXIBLE	FLEXIBLE
MVT	Evaluated <i>at</i> MVT.	Evaluated at any time <i>up to</i> MVT.
UT	Evaluated <i>at</i> UT.	Evaluated at any time <i>up to</i> UT.

<sup>5</sup> Sentence adapted from Enç 1986:407(6).

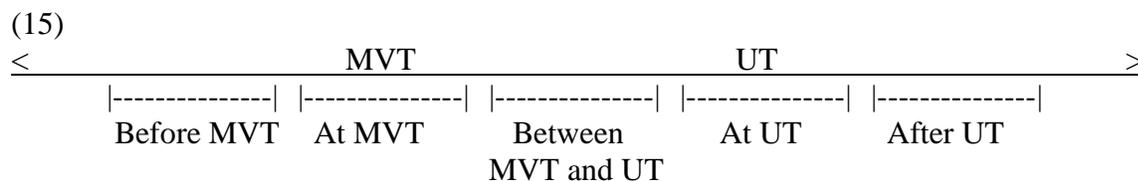
<sup>6</sup> Note that this claim is a significant departure from Enç (1981, etc.), Musan (1999, etc.), and Keshet’s (2008) claims about the temporal interpretation of nouns, which all assert or assume that nominal evaluation times are not affected by the utterance time or the verbal evaluation time.

<sup>7</sup> This is clearly reminiscent of the more general “upper limit constraint” used in other areas of tense work.

- Even with flexible nouns, we can once again show that which time variable the noun takes covaries with the world variable. However, as the judgments are rather complicated and take lengthy situation descriptions, they have been left out of this talk.

## 5. A pilot experiment<sup>8</sup>

- We ran a recent pilot experiment, which showed that 31 undergraduate students<sup>9</sup> share the intuitions that flexible and inflexible nouns behave differently with respect to available evaluation times.
- Back to experimental design: Participants were asked to judge the acceptability of 90 sentences (a version of each of 30 test items + 60 fillers). Each sentence followed a short context which made clear the intended evaluation time of the subject NP.
- We used single clause past tense sentences and tested five possible NP evaluation times:



- For each of the 5 possible evaluation times, we compared the acceptability of both flexible and inflexible nouns, keeping the contexts as similar as possible within each 2x5 (NP-type X evaluation-time) test item paradigm.
- The students were given the following premise for the experiment:

*“In this experiment, you will be required to read a number of very short stories in English. After each story, you will read a statement from Sarah, who speaks English well, but not perfectly. You will rate how accurate Sarah's statement is given the story you just read.”*

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<sup>8</sup> I refer to this as a pilot experiment because, since the running of the experiment, we have become aware of potential confounds in larger discourses. Since we presented the participants with multi-sentence contexts, we will need to re-run this experiment while controlling for discourse effects.

<sup>9</sup> These students were all native English speakers and were given class credit at UC Santa Cruz for participating in the experiment.

- An example:

**Before MVT:**

*During his 20s, Tom worked as a graphic designer. He based his work more on instinct than anything he had ever learned. In fact, it wasn't until he was 34 and employed as an accountant that he started and subsequently quit his first art class.*

**Inflexible:** Sarah: “A twenty-something quit his art class.”

**Flexible:** Sarah: “A graphic designer quit his art class.”

- These sentences are both “before MVT” because the state of being a graphic designer/twenty-something occurs before the verbal predicate of “quitting his art class.”
- Participants were asked to rate Sarah’s sentence on the following Likert scale: -2, -1, 0, 1, 2
  - -2 was labeled as “makes no sense”
  - 2 was labeled as “makes perfect sense”
- Given the theories presented so far, we expect that:
  - both flexible and inflexible nouns will be acceptable **at MVT** and **at UT**
  - both flexible and inflexible nouns will be unacceptable **after UT**
  - and most importantly: only independent nouns will be acceptable **before MVT** and **between MVT and UT**
  - The following chart summarizes these rather binary predictions:

(16)

	Inflexible nouns	Flexible nouns
BEFORE MVT	✗	✓
AT MVT	✓	✓
BETWEEN MVT AND UT	✗	✓
AT UT	✓	✓
AFTER UT	✗	✗

- The last of the points above is what we will focus on today: we predict that only independent nouns will be acceptable **before MVT** and **between MVT and UT**
  - These are the only two evaluation times for which we predict there to be a difference for flexible and inflexible nouns.
  - A statistically significant difference in acceptability here would provide evidence of a true difference between these two noun classes.

- The following data shows the estimated coefficients for the differences between flexible NPs and inflexible NPs at each evaluation time. (*Flexible NPs* are treated as the reference groups for each comparison.)

(17) Comparing independent NPs to dependent NPs at each evaluation time<sup>10</sup>

	Inflexible Mean <sup>11</sup>	Flexible Mean	Coefficient Est.	Std. Error	p-value <sup>12</sup>
before MVT	-0.99	0.13	-1.270	0.225	<0.00001
at MVT	1.27	1.14	0.236	0.230	0.30500
between MVT and UT	-0.80	-0.15	-0.628	0.214	0.00340
at UT	-0.54	0.10	-0.660	0.215	0.00217
after UT	-0.81	-0.39	-0.584	0.221	0.00816

- As predicted, there is a statistically significant difference between the ratings for flexible and inflexible nouns **before MVT** and **between MVT and UT** ( $p < 0.01$ ).
- Additionally, there is a statistically significant difference between the ratings for flexible and inflexible nouns **at UT** ( $p < 0.01$ ). The potential reasons behind this will not be discussed here.
- Whether or not the **at UT** data behaves as expected, the results of this experiment strongly support the theory that flexible and inflexible nouns behave differently, and that flexible nouns are considered more acceptable at a wide array of times.

## 6. The two noun classes- why and how?

- Are there any lexical characteristics which predict or explain why nouns would be separated into two classes? Why should some nouns have flexible evaluation times available to them, while others have more restricted evaluation times?
- I would like to briefly present five potential hypotheses:

<sup>10</sup> The data were analyzed using a cumulative link mixed effects model with a probit link function and random effects of subject and item on evaluation type and NP type.

<sup>11</sup> Given the ordinal nature of the data, the means presented here were not directly used in calculating the other values on the chart (coefficient, etc.). The means are provided here to make the data more accessible to the reader.

<sup>12</sup> Shading indicates statistical significance.

## 6.1 Stage- vs. individual-level predicates:

- Musan (1995, 1997, 1999) claims that certain syntactic constructions can make nouns “temporally dependent,” meaning that they must be evaluated at the MVT.
- One example: existential there constructions  

(18) # There were many professors in kindergarten in the 80s.
- (18) can only be interpreted as discussing people who were simultaneously professors and in kindergarten
- Musan (1999) claims that these effects occur because these constructions force the nouns to be interpreted as *stage-level predicates*.
  - Stage-level predicates describe a temporal chunk of an entity’s existence, while individual-level predicates describe the entirety of an entity’s existence (Carlson 1977a,b).
- She claims that stage-level predicates must be interpreted at the verbal evaluation time, while individual-level predicates are more free.
- Thus, we might assume that inflexible nouns are somehow inherently stage-level predicates, while flexible nouns are individual-level predicates.
- **Pros:**
  - This would give us a single theory to describe how both syntax and lexical properties can cause temporal inflexibility
  - This theory does work on some intuitive level, in that inflexible nouns generally describe stage-like temporal chunks that have a clear temporal beginning and end (*bachelor, teenager, second-grader, twenty-something, etc.*)
- **Cons:**
  - Our flexible and inflexible nouns do not otherwise follow the patterns for stage- and individual-level predicates. For instance, a flexible noun like *fugitive* does not show any lifetime effects (Musan 1997), which we would expect for an individual-level predicate.
    - Given the sentence “John was a fugitive,” we don’t assume that John is now dead.
  - The intuitions are not always clear: we have no reason to think that *fugitive*, a state which clearly ceases when caught, should not describe a stage.

## 6.2 Stages of life:

- Many of the inflexible nouns seem to describe a natural stage of life, that everyone<sup>13</sup> goes through: *teenager, twenty-something, elementary school student*
- Perhaps if a predicate describes a predictable, temporally defined part of life, we treat it in a different way than other, non-predictable predicates
- **Pro:**
  - It seems reasonable to assume that if you can predict when a given state will occur, you do not need as much freedom to communicate its temporal location
- **Con:**
  - There are a number of inflexible nouns that are very much optional stages of life: *graduate student, first-time chess player, etc.* It seems odd that we would make predictions about the temporal location of a completely optional state.

## 6.3 Social Roles:

- Following proposals in the computational knowledge representation literature (e.g. Masolo et al 2004), we could propose that the type of information denoted by the noun grants it its temporal type.
- Claim: inflexible nouns only denote temporal information about the life of the entity, while flexible nouns describe temporal information *and* a social role that the entity plays.
- Because flexible nouns are not lexically defined purely along a temporal dimension, they are more resistant to temporal manipulation.
- The existence of an agentive, social aspect to the description allows a semi-permanent status for these predicates, allowing them greater freedom of evaluation times.
- **Pro:**
  - This observation matches intuitions that are often voiced in colloquialisms like “Once a student of Chomsky, always a student of Chomsky.”
- **Cons:**
  - How can we clearly define what a social role is?
  - Is *bachelor* really a non-social role?

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<sup>13</sup> Barring gender mismatches or early death.

## 6.4 Just memorized

- Just like the distinction between count and mass nouns, the difference between flexible and inflexible nouns might be something that we merely observe and memorize as children.
- **Pros:**
  - This would give us the ability to explain why the groupings might be different in different languages.
  - We don't need to explain discrepancies in groupings, such as why bachelor wouldn't be grouped with other "social" nouns.
- **Cons:**
  - Given a new noun, we (as semanticists) cannot predict which group a noun will fall into.
  - Given a new noun, speakers should either treat one class as default or randomly place the new noun in one group or another at chance.
    - Words that not all students know (*e.g. octogenarian, yearling*) were used (and explained) in our experiment. They patterned as inflexible nouns. However, we did not use any nouns that we expected to pattern as flexible nouns that would be unknown to average English speakers.

## 6.5 Some combination of these theories

- It seems most likely that it is some combination of these theories—that we have something like theories 1-3 but simply memorize the borderline cases.
- This is often found to be the technique used in other categorization tasks.
  - Categorization can be a noisy process
  - Humans will define classes based on a single idealized *prototype* or various good *examples*
  - Any new item will be compared to the prototype or examples and sorted accordingly
  - However, some items are good examples of a category, while some are on the border between two categories. In such cases, we must simply learn the classification of the borderline cases.

## 7. Conclusion

- We have two clear sets of nouns that behave differently from a temporal point of view.
- While we are capable of describing their behavior, we are not capable of describing the groupings.

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