On the Interpretations of Bare Plurals with Individual- and Stage-Level Predicates

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Abstract

The distinction between stage- and individual-level predicates has proven useful to a number of successful theories regarding the interpretations of sentences with bare plural subjects. A series of related theories by Greg Carlson, Angelika Kratzer, Molly Diesing and Ted Fernald are reviewed and evaluated. New modifications to Diesing’s theory are presented and are shown to improve the handling of time semantics, allow a simple account of Spanish copular variation and make the mechanics of the model more explicit and simple. Under this new theory, stage-level predicates are functions of an entity and a spatiotemporal variable whereas individual-level predicates are only functions of an entity. Inflection is given logical form to complete the mechanics of this new theory. Finally, the determination of whether a predicate is a stage-level or individual-level cannot be done mathematically; rather, the type of a predicate is determined pragmatically.
To Gallahad
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1 Introduction

A sentence can be split into a subject and a predicate. The predicate describes, specifies or modifies the subject. For example,

(1) **Ferrets** **burrow at high speed.**

The predicate, *burrow at high speed*, specifies this ability about the subject in the general case. The predicate does not have to be a verb phrase; adjectival predicates can appear with the copula:

(2) Ferrets are intelligent.

Again, this sentence is interpreted to mean that ferrets are generally intelligent. Not all predicates, however, specify properties of subjects in the general case. Take, for example:

(3) Ferrets are wet.

This predicate, *wet*, can be true either in the immediate future or in the general case. Since we know that ferrets are not always wet, we can construe (3) to mean that someone just dumped water on some ferrets and they are currently and temporarily wet.

Whether or not the predicate has a general reading, we are rarely able to infer that a predicate will still be true of the subject at some later time. Consider the following inferences (following Jager 1996:1):

(4) a. Galahad is intelligent.
   Galahad will still be alive in ten years.
   ≠ Galahad will be intelligent in ten years.

b. Galahad is wet.
   Galahad will still be alive in ten years.
   ≠ Galahad will be wet in ten years.

Neither inference is possible. A weaker inference, however, is possible for *intelligent* and shows how the temporal characteristics of these two predicates differ (Jager 1996:2):

(5) a. Galahad is intelligent.
   Galahad will still be alive in ten years.
   ≤ It is more likely that Galahad is intelligent in ten years than that he is not.

b. Galahad is wet.
   Galahad will still be alive in ten years.
   ≤ It is more likely that Galahad is wet in ten years than that he is not.

Following Carlson (1977), predicates that denote temporally “stable” properties like *intelligent* are called “individual level predicates” (ILPs) and those that denote temporally variable properties like *wet* are called “stage level predicates”. An ILP describes properties or facts about an entity that are presumably indelible and permanent. Other examples are *being altruistic* and *having long arms*. An SLP describes the transitory state of an entity. Some
state-describing predicates are hungry, outdoors or naked.

The various interpretations of the sentences (2) and (3) show what is dubbed the stage/individual or SLP/ILP contrast. Switching the ILP for an SLP with the bare plural subject ferrets in these sentences changes the possible logical interpretations of the sentences. Bare plurals are noun phrases (NPs) like ferrets that have no determiner (the, a, etc...) or quantifier (many, three, etc...). To solidify our analysis, we can write the interpretations of these sentences in logical form. The bare plural subject, ferrets, gets a generalizing reading with an ILP in (2). Using logical notation, the interpretation is written as:

(6) Ferrets are intelligent.
⇒ “In general, ferrets are intelligent.” ⇒ Gx[ferret'(x)](intelligent'(x))

which reads, “In general for x such that x is a ferret, x is intelligent”. (Generalized quantifier constructions such as the one used here will be discussed in section 2.3.) When the bare plural subject appears with an SLP, wet, in (3) it is possible to get a generalizing reading or an existential reading:

(7) Ferrets are wet.
⇒ “In general, ferrets are wet.” ⇒ Gx[ferret'(x)](wet'(x))
⇒ “Some ferrets are wet.” ⇒ ∃x[ferret'(x) ∧ wet'(x)]

The former logic reads, “in general for x such that x is a ferret, x is wet”. The latter reads, “there is some x such that x is a ferret and x is wet”. Which interpretation is ultimately chosen is determined by context and other pragmatic and semantic considerations. In a world where ferrets are wet because of special glands in their skin, then the generalizing reading is appropriate. If, on the other hand, ferrets are only wet when humans splash them, the existential reading is appropriate.

Another sentence with a bare plural and an SLP that has two possible readings follows:

(8) Firemen are available.

When two neighbors are talking about how happy they are that their neighborhood is protected by firemen, then (8) gets a generalizing reading. When someone’s house is on fire and someone shouts (8), it gets an existential reading.

A lot of contextual and semantic knowledge is involved in production of the inferences in (5) and the interpretations in (7) and (6). The stage/individual contrast is also essential to a number of phenomena in the syntax. One such example of a syntactic phenomenon is the grammaticality of perceptual and existential reports:

(9) PERCEPTUAL REPORTS (Carlson 1977)
   a. SLP: I saw ferrets outside.
   b. ILP: *I saw ferrets intelligent.

(10) EXISTENTIAL REPORTS (Milsark 1974)
    a. SLP: There were ferrets outside.
    b. ILP: *There were ferrets intelligent.
We can understand on a simple level that the ungrammaticality of (9-b) is due to the fact that intelligence is an ILP and does not change considerably from time to time whereas the perceptual report, *I saw ferrets*... suggests a temporally variable property. A similar argument can be made for the grammaticality of existential reports. Be warned, however, that this argument is deceptively simple as there are many details in the syntax and semantics that must enter into the analysis.

What syntactic and semantic theory can account for the behavior of SLPs and ILPs in these examples? To this end, this thesis explores a range of previous work on this topic that implements and extends Montague's (1973) type-theoretic model, The Proper Treatment of Quantification in Ordinary English (PTQ), and Chomsky's (1981) Government and Binding (GB) theory. Theories by Carlson (1977), Kratzer (1989), Diesing (1992) and Fernald (1994) attempt to produce the correct interpretations using modified rules and structures based on PTQ or GB.

In recent years a lot of work on GB and other structural theories of syntax have met with success. PTQ (or predicate logic in general) remains an excellent tool for working in semantics. This thesis combines elements from both GB and PTQ to produce a working theory. The theory is essentially a modification of Diesing's theory which is based on GB, but clears up a number of problematic elements using PTQ in the logical form of GB. Data in Spanish motivate some of these modifications to Diesing's theory.

Throughout the next two sections (sections 2 and 3), we will assume that predicates come out of the lexicon marked as either an SLP or an ILP. The final section (section 4) will discuss the strengths and weaknesses of such a rigid and binary lexical assignment. The issue of how predicates become SLPs and ILPs will be discussed.

A note on references: many of the ideas that I present here draw on work from other authors so I have adopted the following convention: section titles that contain an author's name indicate that the entire section contains ideas drawn from that author. This is true for all of section 2 and parts of section 4. The ideas from a particular author can almost always be found in their main publication: Milsark (1974), Carlson (1977), Kratzer (1989), Diesing (1992) and Fernald (1994).

2 Previous Work

Since Milsark, many formal theories have been developed to predict the behavior of predicates. A summary of Milsark's work is followed by four important theories by Carlson (1977), Kratzer (1989), Diesing (1992) and Fernald (1994). Carlson extends Montague's type-theoretic grammar, PTQ, to account for the behavior of predicates of different sorts. Kratzer and Diesing extend GB in different ways to achieve similar results. PTQ has a few syntactic limitations that are addressed by using GB instead. The most appealing part of GB, however, is the elegance with which it can be used to explain the origins of different interpretations. Fernald builds on all three theories and goes on to provide some important new features.
2.1 Milsark

Milsark (1974) proposed a general theory that addresses how determiner phrases (DPs) and predicates can combine. He split the predicates into two groups: state descriptions and properties. Hereafter these will be referred to as SLPs and ILPs, respectively, although this was not his terminology. According to his theory, DPs, like the predicates, are split into two groups. DPs can be categorized as having either a Strong, 'quantificational' reading as in every ferret and the ferret or a Weak, 'cardinal' reading such as a dog and sm men.¹ Bare plurals and the quantifiers many and several are ambiguous and can adopt either a cardinal or quantificational reading (often depending on context.)

(11)  a. The ferret climbed the curtains. (Strong Construal)
     b. Some ferrets climbed the curtains. (Ambiguous)
     c. A ferret/Sm ferret(s) climbed the curtains. (Weak Construal)

Sentences (11-a) and (11-c) each have a single interpretation while (11-b) is ambiguous between the following two interpretations: an unspecified number of ferrets climbed the curtains (the weak construal) or a finite, specific number, but not all of the ferrets climbed the curtain (the strong construal). The trifurcation of DPs is summarized in (12) (following Ladusaw 1994:3):

(12)  **WEAK CONSTRUAL:** a dog, sm men ...
    AMBIGUOUS: three, several, many, bare plurals ...
    **STRONG CONSTRUAL:** the, every, most, each ...

Let us consider all the possible ways that SLPs and ILPs can combine with these three types of DP:

(13)  a. The ferret is sick. Strong (Strong + SLPs)
     b. The ferret is intelligent. Strong (Strong + ILPs)
     c. Ferrets are sick. Strong or Weak (Ambiguous + SLP)
     d. Ferrets are intelligent. Strong (Ambiguous + ILP)
     e. A ferret is sick. Weak (Weak + SLPs)
     f. *A ferret is intelligent.²

Except for (13-f), the construal of the DP determines the interpretation of the sentence. (Again, we ignore the generic readings with ILPs for now.) For the ambiguous pair, the interpretation of (13-c) with an SLP can be either strong or weak whereas (13-d) with an ILP can only receive a strong interpretation. The apparently anomalous ungrammaticality of (13-f) coupled with the forced strong reading of (13-d) led to Milsark’s Generalization:

(14)  **MILSARK’S GENERALIZATION:** Properties may only be predicated of Strong NPs. [=ILPs must have strong subjects.]

¹Sm is a contraction of some and is used to indicate that stress is placed on the noun being quantified. Sm ferrets is equivalent to saying Some ferret or other....

²The star is on the existential reading; the generic reading is good, though Milsark did not consider this.
While robust, this statement leaves much work undone. Milsark does not address the production of generic readings or how the various interpretations of the sentences in (13) are derived in a generative manner.

To be complete with Milsark’s analysis, there are really four DPs construals: strong, ambiguous, weak and generic. The generic DPs are mostly bare plurals in Standard English though they are also frequently heard with the quantifiers a and the:

(15) a. An earthquake is a disaster.
b. The ferret is a goal-oriented beast.

For the remainder of the paper, we will treat these examples as exceptional on the generic reading (following Fernald 1994).

2.2 Carlson

Carlson (1977) postulated a sorted intensional logic similar to Montague’s PTQ where the set of entities is divided into three hierarchically organized sorts: kinds, objects and stages.

(If the reader is not familiar with PTQ, a good book to read is Introduction to Montague Semantics by Dowty, Wall and Peters.). Objects are just what we think they are: names of objects, proper names, and explicit deictic references such as refrigerator, Galahad and this ferret. Each object consists of many different ‘stages’ at different locations and times. Imagine, for example, a ferret that is wet and later the same ferret being sleepy. Both being wet and being sleepy are ‘stages’ of the ferret. Similarly, we can imagine many different objects as different manifestations of a ‘kind’. Ferrets, gibbons, and bats and all instances of the kind, mammals. Carlson illustrates his idea for a single kind entity as follows (=Carlson’s figure 1):

(16) SORTED-TYPE HIERARCHY

He also identifies the set of individuals, I, as all the objects and kinds combined, as indicated in the figure. These distinctions between stages and individuals are the predicate logic translations of the SLP/ILP contrast. Note that kind-level predicates will be called KLPs and object-level predicates, OLPs. He assigns each predicate the appropriate “sorted” type: SLPs are of type \( (e^k, t) \), OLPs are of type \( (e^o, t) \) and so on. This correctly predicts the interpretation of sentences where both subject and predicate have compatible types:

(17) Galahad is intelligent. \( \Rightarrow \) intelligent'(g)

Galahad is an individual of type \( (e^i, t) \) and intelligent is an ILP of type \( (e^i, t) \). Since Galahad and intelligent have compatible sorted types (i.e., both contain individual level entities \( (e^i, t) \)), the two can combine to make a well formed sentence through functional
composition. Using PTQ without sorted types results in incorrect interpretations:

(18) Gala.had runs. \( \neq \) run'(g)

Carlson does not allow this interpretation because the types of the SLP predicate, \((e^s, t)\), and the individual-level subject, \((e^i, t, t)\), have different sorts and cannot directly compose. To get the proper interpretation, he introduces a relation, \(R(a,b)\), which is true when \(a\) is a stage of \(b\). Using this relation, Carlson writes the correct interpretation of (18) as:

(19) \( \exists y[R(y^s, g) \land \text{run}'(y^s)] \)

where (19) is to be read, "there exists a stage \(y\) such that \(y\) is a stage of Galahad and \(y\) runs." The proper rule for using \(R\), of type \((s, (e^s, t), (e^i, t))\), to convert SLPs into functions of individual-level entities is given by:

(20) S23. If \(a \in P_{IV}\) and \(a\) is not of the form \([\beta]_{IV}(\delta)\),
    then \(F_{23}(a) \in P_{IV}\), where \(F_{21}(a) = [\alpha]_{IV}\).

T23. If \(a \in P_{IV}\) and translates as \(\alpha'\),
    then \(F_{23}(a)\) translates as \(\lambda x\exists y[R(z, x) \land \alpha'(z)]\).

For non-verbal SLPs, the \(R\) is introduced by the copula which is of type \((s, (e^s, t), (e^i, t))\) to allow it to combine with stage-level predicates and individual-level subjects:

(21) \( \text{be}_2 : \lambda Q^s \lambda x^i \exists y[R(y, x) \land \wedge Q(y)] \)

which is to be read, "Given a stage level predicate \(Q\) and an individual \(x\), there is some stage \(y\) such that \(y\) is a stage of \(x\) and \(x\) is true of \(Q\)." There is a corresponding rule, a modification of function application, that allows \(\text{be}_2\) to compose properly in a mixed type environment. Four different interpretations of to be have been postulated, each with a different translation, for use in a different environment of predicate and subject types (see Carlson 1977).

Note that we have accounted for only one of the two possible readings of (18); we have the existential reading in (19) but do not have a generalizing reading. Carlson writes the generalizing reading as follows:

(22) \( G[^\wedge \text{run}'](g) \)

Carlson postulates that \(G\), of type \((s, (e^s, t), (e^i, t))\), is always available during the derivation. For (18), Galahad runs, \(G\) can be applied instead of rule 23 in (20) to obtain (22).

In summary, Carlson formulates a sorted type intensional logic to distinguish SLPs and ILPs. Two new functions, \(R\) and \(G\) are used to produce the generalizing and existential readings for bare plurals with SLPs. This section is intended as an overview of Carlson's work and is by no means comprehensive of the entire theory.

### 2.3 Generalized Quantifiers (Kamp and Heim)

Before plunging into the next major theory on SLPs and ILPs, a short stop in the quantificational theory developed by Kamp (1981) and Heim (1982) is necessary to provide a few essential concepts. While PTQ did a good job of accounting for some cases of quantification,
Kamp and Heim developed a more general quantificational structure to describe quantificational force of adverbs and other quantifiers that do not conform to the functional form of PTQ. The functional representation of the quantifiers Every and Some in PTQ is:

(23) 
   a. Every \( \Rightarrow \lambda P \lambda Q \forall x(P(x) \rightarrow Q(x)) \)
   b. Some \( \Rightarrow \lambda P \lambda Q \exists x(P(x) \land Q(x)) \)

An alternative representation, called 'generalized quantifier' representation, uses set notation and operators instead of functional operators. The same two quantifiers can be written in generalized quantifier notation without any loss of information:

(24) 
   a. Every\([P]\)(Q) = 1 \text{ iff } P \subseteq Q
   b. Some\([P]\)(Q) = 1 \text{ iff } P \cap Q \neq \emptyset

The generalized quantifier is technically considered to be just Every\([P]\), which then operates on \( Q \). The benefit of using set notation is that quantifiers that previously could not be put into a functional definition can now be successfully captured in generalized quantifier representation. Take, for example, the generalizing quantifier \( G \). One acceptable representation is:

(25) \( G\![P]\)(Q) = 1 \text{ iff } |P \cap Q| > |P - Q|

which reads, "\( Q \) is in general true of \( P \) iff the number of elements shared by \( P \) and \( Q \) is greater than the number of elements in \( P \) that are not a part of \( Q \)." If \( P = \) ferrets and \( Q = \) wet, then (25) is true if more than half the ferrets are wet.

The generalized quantifier construction has a tripartite structure consisting of the quantifier, restriction and nuclear scope. The parts are labeled below:

(26) Every llama loves Galahad.
    \[ \Rightarrow \text{Every}_x [\text{llama}(x)] [\text{loves}(x, g)] \]

which is read, "for every \( x \) such that \( x \) is a llama, \( x \) loves Galahad." This sentence could be represented in functional form as well:

(27) \( \forall_x [\text{llama}(x) \rightarrow \text{loves}(x, g)] \)

which reads, "for all \( x \), if \( x \) is a llama then \( x \) loves Galahad." A sentence requiring the generalized quantifier approach follows:

(28) Most contrabassoonists play too loud.
    \[ \Rightarrow \text{Most}_x [\text{Contrabassoonist}(x)] [\text{play-too-loud}(x)] \]

where we can write the quantifier as:

(29) \( \text{Most}[P](Q) = 1 \text{ iff } |P \cap Q| > 0.8|P| \)

which reads, "\( Q \) is true of most of \( P \) iff the number of \( P \) in \( Q \) is greater than 80% of the total number of \( P \)." So if \( P = \) Contrabassoonists and \( Q = \) play-too-loud, then (28) is true.
when more than 80% of the Contrabassoonists play too loud.

2.3.1 Existential Closure and the Mapping Hypothesis

Heim claims that indefinite NPs do not have explicit quantifiers by themselves and merely put forth free variables in the logical representation. Consider a simple example of this (=Diesing’s 1.8):

(30) A man owns a llama.

The indefinite noun phrases, a man and a llama, do not contain existential quantifiers; rather, they introduce free variables that are not bound by any quantifier. These free variables can subsequently be bound by an existential quantifier that is optionally available. Diesing states the reason succinctly, “indefinites have no quantificational force. They must receive quantificational force by being bound by some operator.” Applying the existential quantifier on the free variables gives the correct logical form:

(31) \((\exists x,y)(man'(x) \land llama'(y) \land owns'(x,y))\)

which is read, “there exists some \(x\) and \(y\) such that \(x\) is a man and \(y\) is a llama and \(x\) owns \(y\).” This so called “existential closure” is assumed to occur on any free variable that appears in the Nuclear Scope.

Diesing’s mapping hypothesis ties syntactic structure closely to the generalized quantifier form. Diesing simply postulates that the material in the IP maps to the restrictive clause while the material in the VP maps to the nuclear scope:

(32) Mapping Hypothesis

Material from VP is mapped into the nuclear scope.
Material from IP is mapped into the restrictive clause.

With this mapping in place, we can couple the mapping hypothesis with Heim’s theory of existential closure and conclude that existential closure occurs on material in VP at logical form. This is usually depicted with a line between IP and VP:
Thus, any free variable that appears in VP at logical form can be bound by the existential operator. Note that I have also written in a generalizing quantifier. Diesing postulates that those free variables that appear in IP in the Restrictive Clause are outside existential closure and receive a generalizing reading when no other quantifier is present to bind them.

The lexical item 'appears in IP' when it is attached to any daughter branch that does not encounter VP first. Likewise, a lexical item 'appears in VP' if it is attached to any daughter branch that does not encounter a subsequent IP or CP (depending on the type of clause, if any.) Thus, the general form for GB structures looks like (Fernald 1994):

We have hereby proposed a theory of how Heim's quantification structure connects to GB structures. Now we seek evidence for its existence.

While Heim has done a good job of justifying the existence of existential closure, data that directly support the mapping hypothesis are difficult to find in English. This is because English does not allow movement of words from VP to IP at surface structure while maintaining grammaticality. Diesing discovered that German does have this ability and that it can be used to get differences in interpretation. In considering the following pair of sentences, note how the interpretation changes when the NP subject, Kinder, is moved: (Diesing 1992:33-34)

(35) a. ... weil Kinder ja doch auf der Straße spielen.
    since children PRT PRT on the street play
'... since (in general) children play in the street.'

b. '... weil ja doch Kinder auf der Straße spielen.
'since there are children playing in the street.'

In (35-a) when the NP subject appears before the sentential particles *ja doch* (which together translate roughly as 'indeed'), a generalizing reading is obtained; when it appears after *ja doch* in (35-b) the phrase receives an existential reading. Many studies including Jackendoff (1972) for English and Webelhuth (1989) for German have established that such sentence adverbs mark the VP boundary. The following shows the phrase boundaries for the two previous examples in (35):

(36) a. $[\text{cp weil [ip Kinder ja doch [vp auf der Straße spielen ]]}]. \text{ (Generalizing)}$
   since children 'indeed' on the street play

b. $[\text{cp weil [ip ja doch [vp Kinder auf der Straße spielen ]]}]. \text{ (Existential)}$
   since 'indeed' children on the street play

If we assume that the phrase boundaries are correct, then the generalizing reading is correlated with the subject appearing in IP and the existential reading is correlated with the subject appearing in VP. This directly supports the mapping hypothesis.

Kratzer and Diesing use the mapping hypothesis and existential closure in their theories. Their theories include all the elements necessary to make the syntax or semantics put the predicate in IP or VP according to whether it is an SLP or an ILP. Kratzer uses theta assignment to place the subject whereas Diesing employs two different types of inflection as a syntactic means to accomplish this common goal.

### 2.4 Kratzer

Kratzer (1989) builds the mechanics of her theory on the argument structures of SLPs and ILPs. Like Carlson, Kratzer believes that SLPs are distinct from ILPs in that they contain an explicit reference to a place and a time. *The ferret ate dinner* has a permanent time reference whereas *the ferret has short legs* does not. Kratzer proposes that SLPs have an external spatiotemporal argument $\ell$ in their argument structures that ILPs do not have. This so called Davidsonian argument allows for an intuitively appealing theory that successfully accounts for the interpretations of bare plurals.

#### 2.4.1 The Davidsonian Argument

A few examples that demonstrate the usefulness of the spatiotemporal variable follow (Kratzer's 12-14):

(37) a. Manon is dancing on the lawn. $\Rightarrow \exists [\text{dancing'(m,}\ell) \land \text{on-the-lawn'}(\ell)]$

b. Manon is dancing this morning. $\Rightarrow \exists [\text{dancing'(m,}\ell) \land \text{this-morning'}(\ell)]$

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3 Use of a single variable for both space and time has the added benefit of being relativistically invariant under the Lorentz transform and would be easily applied to languages travelling near the speed of light.
c. Manon is a dancer.  ⇒ dancer'(m)

The first two, (37-a) and (37-b) have an SLP, dancing, that is a function of both an entity and a spatiotemporal location. The spatiotemporal variables are bound by the spatiotemporal quantifier ∃ obtained from existential closure. The ILP, dancer, in (37-c) is not a function of a spatiotemporal variable and therefore is not fixed in time by any spatiotemporal predicate or quantifier.

Kratzer uses the presence of this spatiotemporal variable in the argument structure to differentiate SLPs from ILPs. The reasoning is simple: SLPs have the spatiotemporal variable to denote that they are explicit functions of time whereas ILPs do not have the spatiotemporal variable because they do not change in time.

2.4.2 The Mechanics of Kratzer's Theory

We seek to produce only generalizing readings with ILPs and both generalizing and existential readings with SLPs. Consider again the sentences that we discussed in section 1:

(6) Ferrets are intelligent.  ⇒
   a. Gx[ferret'(x)][intelligent'(x)]  (ILP: Generalizing Reading)

(7) Ferrets are wet.  ⇒
   a. ∃x(ferret'(x) ∧ wet'(x))  (SLP: Existential Reading)
   b. Gx[ferret'(x)][wet'(x)]  (SLP: Generalizing Reading)

In order to understand how Kratzer intends to generate these interpretations, we must review some of her major assumptions. First, she assumes the mapping hypothesis and existential closure at VP. Second, subjects can base generate either at SpecVP or at SpecIP. Those that are base generated at SpecVP must move up to SpecIP to receive case at surface structure (SS) but can also move back down when going to logical form (LF). This is called reconstruction. Third, she assumes that SLPs have an external "spatiotemporal" theta role, labeled ℓ. It is always an external theta role and has the unique property of being assigned to a position whether or not that position is filled. This external spatiotemporal theta role is intended to resemble the Davidsonian argument.

Kratzer's theory, in essence, uses the presence of the spatiotemporal theta role in the argument structure of the predicate to specify whether the subject is base generated at SpecVP (ℓ present, SLP) or SpecIP (ℓ absent, ILP). When the spatiotemporal theta role appears as the external argument in the argument structure, then the subject can only receive a theta role internally at SpecVP. Subjects base generated at SpecVP can appear at either SpecIP or SpecVP at logical form via optional LF lowering whereas subjects base generated at SpecIP cannot move around. Both starting points can receive a generalizing reading by appearing at SpecIP in logical form. Only those subjects that are base generated at SpecVP can receive an existential reading. These mechanics will become clear with a few examples.

To see how a derivation works, we will walk through a sentence with an ILP and a sentence with an SLP. First consider the ILP sentence:

(38) Ferrets are intelligent.
The external argument of the ILP is the normal (theme). Since there is no spatiotemporal argument, the subject base generates at SpecIP as usual and receives the theta role from the predicate. This is illustrated as follows:

(39) **Base generated tree for an ILP:** Ferrets are intelligent.

An arrow with a dotted line indicates theta assignment. The subject cannot generate at SpecVP because it cannot receive a theta role there. Going to surface structure, the subject receives case without movement since it is already at SpecIP and the verb moves up to I to get inflection. Going to logical form, the generic reading is formed without any further movement as follows:

(40) **Generalizing reading for an ILP:**

Ferrets are intelligent. ⇒ $G_{x,t}(\text{ferret}'(x))(\text{intelligent}'(x))$

The finely dotted lines (without arrows) indicate the projection of the lexical items into logical form. The crossing of dotted lines is not allowed. When more than one predicate appear in the Nuclear Scope or the Restrictive Clause, they are joined by ∧. The interpretation of this tree receives a generalizing quantifier because the subject (and, at LF, its free variable) lies in SpecIP outside existential closure.

For SLPs with bare plural subjects, we seek to produce both generic and existential readings.

(41) Ferrets are wet.

Using Kratzer's assumptions, the SLP assigns the spatiotemporal variable as its external argument to SpecIP. Note that this is highly non-standard because theta roles usually are assigned to positions filled with lexical items. The subject is base generated at the SpecVP
where it receives an internal theta role from the predicate. Going to surface structure, the subject, *ferrets*, moves up to SpecIP to receive case:

\[(42) \quad \text{Base generation to Surface Structure for an SLP: Ferrets are wet.}\]

The generic and existential readings are generated by either leaving the subject at SpecIP in LF to receive a generalizing interpretation or moving the subject back down to SpecVP in LF under existential closure during reconstruction. Continuing the example, if the subject is left at SpecIP, logical form gives the generalizing reading:

\[(43) \quad \text{Generalizing reading for an SLP: Ferrets are wet. } \Rightarrow G_{x,t}[\text{ferret'}(x)](\text{wet'}(x))\]

And if the subject is moved down during reconstruction, logical form gives the existential reading:

\[(44) \quad \text{Existential reading for an SLP: Ferrets are wet. } \Rightarrow \exists x(\text{ferret'}(x) \land \text{wet'}(x))\]
Thus we have accounted for both generic and existential readings of a bare plural with an SLP.

2.4.3 Remarks on Kratzer’s Theory

Kratzer’s theory successfully accounts for the possible interpretations of bare plurals. Her theory is robust and offers many of the benefits of GB syntax. There are, however, a few non-standard assumptions that need to be carefully analyzed. The behavior of the spatiotemporal variable as a theta role, for example, is unsettlingly non-standard. It is assigned to an unfilled position which is later allowed to be filled through movement. Note that this spatiotemporal theta role is really just a placeholder to determine whether the subject’s theta role is internal or external. The theory would work just as well if the spatiotemporal variable were replaced with a dummy placeholder that took the external argument position. Furthermore, the same effect would be had if we assume that SLPs simply do not have an external argument. This latter approach would avoid the strange assumptions regarding the behavior of the spatiotemporal theta role. Diesing, in contrast, uses more regular assumptions and syntactic means to achieve the same effect.

2.5 Diesing

Diesing assumes that bare plurals and other indefinites contain free variables which are not explicitly quantified. In doing so, she follows the theories of Kamp (1981) and Heim (1982). These assumptions led to her mapping hypothesis as discussed in section 2.3.1. According to her theory, SLPs and ILPs take different inflections, which control placement and movement of the predicates into VP and IP.

The essential behavior that we wish to capture, as discussed above, is that stage level predicates with bare plural subjects can receive either an existential or generic reading whereas individual level predicates can only get a generalizing reading. Consider once again the sentences and their interpretations that we discussed in section 1:

(6) Ferrets are intelligent. ⇒
   \( G_x[\text{ferret'}(x)](\text{intelligent'}(x)) \) (ILP: Generalizing Reading)

(7) Ferrets are wet. ⇒
   a. \( \exists_x(\text{ferret'}(x) \land \text{wet'}(x)) \) (SLP: Existential Reading)
   b. \( G_x[\text{ferret'}(x)](\text{wet'}(x)) \) (SLP: Generalizing Reading)

As in Kratzer’s theory, the distinction between SLPs and ILPs is manifested in the ability of SLPs to move into the nuclear scope under existential closure while ILPs cannot. To demonstrate Diesing’s theory, all the possible readings of SLPs and ILPs with bare plural subjects will be derived. First, we will perform a derivation of the two readings of an SLP. Diesing states that SLPs have “raising inflection” that does not assign any theta role to the subject position. The subject is allowed to form at SpecVP where it gets a theta role from the external argument of the predicate:

(45) **Base generated tree for an SLP:** Ferrets are wet.
Going to surface structure, the verb moves up to I to receive inflection and the predicate moves up to SpecIP to receive case:

(46) *Surface structure for an SLP:* Ferrets are wet.

Now we need to generate the existential and generalizing readings. This is accomplished by allowing *ferrets* to optionally lower back down to its original position during reconstruction. When *ferrets* is lowered, the free variable introduced by the bare plural is bound by the existential quantifier. If it is not lowered, the free variable receives a generalizing quantifier. Schematically, LF lowering looks like:

(47) *Existential reading for an SLP:* Ferrets are wet. \( \Rightarrow \exists x (\text{ferret'}(x) \land \text{wet'}(x)) \)

If no lowering is performed, then we get a generalizing reading:

(48) *Generalizing reading for an SLP:* Ferrets are wet. \( \Rightarrow G_d[\text{ferret'}(x)](\text{wet'}(x)) \)
Thus Diesing has correctly generated both readings for an SLP by using raising inflection.

Now let us perform a derivation of (6), *ferrets are intelligent*, to show how to get the single, generalizing reading and not an existential reading for an ILP with a bare plural subject. ILPs take "control inflection" which, unlike raising inflection, assigns an external theta role to the SpecIP. The theta role means something close to "y has the property x" where y is the NP and x is the ILP. Both the ILP and the inflection assign a theta role, so we must use PRO. The following base generated structure makes this clear:

(49) *Base generated tree for an ILP*:
Ferrets are intelligent.

Since the subject is base generated in the position that it receives case, it does not move en route to surface structure. Furthermore, it cannot move out of the subject position because the inflection assigns a theta role to it in that position. Thus, LF lowering to get the existential quantifier fails spectacularly:

(50) *Generalizing reading for an ILP*:
Ferrets are intelligent. ⇒ G₂[ferret'(x)](intelligent'(x))
Thus, the single generalizing interpretation is derived.

To summarize, Diesing assumes the mapping hypothesis and alters how the predicate can move around the tree using two different inflections with different theta assignments. The theta assignment of the inflections determines where the subject is base generated. Like Kratzer’s theory, this theory successfully predicts the readings of bare plurals. Since the behavior of the predicate is determined through the choice of inflection, this theory has the advantage of not modifying the argument structure of each verb as Kratzer proposed. Furthermore, it completely eliminates the non-standard theta role $\ell$ that Kratzer had to invoke to make the mechanics work.

2.6 Fernald

Fernald (1994) proposed numerous improvements on all three theories discussed. Among them, we will discuss his important modification of Carlson’s type-theoretic model to include spatiotemporal variables as a type. Two other important developments are presented later in section 4.1.

2.6.1 Fernald’s Carlson Extension

Carlson’s model (reviewed in section 2.2) had an SLP combine with a stage to produce a proposition and an ILP combine with an object or kind to produce a proposition. Once saturated, it is impossible to tell whether the propositions contain SLPs or ILPs. This becomes a problem whenever the SLP/ILP distinction is made on the clause level (seen with some absolute adjuncts (Stump 1985)).

The distinction must therefore be made in the type of the predication, not only in the predicate. Fernald borrows the spatiotemporal variable $\ell$ from Kratzer’s analysis to express this distinction, suggesting that the distinction be made using the following types (=Fernald’s 189):

\[
\text{(51) } \begin{align*}
\text{ILP: } & \text{clever}^\ell (e, t) \\
\text{SLP: } & \text{finished}^\ell (e, \ell, t)
\end{align*}
\]

SLPs must combine with stages to produce a function from spatiotemporal points to truth values. ILPs are only functions from individuals (objects, kinds) to truth values; there is no reference to time or location. When a sentence is constructed with an ILP, the result is a proposition of type $(t)$. A sentence with an SLP will have a type and will thus not be a proposition. Fernald proposes that a sentence (type $(t)$) can be made from these SLP proposition (type $(\ell, t)$) by existentially binding the spatiotemporal location (=Fernald’s 190):

\[
\text{(52) } \begin{align*}
\text{S100. If } & \alpha \in \text{Type}(\ell, t) \text{ then } F_{100} \in \text{Type}(\ell) \\
\text{T100. If } & \alpha \in \text{Type}(\ell, t) \text{ and translates as } \alpha', \\
& \text{then } F(\alpha') \text{ translates as } \exists \alpha'(\ell) \text{ then } F_{100} \in \text{Type}(\ell)
\end{align*}
\]

This rule provides a mechanism that is analogous to Diesing and Kratzer’s existential closure. Thus, in the following sentences, the spatiotemporal locations are existentially quantified:
(53) a. Manon is dancing.  \( \Rightarrow \exists \ell \text{ dancing}'(m,\ell) \)
   b. Manon is dancing on the lawn.  \( \Rightarrow \exists \ell \text{ dancing}'(m,\ell) \wedge \text{on-the-lawm}(\ell) \)

Note that the latter sentence restricts the spatiotemporal locations using the function \( \text{on-the-lawm}(\ell) \). We now have a type theoretic way for heads to select clauses containing SLPs or ILPs. Consider, for example, (=Fernald's 191)

(54) a. I see Manon dancing.
   b. *I see Manon intelligent.

In these examples, \( \text{see} \) must select the proper clause type, \((\ell,t)\), to be grammatical. Thus, we assign perceptual verbs like \( \text{see} \) the following type (=Fernald's 192):

(55) \( \text{see} \ (\langle \ell,t \rangle, \langle e^*, t \rangle) \)

This allows \( \text{see} \) to combine only with clauses that contain SLPs and correctly predicts the ungrammaticality of perceptual reports with ILPs.

3 New Considerations

3.1 Modifying Diesing's Theory

This section presents my modifications to Diesing's theory which address the quantification of the spatiotemporal variable \( \ell \) in a move to simplify the theory and account for more data. While Diesing's theory presents a good way for SLPs and ILPs to get readings with bare plurals, the coordination between predicates and their appropriate raising or control inflection is not explicit. The following modifications clarify this coordination and make an attempt at the treatment of time quantification with SLPs and ILPs.

We begin by taking Diesing's theory and applying the following two modifications. First, the inflection is given a logical form involving \( \ell \) to improve the way that the theory accounts for time semantics. As will be made clear below, the coordination of SLPs and the appropriate inflection is a natural consequence of using this inflectional logical form with \( \ell \).

Second, the behavior of raising and control inflection is changed so that raising inflection provides only the generalizing reading and control inflection provides only the existential reading. Thus, there is no longer any implicit coordination between the predicate type and inflection type. These changes are motivated by data from Spanish that are discussed subsequently.

Whereas Kratzer and Fernald's Carlson extension base their theories on the fact that SLPs are a function of time, Diesing does not mention the time variable at all. This is largely due to the purely syntactic approach that she uses to make the mechanics of her theory work. That is, Diesing merely chooses inflection based on the predicate's type, independent of what free variables that the predicate introduces. She does not propose an explicit way to coordinate the inflection and the predicate. I will present a more explicit coordination of the inflection and predicate using time semantics.
3.1.1 Inflection Logical Form

In the section on the Davidsonian argument, section 2.4.1, we concluded that SLPs have a
spatiotemporal variable whereas ILPs do not. Let us return to that line of thinking again and
reconsider the interpretations of the following sentences with an eye on the quantification of
time:

(56)  
   a. Manon is dancing on the lawn.  
       \Rightarrow \quad \text{Now}_t \; [\text{dancing}'(m,\ell) \land \text{on-the-lawn}'(\ell)]  
   
   b. Manon is dancing this morning.  
       \Rightarrow \quad \text{Now}_t \; [\text{dancing}'(m,\ell) \land \text{this-morning}'(\ell)]  
   
   c. Manon is a dancer.  
       \Rightarrow \quad \text{dancer}'(m)

SLPs have a spatiotemporal variable that is bound by the implicit spatiotemporal quantifier
from the present tense, Now. Note that (56-b) is ungrammatical whenever the time of
utterance, Now, does not coincide with the times denoted by this-morning(\ell). Sentences
with ILPs never appear with a spatiotemporal quantifier (Now). Assuming, as Diesing did,
that there is more than one type of inflection, we can postulate that one of the inflections
has the time quantifier as its logical representation and the other does not. The latter form
of the inflection would, in general, appear with ILPs since no spatiotemporal quantifier can
appear with ILPs. Let us assign the logical form to the inflections as follows:

(57)  
   a. I_{raising}  \Rightarrow  \text{Now}_t  
   
   b. I_{control}  \Rightarrow  \emptyset

We must consider the consequences of such a change. Consider first the interpretations of
the canonical bare plural-ILP sentence,

(58)  
   Ferrets are intelligent.  \Rightarrow  \; G_x [\text{ferret}'(x)](\text{intelligent}'(x))  \quad \text{(I_{control} + ILP)}

This interpretation is identical to the one previously obtained under Diesing's theory because
the logical form of control inflection remains empty. The interpretations of SLPs, however,
pose a problem. We want to derive the following:

(59)  
   Ferrets are wet.  \Rightarrow  
   
   a. \text{Now}_t \exists_x (\text{ferret}'(x) \land \text{wet}'(x,\ell))  
   
   b. \text{G}_{x,\ell} [\text{ferret}'(x)](\text{wet}'(x,\ell))

The former interpretation in (59-a) reads, "At the present time \ell, there is some \( x \) such that \( x \)
is a ferret and \( x \) is wet at this time \ell." The latter interpretation in (59-b) reads, "In general
for entities \( x \) and times \ell, where \( x \) is a ferret, \( x \) is wet at time \ell." Now, if we apply I_{raising}
on the SLP, wet, wet do not get both of the above interpretations:

(60)  
   Ferrets are wet.  \Rightarrow  \quad \text{(I_{raising} + SLP)}
   
   a. \text{Now}_t \exists_x (\text{ferret}'(x) \land \text{wet}'(x,\ell))  
   
   b. \text{G}_x \text{Now}_t [\text{ferret}'(x)](\text{wet}'(x,\ell))
The former interpretation is acceptable and is the same as the one we wanted to get above in (59-a). The latter reveals a new interpretation that had previously not been considered: a mixture of generalizing and existential quantification. The interpretation in (60-b) reads, “At the present time \( \ell \), in general for entities \( x \), where \( x \) is a ferret, \( x \) is wet at this time \( \ell \).”

How do we derive the remaining interpretation in (59-b)? Let’s just try applying control inflection with the SLP, in violation of Diesing’s original theory. Surprisingly, we derive the desired interpretation:

(61) Ferrets are wet.  \( \Rightarrow \) \( G_{x, \ell} \text{ferret}'(x) \) \( (\text{wet}'(x, \ell)) \)  

\[(I_{\text{control}} + \text{SLP})\]

Thus, our second major modification to Diesing’s theory is that there is no coordination between the predicate type and the inflection type. Both can appear independent of each other. The final remaining combination of predicate and inflection is raising inflection with an ILP. We have already derived the only (generalizing) interpretation that exists for the sentence in (58). If we attempt to place raising inflection with an ILP we will produce the following logical forms (depending on whether the ferret moves into VP or IP in LF:

(62) Ferrets are intelligent.  \( \neq \)  \( G_{x, \ell} \text{ferret}'(x) \) \( (\text{intelligent}'(x)) \)  

\[I_{\text{raising}} + \text{ILP}\]

\[a. \; *G_{x, \ell} \text{Nowe}(\text{ferret}'(x)) \; (\text{intelligent}'(x))
\]

\[b. \; *\text{Nowe}G_{x} (\text{ferret}'(x) \land \text{intelligent}'(x))\]

both of which are not well formed because of the vacuous quantification by the spatiotemporal quantifier \( \text{Nowe} \).

To recapitulate, we introduced inflectional logical form for raising inflection. This produced two readings, one of the expected readings and one new. The other expected reading was found by assuming that there is no coordination between predicate type and inflection type and applying control inflection to the SLP.

So far, the changes to Diesing’s theory are summarized below:

(63) **Modifications to Diesing’s Theory (First Try)**

1. No explicit coordination between inflection and predicate type.
2. \( I_{\text{raising}} \Rightarrow \text{Nowe} \); \( I_{\text{control}} \Rightarrow \emptyset \).

The actual mechanics will be made clearer and further modifications will be presented through the examination of examples presented below.

### 3.2 Examples and Refinement

To clarify and refine the mechanics of this theory, we will step through a few derivations. First consider the derivation of the interpretations of the SLP sentence in (59). Either raising or control inflection can be used because there is no longer any coordination between inflection and predicate. Raising inflection puts the subject at SpecVP in logical form to provide the existential reading. The base generated tree looks just like it did in (45) under Diesing’s original theory. Going to surface structure, the verb moves up to get inflection and the subject moves up to get case. To get the existential reading, LF lowering occurs on the subject during reconstruction and the following configuration is obtained:
(64) Ferrets are wet \( \Rightarrow \) Now\(_t\)\(\exists_x(\text{ferret}'(x) \land \text{wet}(x, \ell))\)

Which gets us the first interpretation of a bare plural with an SLP. The sentence is well formed because there are no vacuous quantification or free variables after existential closure.

If we had not performed LF lowering, then we would have obtained the mixed G/Now\(_t\) reading, with ferrets\((x)\) in SpecIP receiving the generalizing quantifier and Now\(_t\) binding the spatiotemporal variable.

The third interpretation of an SLP with a bare plural is obtained by choosing control inflection. The theta role assigned to the subject position by control inflection must be taken by the subject, ferrets. The only possible quantification of ferrets is generalizing:

(65) Ferrets are wet \( \Rightarrow \) G\(_x,\ell\)[ferret\((x)\)](wet\((x, \ell))\)

Both variables are bound by the generalizing quantifier to produce the second possible reading for an SLP with a bare plural, (59-b). Note that we must postulate that existential closure cannot occur on the spatiotemporal variable \(\ell\).\(^4\)

The interpretations of ILPs should work in the same way as they did in Diesing's original theory because we have not changed the control inflection. Choosing control inflection yields the same base generated tree as Diesing's original theory did in (49). Going to surface structure we obtain the same tree as in (50):

\(^4\)This may be equivalent to saying that there must be a constriction on the variable \(\ell\). There are no constrictions on \(\ell\) in these examples.
Ferrets are intelligent  ⇒  \( G_x[\text{ferret}^!(x)][\text{intelligent}^!(x, \ell)] \)

The changes presented here are thus far motivated by purely theoretical concerns. We eliminated the implicit coordination that Diesing postulated between inflections and predicates and replaced it with a mechanism that is grounded in existing theory and that makes new, correct predictions about interpretations and time semantics. The spatiotemporal quantifier remains a bit of a mysterious quantity and it will be discussed in depth in section 3.2.2.

### 3.2.1 Spanish copular variation: ser and estar

In this section, we are able to provide some additional motivation to the changes presented above. Spanish has two forms of the English copula, *be*, that appear depending on the intended interpretation of the predicate. If a generalizing interpretation is desired for the predicate, then *ser* is used as the form of the copula. If an existential interpretation is desired then *estar* is the form of the copula. This is exemplified by the following sentences (Ayllon et al. 1992):

(67)  
\[
\begin{align*}
\text{a. } & \text{Carlos es sucio.} \\
& \text{Carlos is dirty} \\
& \text{‘Carlos is [in general] dirty.’} \\
\text{b. } & \text{Carlos está sucio.} \\
& \text{Carlos is dirty} \\
& \text{‘Carlos is dirty.’}
\end{align*}
\]

(68)  
\[
\begin{align*}
\text{a. } & \text{La tierra aquí es dura.} \\
& \text{The ground here is hard} \\
& \text{‘The ground here is [in general] hard.’} \\
\text{b. } & \text{La tierra aquí está dura.} \\
& \text{The ground here is hard} \\
& \text{‘The ground here is hard.’}
\end{align*}
\]

Note that we are not using indefinites here so the generalization is over spatiotemporal locations. As is the case in English, an existential reading can only appear with an SLP. The predicates above, *sucio* and *dura*, are SLPs. As expected, an existential reading with an ILP is ungrammatical:
(69) a. Carlos es inteligente.
   Carlos is intelligent
   'Carlos is [in general] intelligent.'

b. ??Carlos está inteligente.
   Carlos is intelligent
   'Carlos is ??[at the moment] intelligent.'

The choice of *ser* or *estar* attempts to force the generalizing or existential reading, respectively. This behavior is very similar to the choice of inflection in Diesing's theory and, in particular, the modifications presented in section 3.1. The Spanish examples suggest that there is a base generated copula that raises to receive different raising or control inflection which produce the different forms at surface structure. In section 3.1, raising inflection provides the existential reading and control inflection provides the generalizing reading. This theory applies easily to Spanish if we note that *estar* is the raising inflection form of the copula and *ser* is the control inflection form of the copula. This is summarized in the following:

\[
\begin{align*}
\text{Copula}_{\text{raising}} & \Rightarrow \text{estar} & \text{(Existential Reading)} \\
\text{Copula}_{\text{control}} & \Rightarrow \text{ser} & \text{(Generalizing Reading)}
\end{align*}
\]

The identification of surface structure forms with inflections is made possible by my modification to Diesing's theory; that is, each of the inflections produces either the generalizing reading or the existential reading but not both. In Diesing's original theory, when raising inflection could produce both readings for an SLP, the identification of *estar* with raising inflection would produce both the correct, existential reading as well as the incorrect generalizing reading.

Whereas English provides no variation in the form of the copula, Spanish shows a clear difference between the two inflectional forms. Furthermore, these inflectional forms are correlated with different interpretations, all of which support the modified version of Diesing's theory.

3.2.2 What is *Now*{\text{t}}, really?

To burrow deeper into the guts of *Now*{\text{t}}, we must seek its generalized quantifier representation. Note that a spatiotemporal quantifier such as *Now*{\text{t}} should really be a predicate *Now*(\text{t}) just like all the other spatiotemporal predicates: *this-morning*(\text{t}), *on-the-lawn*(\text{t}), etc. The solution that one might suggest is to make the predicate existentially bound:

\[
\text{Now}_t \Rightarrow \exists_t \text{Now}(\ell)
\]

There two major problems with this new form of the raising inflection. First, it no longer rules out the appearance of ILPs with raising inflection through vacuous quantification since the existential quantifier now quantifies the predicate *Now*(\text{t}). That is, the following readings would be incorrectly predicted for an ILP:

\[
\text{Ferrets are intelligent.} \quad \not\exists
\]

a. \(G_x \exists_t \text{Now}(\ell)[\text{ferret}'(x)](\text{intelligent}'(x))\)
b. \[ \exists \ell \text{Now}(\ell) \exists x (\text{ferret'}(x) \land \text{intelligent'}(x)) \]

This can be fixed by simply assuming that raising inflection always appears with SLPs as Diesing originally did (leaving control inflection free to apply to either SLPs or ILPs). However, the second and more troublesome problem is that the PTQ type of \[ \exists \ell \text{Now}'(\ell) \] is just \( (t) \). It cannot compose with anything below it in the tree.

Consider a predicate logic solution to the problem. For the SLP sentence:

\[ (73) \quad \text{Ferrets are wet.} \]

We want \( \exists \ell \text{Now}'(\ell) \) to compose with \( \text{wet'}(\text{ferret'},\ell) \) which is of type \( (\ell, t) \). Note that \( \text{wet} \) is of type \( (e, (\ell, t)) \) but has \( e \) saturated by the entity, \( \text{ferrets} \). To make our spatiotemporal quantifier the correct type we can create an explicit function of SLP-based propositions \( \mathfrak{P} \) of type \( (\ell, t) \):

\[ (74) \quad \text{Now}_\ell \Rightarrow \lambda \mathfrak{P} \exists \ell_2 (\text{Now}'(\ell_2) \land \mathfrak{P}(\ell_2)) \]

The entire expression has type \( ((\ell, t), t) \) since it combines with SLP-based propositions and outputs a truth value. The types of \( \text{Now}_\ell \mathfrak{P}^{\text{SLP}} \) and \( \mathfrak{P}^{\text{ILP}} \) are the same: \( (t) \) (again, both have entities saturated by free variables). This solution runs into problems when the subject appears in SpecIP because then the predicate, of type \( (e, (\ell, t)) \) can no longer compose with the inflection, which is of type \( ((\ell, t), t) \) (with the entity unsaturated). The variability of the ordering of subject, inflection and predicate at logical form creates a difficult situation for PTQ, which is designed to operate on a more fixed structure. A possible resolution to this ordering problem would be to have the predicate logic representation float to the top, just like negation float. In this way, the subject would always have to compose with the predicate before composing with the spatiotemporal quantifier.

Now consider a second solution to this problem. The generalized quantifier representation of \( \text{Now} \) is:

\[ (75) \quad \text{Now } \mathfrak{P} \Rightarrow \exists \ell [\text{Now}'(\ell)](\mathfrak{P}) \]

where \( \mathfrak{P} \) is a proposition of type \( (\ell, t) \), indicating that it contains an SLP. The entire expression for \( \text{Now} \) has type \( ((\ell, t), t) \). Since \( \text{Now} \) requires that the predicate and subject combine into a proposition before operating, we must assume that it floats to have wide scope over the entire sentence. For the purposes of this paper, we will assume that it operates using the same mechanism as negation float. Since the second solution is much simpler than the first, predicate logic solution, we will pursue example using the second solution. Note, however, that the solutions do the same things using different notation.

To demonstrate how the second solution works, let us perform a derivation of two of the interpretations of \( \text{ferrets are wet} \) that exercise this new logical form. The base generated tree shows the subject at SpecVP and the quantifier at the inflection:
(76) **Base generated tree for an SLP with Iraising:** Ferrets are wet.

Moving to logical form, *Now* floats up to have wide scope over everything, just like negation does. The other movements are standard:

(77) **SLP with Iraising:** Ferrets are wet. $\Rightarrow \exists \ell[\text{Now}')(\exists x (\text{ferret}'(x) \land \text{wet}(x, \ell)))$

And we derive the correct logical form. It is possible to nest generalized quantifiers if the subject receives a generalizing reading:

(78) **SLP with Iraising:** Ferrets are wet. $\Rightarrow \exists \ell[\text{Now}')(\exists x (\exists z \text{[ferret}')(x)\text{[wet}(x, \ell)))$

The third reading for this sentence is obtained using control inflection, but since there is no change to its logical form, the reading will remain the same. The three possible readings in generalized quantifier form for this sentence are summarized below:

(79) Ferrets are wet. $\Rightarrow$
- $\exists \ell[\text{Now}')(\exists x (\exists z \text{[ferret}')(x)\text{[wet}(x, \ell)))$ (Iraising + SLP)
- $\exists \ell[\text{Now}')(\exists x (\exists z \text{[ferret}')(x)\text{[wet}(x, \ell)))$ (Iraising + SLP)
c. \( G_{x,t}[\text{ferret}'(x)](\text{wet}'(x, \ell)) \) (I\textsubscript{control} + SLP)

Attempting to construct a sentence with raising inflection and an ILP will be ruled out by the vacuous quantification of the spatiotemporal variable:

(80) Ferrets are intelligent. \( \Rightarrow \) \( \neg \)

a. \( \exists \ell [\text{Now}'(\ell)](G_x[\text{ferret}'(x)](\text{intelligent}'(x))) \)

b. \( \exists \ell [\text{Now}'(\ell)](\exists_x(\text{ferret}'(x) \land \text{intelligent}'(x))) \)

Since there is no instance of \( \ell \) in the nuclear scope of either interpretation, both are ruled out as being ill-formed. Thus, the generalized quantifier approach solves both problems stated above.

### 3.3 New Considerations in Summary

The modifications to Diesing's theory that were presented in this section provide an explicit mechanism for getting all the interpretations of sentences that contain bare plurals with SLPs and ILPs. The modifications and assumptions are stated here:

(81) **MODIFICATIONS TO DIESING'S THEORY**

1. No explicit coordination between inflection and predicate type.
2. \( I_{\text{raising}} \Rightarrow \text{Now}_t \Rightarrow \exists_\ell [\text{Now}'(\ell)] \) and floats wide; \( I_{\text{control}} \Rightarrow \emptyset \).
3. Existential closure does not operate on spatiotemporal variables.

Including a spatiotemporal variable in predicates is compatible with existing work and enjoys the benefit and support of that previous research. It also accounts for Spanish copular variation and makes some correct predictions about time semantics.

### 4 Interpretation and Pragmatics

All the theories that we have discussed agree that the distinction between stage- and individual-level predicates is written in the lexicon. This specification of SLP or ILP, whether by argument structures, sorted types, or free spatiotemporal variables, is all that needs to be encoded in order to predict their behavior using theory. Carlson explicitly assigns each predicate the appropriate type, Kratzer assigns each predicate an argument structure with or without a spatiotemporal variable, and Diesing simply assumes that predicates come labeled appropriately. Fernald's Carlson extension and the modified Diesing theory put a spatiotemporal variable in the type and the function, respectively. All of these theories assume that the distinction between SLPs and ILPs is forever embedded in the lexicon. There are, however, exceptions to this lexical rule in cases where sentences such as *I saw ferrets having short legs* make sense. Fernald addresses this by developing rules to coerce SLP readings for ILPs while leaving the lexicon as it is. He also provides a direct test for whether a predicate is SLP or ILP. These two subjects are discussed in the following two sections. Afterward, we will briefly discuss whether the lexical distinction is really warranted.
4.1 Evidential Coercion (Fernald)

There are select situations where an ILP can act like an SLP. The phenomenon is best understood through examples; carefully consider the interpretation of the following:

(82) a. Tom is sometimes tall.
   b. Ben is usually funny.
   c. I saw Daniel apoplectic.

In all these examples, the ILPs, tall, funny and apoplectic, behave like SLPs. This is forced by the quantifiers that need to bind a time variable in the first two examples and the perceptual report in the last example. How do these ILPs get coerced into masquerading as SLPs? The answer lies in the situational interpretation of the sentences. The only possible interpretation of (82-a) is that Tom sometimes acts as though he is tall, boosting himself up on his tippy toes to make people think he is 6'5". The implicit word or phrase in all these examples is something along the lines of acting x or behaving as though he were x. With these examples in mind, Fernald states the logical rule for coercion as follows (=Fernald’s 1994:124):

(83) EVIDENTIAL COERCION
Let \( \alpha \) be an ILP with interpretation \( \alpha' \). \( \alpha \) can be used as an SLP with the following interpretation:
\[
\lambda x \lambda \ell \exists Q \left[ G_{y, \ell} (Q(y, \ell)) [\alpha'(y)] \wedge Q(x, \ell_j) \right]
\]

where the logic reads, “Given an entity \( x \) and spatiotemporal point \( \ell_j \), there exists some SLP \( Q \) such that \( Q \) is true for \( x \) and \( \ell_j \) and it is true that in general for an entity \( y \) and a spatiotemporal variable \( \ell \), if \( y \) and \( \ell \) satisfy the SLP \( Q \) then \( y \) is true of the ILP \( \alpha' \).” To paraphrase, this rule coerces sentences such as (82-a), Tom is sometimes tall, to get the interpretation that Tom generally participates in activities, \( \alpha' \), and when he does, one would say that he is tall. The activity is usually acting or behaving but could be anything. The determination of that activity \( Q \) rests upon the listener. If no such activity can be thought of, the coercion derails because \( Q \) cannot be determined.\(^6\)

Using Fernald’s coercion rule on the ILP tall in (82-a) we get:

(84) \[
\lambda x \lambda \ell \exists Q \left[ G_{y, \ell} (Q(y, \ell)) [\text{tall}'(y)] \wedge Q(x, \ell_j) \right]
\]

The first line of (84) reads, “\( x \) generally participates in activities, and when she does, one would say that she is tall.” Thus, we have created an SLP that is a function of entities and spatiotemporal location and where the existentially quantified predicate has been specified as acts.

4.2 SLP- and ILP-based propositions (Fernald)

Consider the interpretation of the following sentence:

\(^6\)Technically, I suppose, the coercion can get carried out regardless of whether the listener can think of an action that produces a satisfactory interpretation. The resulting sentence is simply true or false depending on whether or not there exists a \( Q \) action for this to be grammatical.
The ferret ate supper at 5:32.

The time reference is bound by the time 5:32. Regardless of what time this sentences is uttered, the interpretation is the same; it will always be true in any world and time in which it is uttered. Formally speaking, there is no world in which you can find a difference in the interpretation of (85) at two different times:

\[
\text{[eat-supper'}(\text{ferret}, t_{5.32})]\mathcal{M},w',t_{1} \equiv [\text{eat-supper'}(\text{ferret}, t_{5.32})]\mathcal{M},w,t_{2},t_{3} \ldots t_{n},g
\]

Note that I have explicitly made eat-supper a function of time. ILPs, on the other hand, do not have such an explicit reference to time. Thus, it is possible to utter the following at two different times and have it mean two different things:

(87) The ferret is smart.

For example, the interpretation would be different if this sentence were evaluated now, when the ferret is old and wise, and two years ago when the ferret was just a pup. There is some world in which the ferret is not smart at one time and smart at another. Formally, that is:

\[
\text{[smart'}(\text{ferret})]\mathcal{M},w',t_{1} \not\equiv [\text{smart'}(\text{ferret})]\mathcal{M},w,t_{n},t_{m},g
\]

Note that the ILP, smart, is not a function of time. Thus, the interpretation of an ILP varies depending on the time and world in which it is evaluated. These observations led Fernald (1994) to a concise definition of SLP- and ILP-based propositions:

(89) ILP-based Proposition: \( p \) is an ILP-based function if and only if it is necessarily the case that \( \exists w_n \in W, t_k, t_m \in I : [p]_{\mathcal{M}, w_n, t_k, t_m, g} \not\equiv [p]_{\mathcal{M}, w_n, t_m, g} \).

(90) SLP-based Proposition: \( p \) is an SLP-based function if and only if it is necessarily the case that \( \forall w_n \in W, t_k, t_m \in I : [p]_{\mathcal{M}, w_n, t_k, t_m, g} = [p]_{\mathcal{M}, w_n, t_m, g} \).

These definitions provide a robust groundwork for an explicit mechanism to distinguish SLP-based propositions and ILP-based propositions in the semantics.

These definitions should not, however, come as a surprise because they merely restate in intensional logic terms that SLP-based propositions are a function of spatiotemporal variables while ILPs-based propositions are not. This contrasts sharply with the initial impression of SLPs and ILPs (not the propositions that contain them). SLPs were introduced as predicates that describe temporally variable properties while ILPs described indelible properties. When a proposition is created with an SLP, the SLP (an explicit function of time through \( \xi \)) is fixed in time when the spatiotemporal variable is saturated. Since an ILP is not an explicit function of time, there is no way to fix the time at which the predicate is evaluated. This allows the truth conditions of ILP-based propositions such as Ben is tall to change over time as Ben grows up.

4.3 Science Fiction

Given these tools, let us briefly attempt to tackle some difficult cases. The notion that predicates were marked for being stage level or individual level in the lexicon is troublesome
when different contexts are considered. When reading a science fiction novel, one might perfectly well understand the following sentence:

(91) I saw Oro short yesterday. He must be sad.

In this context *short* is an SLP because it can change in time depending, in this case, on the alien’s mood. His height might be directly proportional to his mood.

Given that *short* is lexically marked as an ILP in our lexicon, our previous theories fail when attempting to predict the correct interpretation for (91). Coercion produces the interpretation:

(92) I saw Oro behaving short.

Which is clearly not the correct interpretation. Coercion never actually changes the ILP but rather adds quantifiers and other predicates around the ILP so that a time variable is introduced and the entire unit can be treated as if it were an SLP. In this context, there is no two place predicate, Q, (such as *acts, behaves*) in our definition in (83) that produces the correct interpretation. Coercion fails to produce this interpretation because it entails that *being short* is an ILP that is converted to an SLP by some other verbal SLP.

How can we check that *short* is an SLP? Fernald’s explicit test states that *short* is an SLP if in all worlds the denotation of the predicate is the same:

(93) *short* is an SLP iff \( \forall W_n \in W, t_k, t_m \in I : [\text{short}'(o)]^{M,W_n,t_k,t_m} = [\text{short}'(o)]^{M,W_n,t_m,t_g} \).

Note that the truth of this equality depends entirely upon the presence of a spatiotemporal argument. As it lies above, such an argument is not present, the equality does not hold and the rule therefore predicts that it is not an SLP. The only way that we are able to get the desired interpretation is if we simply include the spatiotemporal argument:

(94) *short* is an SLP iff \( \forall W_n \in W, t_k, t_m \in I : [\text{short}'(o,now)]^{M,W_n,t_k,t_m} = [\text{short}'(o,now)]^{M,W_n,t_m,t_g} \).

This equality is true and the rule correctly predicts that it is an SLP. The entire distinction thus, in my mind, boils down to a pragmatic issue: the addition of a spatiotemporal variable in the function domain is completely determined by the context that the speaker and listener are in. Whether a predicate is an SLP or an ILP is entirely determined at the time of utterance and is largely based on what is common knowledge between two speakers. A predicate is interpreted as an SLP or an ILP based on what possible interpretations are compatible with the context. Thus, while all the semantic and syntactic theory continues to work in the same way, we choose the presence of the spatiotemporal variable in the domain of the function based on pragmatics using the context of the communication.

5 Conclusion

The distinction between stage- and individual-level predicates has proven useful to a number of successful theories regarding the interpretations of sentences and, in particular, sentences with bare plurals subjects. A series of modifications to Diesing’s original theory improve the
handling of time semantics, allow a simple account of Spanish copular variation and make the mechanics of the model more explicit. These modifications include the identification of SLPs with predicates that are functions of an entity and a spatiotemporal variable and the assignment of a spatiotemporal quantifier as the logical form of the inflection. Finally, whether a predicate is an SLP or an ILP is determined pragmatically.

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