Domain Restrictive Predicates

Sangceup Yune

Directed by

Professor Line Mikkelsen

Professor Eve Sweetser

University of California, Berkeley

December 15, 2015

Submitted in partial fulfillment of the requirements

for the honors thesis.

Contents

Domain Restrictive Predicates

Sangceup Yune, University of California, Berkeley

December 15, 2015

1 Introduction

Some English ditransitive verbs such as *feed, pay, repay*, and *serve* have a distributional peculiarity such that their theme arguments can be either expressed or unexpressed. This thesis will investigate what conditions are needed for such a structural alternation, and will present a syntactic, semantic and pragmatic analysis of the argument structure in the predicates.

Section 2 will introduce empirical patterns of some English ditransitive predicates that can and cannot have an unexpressed theme. The concept of restrictive domain and the possibility of semantic reconstruction of syntactically unexpressed arguments will be informally discussed in section 3.

Section 4 will suggest the concept of domain restrictive predicates by presenting a syntactic and semantic analysis of the predicates with unexpressed arguments, whose semantics has two possible manners of placing the domain restriction, i.e., on the lexical and propositional level. It will briefly discuss the implications of domain restriction with regard to pragmatics. Lastly, this thesis will present a schematic understanding of the relationship between syntactic valency and semantic adicity.

2 Empirical patterns: unexpressed arguments in ditransitive verbs

English ditransitive verbs are morphosyntactically distinctive in that they take two objects in the same accusative case, one of which came from the dative case. The selectional restriction on English ditransitive predicates generally requires a benefactive/recipient and a theme/patient to play their roles in the scenario of the predicate.

Grammatical relations are structurally defined, whereas thematic relations are described primarily in terms of semantics and discussed mainly in the syntax-semantics interface. Grammatical relations and theta roles are interconnected mainly by the selectional restrictions and the Uniformity of Theta Assignment Hypothesis (UTAH). The formal relationship between the predicate and the arguments will be discussed in section 4.

2.1 The judgment of grammaticality

The paradigm cases of ditransitive predicates capture the change in possession of the theme from the agent/causer/source to the recipient/benefactive. Levin categorizes *serve, (re)pay*, and *feed* under Verbs of Change of Possession in that they display dative alternations with other verbs (Levin, 1993, 138):

(1) Part One: Alternations

13. Verbs of Change of Possession

13.1 Give Verbs: feed, give, lease, lend, load, pass, pay, peddle, refund, render, rent, repay, sell, serve, trade

This thesis has conducted a grammaticality judgment survey on the verbs in Levin's category except *peddle* and *render* because of their rare use. The purpose of the survey

was to separate a subgroup of verbs that can have their themes unexpressed from the other ones. Fifteen native speakers of English who major in linguistics or philosophy at the University of California, Berkeley responded as to the grammaticality of 45 sentences. The appendices include the full information related to the survey.

2.2 The subgroup of ditransitive verbs with the null instantiated theme

The following show three different distributions of the arguments in a predicate. The first sentence has an unexpressed theme (a), the second has the benefactive unexpressed (b), and the last one is the canonical ditransitive predication without any omission (c).

(2) a. Jack served Kate.

 b. Jack served coffee.

 c. Jack served Kate coffee.

(3) a. Jack paid Kate.

 b. Jack paid 10 dollars.

 c. Jack paid Kate 10 dollars.

(4) a. Jack repaid Kate.

 b. ? Jack repaid 10 dollars.

 c. Jack repaid Kate 10 dollars.

(5) a. Jack fed the dog.

 b. * Jack fed canned food.

 c. Jack fed the dog canned food.

As shown in (2a), (3a), (4a), and (5a), some of the predicates in Levin's category can appear without their themes explicitly expressed. Construction Grammar treats the

unexpressed arguments as null instantiated and consider the construction to be an indefinite null instantiation (INI) (Fillmore, Johnson, & Petruck, 2003). This thesis will interchangeably use "INI", "implicit argument" (Bhatt & Pancheva, 2006), and "unexpressed argument" (hereafter referred to as UA).

Also of note, while (2) and (3) can take a theme without a recipient/benefactive, (4) and (5) were judged mostly ungrammatical or marginal for the same construction.

2.3   Contrast with other ditransitives

A canonical ditransitive verb *give*, including the other predicates in the survey, was judged strongly unacceptable when the predicates occur only with benefactives without themes as shown in (6) to (9).

(6)   a.   * He gave Kate.

    b.   ? He gave a/the ring.

    c.   He gave Kate a ring.

(7)   a.   * Kate passed Jack.

    b.   Kate passed the salt.

    c.   Kate passed Jack the salt.

(8)   a.   * Kate sold Jack.

    b.   Kate sold her car.

    c.   Kate sold Jack her car.

(9)   a.   * Kate rented Jack.

    b.   Kate rented her apartment.

    c.   Kate rented Jack her apartment.

The distributional peculiarity of *feed, serve*, and *(re)pay* in the theme alternation seems to be a good criterion to separate them from the other ditransitive verbs in (1).

As noted in the previous section, another notable distributional difference is seen in the benefactives. While *feed* cannot occur without its benefactive, *serve, pay, pass* and *sell* can. It seems possible that the latter group may constitute another subcategory different from that of *feed*, yet this thesis will concentrate on the surface alternation of the themes in (2a) to (5a).

As to *refund* only (10c) was unanimously judged grammatical.

(10) a. ? Jack refunded Kate.

  b. ? Jack refunded ten dollars.

  c. Jack refunded Kate ten dollars.

Since the judgments on theme omission in (2) to (5) and (6) to (9) are clear, I suggest (10) be an intermediate category or a borderline case in which neither the theme nor the benefactive is omissible. The predicate *refund* seems to be a ditransitive verb that stands between two separate subgroups in (1).

In brief, *feed, pay, repay*, and *serve* constitute a subgroup of ditransitive verbs presented in (1). The distinctive feature of these predicates is that they can have a theme syntactically unexpressed, or null instantiated.

2.4   Other languages

The same alternation in expressing the themes occurs in a language hardly thought of as akin to English.

(11) a. (Na-nun) gangaji (bap-)meok-i-et-da.

  (I-NOM) dog   (food-)eat-CAUSE-PAST-DECLATIVE
  'I fed the dog.'

b. Sonnim (umsik) daejeopha-et-ni?

   guest (food) serve-PAST-INTERROGATIVE
   'Did you serve the guest (some food)?'

c. Kate-ege Banji ju-et-ni?

   Kate-DATIVE ring-∅ give-PAST-INTERROGATIVE
   Did you give Kate the ring?

In Korean, an agglunative language, predicates *(bap-)meok-i-et-da* and *daejeopha-et-ni*, which correspond to *feed* and *serve* respectively, can occur with or without its theme *bap* and *umsik* as either an isolated object or an agglutinated object. Korean *ju-* ('give') normally requires both benefactive and theme except when one of them is clear in context, which shows the omission of a contextually agreed definite item, or a case of definite null instantiation (Fillmore, 1986).

Mandarin Chinese, an isolating language, exhibits the same distribution. *Fan* in (12a) meaning the food, just as Korean *bap* does, can be unexpressed.

(12) a. Wo chi fan le.

      I eat food PAST
      'I ate (some food).'

   b. Wo chi le.

      I eat PAST
      'I ate (some food).'

   c. Ni ba zhihuan gei ta le ma?

      you ACC ring   give her PAST INTERROGATIVE
      'Did you give Kate the ring?'

Chinese shows the same distribution as Korean concerning *gei* ('give'), requiring both arguments unless either of them is clear in context.

As shown in Korean and Chinese data as well as English data, the matter of indefinite null instantiation does not seem to be purely related to the morphosyntax because two distinct morphological types manifest the same distributional feature. It seems that indefinite null instantiation is more of a semantic matter in which what can be syntactically unexpressed is semantically restricted to a certain kind of things.

3 Conceptual analysis of UAs

3.1 The nature of UAs

We have seen that a subgroup of ditransitive verbs from (1) can optionally have an unexpressed theme. There is a semantic feature that should be clarified here.

The possible semantic domain of the theme of *feed* and *serve* seems to be restricted to the set of food or something edible at most, and that of *(re)pay* is to the set of money or its equivalent. In contrast, *give* or any other ditransitive verbs in the other subgroup do not seem to have such a restriction on their domain because almost anything can be given, passed, or sold (to someone).

In other words, the meaning the UAs can possibly have is about what kind it is. i.e., the denotation of the UAs is the domain of the things of a specific kind. The restriction on the possible domain of the theme is one of the distinct features that marks the subgroup from (1) that can have UAs.

The other semantic feature of UAs to note is the indefiniteness of their denotation. This feature does not logically follow the first feature because a theme in the restricted domain could denote a definite individual such as (13a) and (13b).

(13) a. She served him a bloody cut of meat.

   b. She served him the wine her father sent her from Napa.

   c. She served him.

As in (13c) above, what the UAs denote is something of a certain kind whose individuality is unspecific and indefinite, or an indefinite member of a set. We cannot specify a definite individual that was *served* in the meaning that (13c) conveys. If a theme is a specific or definite entity as in (13a) and (13b) rather than an unspecified indefinite kind, its meaning simply cannot be conveyed with itself unexpressed.

With respect to the indefiniteness of UAs, Fillmore named this sort of UAs "indefinite null complements", where the nature of UAs is unspecified (Fillmore, 1986; Fillmore et al., 2003). In *Pragmatically Controlled Zero Anaphora* (1986), Fillmore observed two types of syntactically unexpressed arguments, namely, "indefinite null complements" (INC) and "definite null complements" (DNC). He argues that the referent of DNC is retrievable from the context, while that of INC is "unknown or a matter of indifference" and "obligatory disjoint in reference with anything saliently present in the pragmatic context." The following is some of the examples he presented in the article:

(14)   (Fillmore, 1986)

      a.   When my tongue was paralyzed I couldn't eat or drink.

      b.   We've already eaten.

      c.   They concurred.

Thus far, this thesis argue that there is a subgroup of ditransitive verbs from (1) that has a distributional peculiarity in the syntactic realization of the direct object, or the semantic theme, and the reason for the alternating construction is not purely morphosyntactic.

Considering all the features of the syntactic and semantic property shown so far, there seems to be no reason for assuming indefinite null instantiation is possible only in a ditransitive construction. Here are some well-known examples of some transitive verbs:

(15)   a.   My daughter has eaten already.

     b. Kate has been painting all day in her atelier.

     c. I have been baking all day.

The domain restrictive predicates do not confine themselves in the category of ditransitive verbs. As long as the UA is restricted to a certain kind (restricted domain) and denotes an indefinite individual in the kind (indefinite and unspecific), some transitive verbs (including di-transitive verbs) are able to have an argument unexpressed.

However, the indefiniteness of UAs is not cross-linguistically applicable. Unlike the UAs in English we saw so far, those in Korean and Chinese (and the polysynthetic languages to be discussed in the following section) can also denote definite entities. For example, (11a) can mean "I fed the dog *the canned food we bought at the store last night*", and (12b) can mean "I ate *the candy you gave me*" as well, while a definite reading of a UA in (15a) such as "My daughter has eaten *the potato* already" is improper in English.

Therefore, the indefiniteness, as opposed to the domain restriction, does not seem to be a cross-linguistic requirement for the property of UAs. I will mainly discuss the indefinite readings in the English data obtained in the survey although I will suggest a methodology to analyze the definite readings in other languages at the end of section 4.

3.2   Noun incorporation

As a transitional phase to formal structural analysis, this thesis will look into a possible analogue between the predicate structure with a UA in English and noun incorporation in the polysynthetic languages, the fourth morphological type of language which was not previously discussed. The two distributions may be viewed as disparate because the former is morphological and the latter is syntactic, but there seem to be some notable parallels.

Polysynthetic languages represent extreme agglutinative forms, where a number of morphemes comprise a word corresponding to a clause in the other language types. Noun

incorporation (NI) is a linguistic process in which an argument is morphologically integrated into the predicate to form a polysynthetic expression (Baker, Aranovich, & Golluscio, 2005). The incorporated arguments also can be syntactically paraphrased and can be doubled as in (16a) in some polysynthetic languages (Mithun, 1984, 848).

(16) Mohawk (Baker et al., 2005)

    a. Wa'-k-ather-a-hninu-'   thikv ather-e'.

       FACT-1sS-basket-0-buy-PUNC that basket-NSF
       'I bought that basket.'

    b. Kikv a'shar-e'   ka-na'tar-a-kwetar-vs.

       this knife-NSF NSS-bread-∅-cut-HAB
       'This knife cuts bread.'

    c. T-a'-khey-athvno-tsher-u-'   ne owira' a.

       CIS-FACT-lsS/FsO-ball-NOML-give-PUNC NE baby
       'I gave the ball to the baby.'

    d. #T-a'-ke-wir-u'   ne athvno.

       CIS-FACT-1sS-baby-give-PUNC NE ball
       NOT: 'I gave the ball to the baby.'

Baker et al. report three stable cross-linguistic properties of NI, some of which are analogous to the predicate structure at the center of our attention. As shown in (16), Baker et al. say that "in virtually all languages the direct object of a transitive verb can be incorporated" (16b). They report the theme/patient can be incorporated into ditransitive verbs (16c), while the recipient/benefactive cannot (16d), which is analogous with the English data this thesis has shown.

The UAs in English do not have a definite reading but only have an unspecified indefinite reading (even in specific types or domains). But, the incorporated noun, cross-linguistically, can have a generic or definite interpretation in the discourse, but cannot

have a specific indefinite interpretation (Mithun, 1984; Baker et al., 2005).

It is far from likely that English verbs can morphologically incorporate the themes in the way that NI does. However, it would not be implausible to postulate a layered semantic structure inside the predicates wherein an argument or a variable for the argument can be embedded so that semantics can explicitly reconstruct them out while syntax retains the argument unexpressed.

English is a non-polysynthetic, inflectional language, and it does not seem to have such examples that are structurally comparable to NI. Noun incorporation, thus, cannot be adduced as evidence for the alternating distribution of themes under discussion. But, it could be deemed as a signpost indicating the parallel predicate-argument structure is possible in human language, where a semantic argument occurs closer to the predicate when it fails to be realized in canonical argument position. That is, the syntactically unexpressed themes occur inside the predicate morphologically in some languages and semantically in other languages including English. This thesis will formally develop this intuitive hypothesis in the next section.

4 Formal Analysis

This section will develop a formal implementation of the hypothesis put forth in the previous sections. As mentioned in the previous section, it does not seem reasonable in English to assume the same morphological incorporation of the UA inside the predicates as in noun incorporation. I have suggested a hypothesis that a theme could be lexically embedded inside the semantic structure of the predicate. Based on this hypothesis and the conceptual analyses thus far, this section will show how such ditransitive verbs that have an alternating number of arguments can be captured syntactically and semantically and will test the hypothesis by the full syntactic and semantic derivation of the sentence *Kate fed Fido*. The object language for this section will remain to be English.

4.1 Syntax of UAs and *feed*

It is important to note again that definite arguments cannot occur in the same distribution as in (2a) to (5a). The sentences with UAs are acceptable only when the UAs denote something indefinite. Fillmore et al. describes this property of UAs as "missing [element] whose identity is not retrievable, but whose type is usually known" (Fillmore & Petruck, 2003).

So, it could be a sterile discussion to think about the syntactic structure of UAs because their exact denotations are not to be conveyed in indefinite null instantiation. However, the discussion seems to be necessary because the syntactic structure of UAs is semantically germane to the establishment of their meanings, which this thesis aims to reveal.

The syntax of an indefinite entity or entities requires two devices in English, viz., a quantifier (determiner) and a predicate (NP) such as *an apple, some apples*, and ∅ *apples*.

(17)

```
            DP
            │
            D′
           ╱  ╲
          D    NP
     quantifier  predicate
```
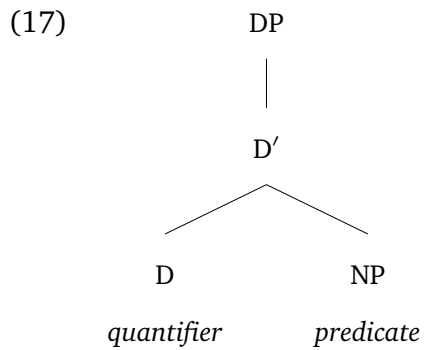
The corresponding syntactic structure of UAs is to be $[_{DP} D [NP]]$. The domain restriction would be marked by the predicate NP if it were expressed, i.e., NP would otherwise stipulate the kind of the UA.

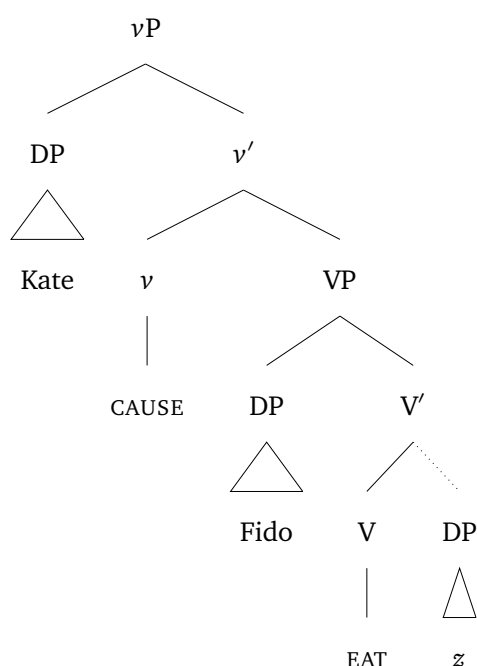The syntax of English ditransitives can be captured in many ways, including Larson's VP Shell (Larson, 1988) and small clause. The following is the syntax of *Kate gave me a book*, in which all the arguments of *give* are instantiated.

(18)

```
              VP
            ╱    ╲
          DP      V′
          △     ╱   ╲
        Kate   V      VP
               │    ╱    ╲
               e   DP      V′
                   △     ╱   ╲
                  me    V      DP
                        │      │
                       give   a book
```

(19)

```
              vP
            ╱    ╲
          DP      v′
          △     ╱   ╲
        Kate   v      VP
               │    ╱    ╲
             CAUSE  DP     V′
                   △     ╱   ╲
                  me    V      DP
                        │      △
                       GET    a book
```
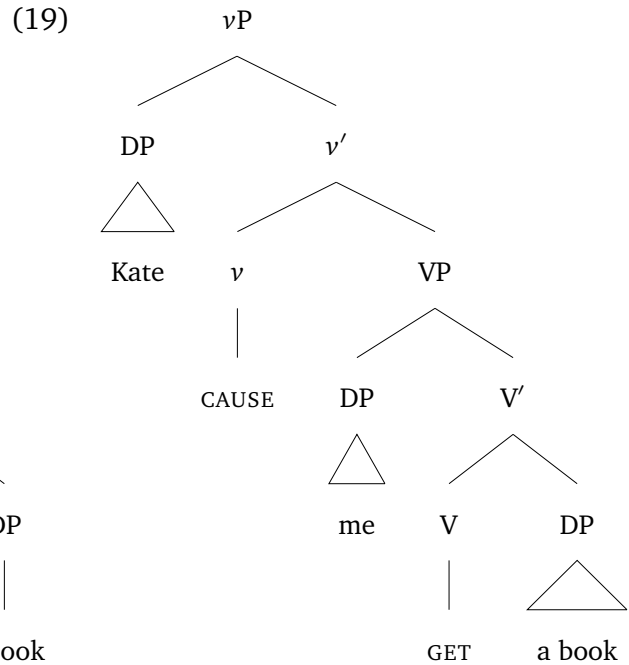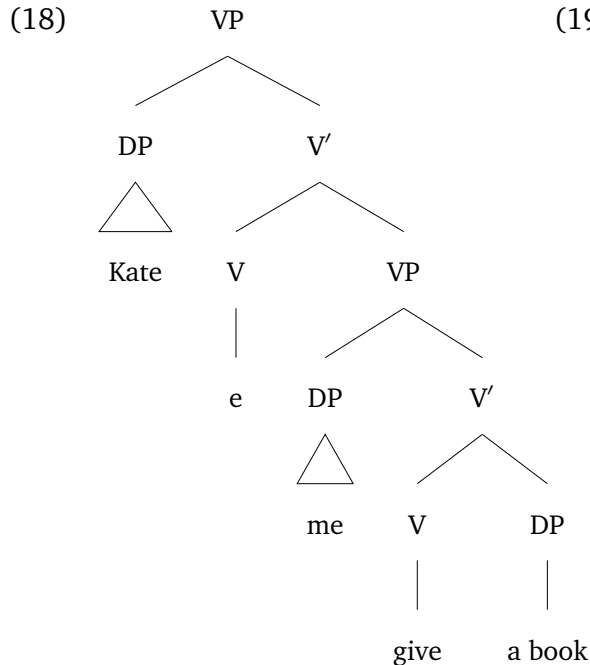
(18) is Larson's VP shells, and (19) is the comparable structure under the assumption of semantic decomposability from *give* to CAUSE TO GET, where the abstract verb head GET

13

will move to adjoin to CAUSE, and then, the adjoined will be eventually spelled out as the same denotation as *give* has (Huang, 2006; Levin, 2015). This thesis will employ (19) to test the hypothesis primarily because it is more compatible with the distinct (internal and external) event structures represented by the predicate *feed* (Kratzer, 1996) and many other reasons whose enumeration would be parenthetical at most when considering the purpose of this thesis.

(20)   Kate fed Fido.

```
                      vP
              _____/_____
            DP                  v′
            /\          _____/_____
          Kate        v                  VP
                      |           _____/_____
                    CAUSE       DP               V′
                                /\          _____/ ⋮
                              Fido        V       DP
                                          |       /\
                                        EAT       z
```

The dotted lines in (20) represent the alternating argument structure, where the complement DP can either be expressed or not. The assumption of semantic decompositionality can be formally stated as the following:

(21)   ⟦Kate feed Fido⟧^{M,g} = 1 iff Kate causes Fido to eat some food (or Kate causes the event such that Fido eats some food).

4.2 Semantics of *feed*

As mentioned earlier, the puzzle in the sentence *Kate fed Fido* is that both speaker and hearer know what kind it is that was fed to *Fido* even though "the kind" was not said. We have seen that the UA is not morphologically incorporated in the predicate, and it is obvious we cannot attribute the understanding to the syntax of it. Then the only option left is semantics and pragmatics.

The hypothesis is that the UA is somehow expressed in the semantics of the predicate. Then, the question is how the semantics of such predicates can be captured. In other words, the question as to how the meaning of an unasserted element is conveyed can be reduced to if the UAs are revived as an assertion in the truth conditional semantics.

There are three tasks to achieve here in the semantics of *feed*. The first task is the assertion that a UA of the predicate exists, and the second is restricting its domain. The last task is to determine which level such an assertion should be on. By the "semantic layers" of the predicates in the previous chapter, I mean the following:

A predicate must incorporate all of its argument in its denotation. The reason that the denotation of a predicate must include even a syntactically unexpressed argument, say z, lies in logic. The predicate, *feed* in this instance, is a relation of three semantic arguments, and thus needs three arguments in the syncategorematic logical expression to be well-formed.

Further, semantics is required to define the range of what is *conveyed* in the expressions by an assertion or by leaving a logical antecedent that an entailment would follow so that the next linguistic process, or the pragmatics can exclude them from the conversational implicature.

In a more formal sense, a predicate is a relation among the arguments that take part in the state of affairs that the predicate refers to. Under the axiom that the set exists, a

relation R is defined as a subset of Cartesian Product:

$$R \subset X \times Y \times Z = \{\langle x, y, z \rangle : x \in X, y \in Y, z \in Z\}$$

Following the definition, a predicate must exhaustively include all the arguments that comprise itself to be well-formed as a relation. Therefore, (the denotation of) *feed* must include all the semantic arguments—the agent, the benefactive, and the theme—in its semantic value as shown in (22a).

(22) a. $[\![\text{feed}]\!] = \lambda z.\lambda x.\lambda y.\textit{feed}'(y, x, z)$

   b. $[\![\text{feed}]\!]^{M,g} = \lambda x.\lambda y.\exists z_i \in D.\textit{feed}'(y, x, z_i)$

   c. $[\![\text{feed}]\!]^{M,g} = \lambda x.\lambda y.\exists z_i \in D.\textit{feed}'(y, x, z_i) \wedge \textit{food}'(z_i)$

If an argument cannot be abstracted over for some reason including its being unexpressed in syntax, it must be bound by a quantifier, and (22b) is to be such a case. The denotation includes the existential assertion (instantiation) of an indefinite UA in the domain of discourse D of the model, where the index i is in the domain of a variable assignment function g.

As to the domain restriction, there are two choices in implementing the domain restriction. The first choice is (22c), where $\wedge \textit{food}'(z_i)$ asserts the restriction inside the denotation of *feed*. With a modified assignment, we can replace the domain restriction of the UA to a set of food placed by the assertion $\wedge \textit{food}'(z_i)$ in (22c):

$$g' : i \rightarrow x \in F \subset D$$

, where F denotes a set of food in the domain of discourse. (22c) can be restated as:

(23) $[\![\text{feed}]\!]^{M,g':i \rightarrow x \in F} = \lambda x.\lambda y.\exists z_i \in D.\textit{feed}'(y, x, z_i)$

It should be noted that the meanings of (22c) and (23) are different. (22c) accomplishes the existential instantiation of the UA and its domain restriction on the same lexical level, while (23) places the domain restriction when it is interpreted.

16

(23) may seem better if one seeks a uniform denotation of *feed*. However, the unique canonical denotation of a predicate will be invariably as (22a). The differences in (22b) and (22c) are only due to the modifications because z is not a constant but a variable, i.e., the modifications were made because of the quantification of an indefinite argument and its domain restriction. And these modifications should be distinguished from the uniqueness of the canonical denotation of a predicate itself.

This thesis will use the denotations in (22c). (22c) is simpler and better fits my hypothesis because all three tasks aforementioned are done on the same lexical level. What *Kate fed Fido* means is that Kate fed Fido something indefinite in a certain kind (=food), and what it does not mean to convey is that what exactly the individual with which z is co-indexed is. So, (22c) is enough to satisfy our intuitive understanding that what is needed for the truth condition of the utterance *Kate fed Fido* is a kind of food, not a specific and definite individual food.

The existential quantifier binding an indefinite argument in the restricted domain of food well captures the syntactic structure of the UAs $[_{DP} D [NP]]$ as shown in (24).

(24)
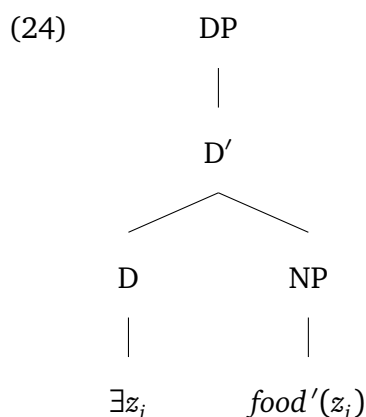
Following the same reasoning, the denotations of the transitives in (15) are:

(25)   a. $[\![eat]\!] = \lambda y. \exists x. eat'(y, x) \wedge food'(x)$

     b. $[\![paint]\!] = \lambda y. \exists x. paint'(y, x) \wedge picture'(x)$

c. $[\![\text{bake}]\!] = \lambda y.\exists x.\mathit{bake'}(y,x) \wedge \mathit{food\text{-}cooked\text{-}by\text{-}dry\text{-}heat'}(x)$

(25) shows the denotations of the predicates in (15), which contain exactly the same information as the denotation of *feed*: the assertion of a syntactically unexpressed but semantically meaningful argument, the domain restriction, and the implementation of these two on the lexical level.

So far, I have formally developed my hypothesis that a syntactically dislodged indefinite argument is relocated in semantics at the request of the predicate being well-formed as a relation. In Gricean terms, the meaning of a UA, then, would not be implicated but asserted or at least entailed.
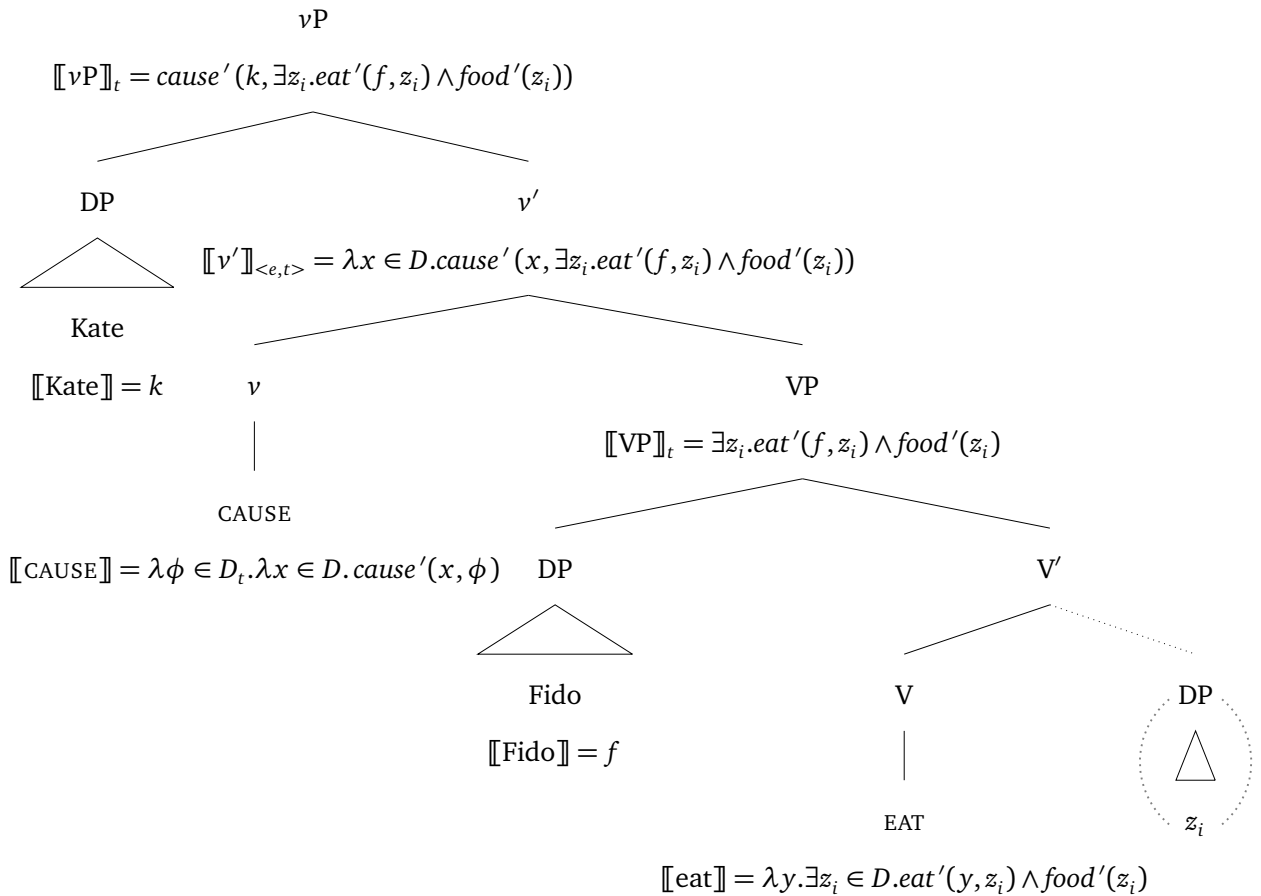
4.3 The derivation of *Kate fed Fido*

From (20), the lower abstract head EAT must have the same existential force in its denotation as that of *feed* because the upper abstract head CAUSE is mainly as to the event structure semantically corresponding to the agent's participation.

(26) a. $[\![\text{CAUSE}]\!]_{<t,<e,t>>} = \lambda \phi \in D_t.\lambda x \in D.cause'(x,\phi)$

b. $[\![\text{EAT}]\!]_{<e,t>} = \lambda y.\exists z_i \in D.eat'(y,z_i) \wedge food'(z_i)$

Accordingly, the denotations of each head will be the ones in (26a) and (26b) for CAUSE and EAT to semantically compose $[\![\text{feed}]\!] = \lambda x.\lambda y.\exists z_i \in D.feed'(y,x,z_i) \wedge food'(z_i)$.

(27) Kate fed Fido.

vP

$[\![vP]\!]_t = cause'(k,\exists z_i.eat'(f,z_i) \wedge food'(z_i))$

DP

v'

$[\![v']\!]_{<e,t>} = \lambda x \in D.cause'(x,\exists z_i.eat'(f,z_i) \wedge food'(z_i))$

Kate

$[\![\text{Kate}]\!] = k$

v

VP

$[\![\text{VP}]\!]_t = \exists z_i.eat'(f,z_i) \wedge food'(z_i)$

CAUSE

$[\![\text{CAUSE}]\!] = \lambda \phi \in D_t.\lambda x \in D.cause'(x,\phi)$

DP

V'

Fido

$[\![\text{Fido}]\!] = f$

V

DP

EAT

z_i

$[\![\text{eat}]\!] = \lambda y.\exists z_i \in D.eat'(y,z_i) \wedge food'(z_i)$
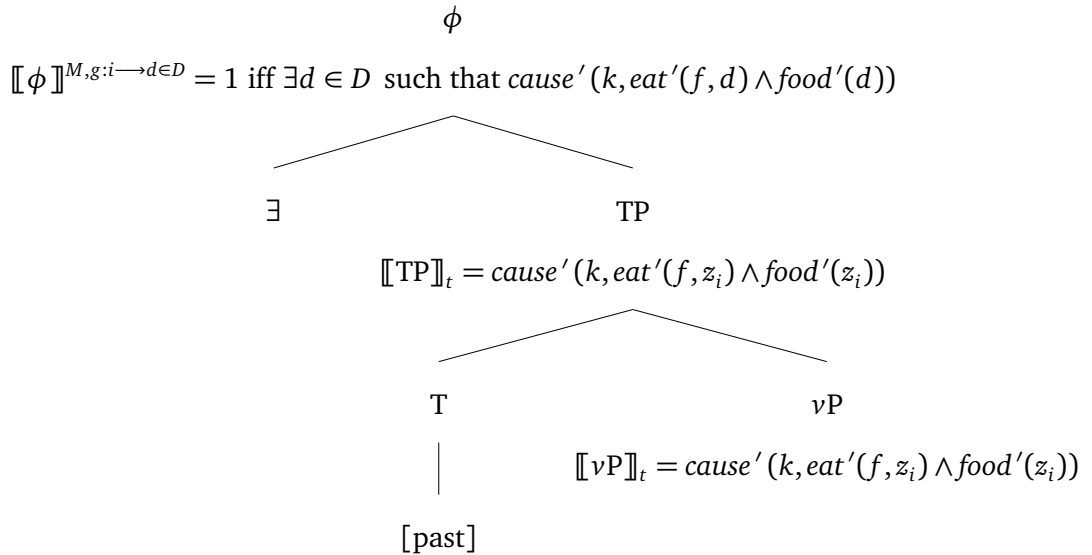
19

There is another way to existentially instantiate the unexpressed variable. Alternatively, an indefinite UA z_i can be maintained free up to TP, or the penultimate level of derivation in LF. Then, the unselective existential quantifier can close it (Heim, 1982, 81-177). Unselective existential quantifier $\exists$ can bind any free variables in the sentence on the propositional level. David Lewis defines the sentential quantifier as "$\exists\phi$ is true iff ϕ is true under some admissible assignment of values to all variables free in ϕ" (Lewis, 1975).

(28a) is an alternate denotation of *feed* that does not have an existential closure on the lexical level.

(28)   a. $[\![\text{feed}]\!] = \lambda x.\lambda y.feed'(y,x,z_i) \wedge food'(z_i)$

   b. $\exists z_i[feed'(k,f,z_i) \wedge food'(z_i)] = \exists z_i.cause'(k,eat'(f,z_i) \wedge food'(z_i))$

An existential closure is to be placed on an open formula *Kate fed Fido* whose predicate is (28a) on the propositional level, and subsequently yields (28b). The following is the derivation based on the same semantic decomposition and the Logical Form as (27).

(29)   Kate fed Fido.

$$\phi$$

$$[\![\phi]\!]^{M,g:i\longrightarrow d\in D} = 1 \text{ iff } \exists d \in D \text{ such that } cause'(k,eat'(f,d) \wedge food'(d))$$

$\exists$ TP

$$[\![\text{TP}]\!]_t = cause'(k,eat'(f,z_i) \wedge food'(z_i))$$

T vP

$$[\![v\text{P}]\!]_t = cause'(k,eat'(f,z_i) \wedge food'(z_i))$$

[past]

In sum, I have shown two formal ways to assert the indefiniteness of a UA and two formal ways of asserting the domain restriction in the semantics of a predicate *feed*:

the Denotation of *feed*	Indefiniteness	Domain restriction
$\llbracket \text{feed} \rrbracket = \lambda x.\lambda y.\exists z_i \in D.feed'(y,x,z_i) \wedge food'(z_i)$	lexical level	lexical level
$\llbracket \text{feed} \rrbracket = \lambda x.\lambda y.feed'(y,x,z_i) \wedge food'(z_i)$	propositional level	lexical level
$\llbracket \text{feed} \rrbracket^{M,g':i \rightarrow x \in F} = \lambda x.\lambda y.\exists z_i \in D.feed'(y,x,z_i)$	lexical level	interpretation level
$\llbracket \text{feed} \rrbracket^{M,g':i \rightarrow x \in F} = \lambda x.\lambda y.feed'(y,x,z_i)$	propositional level	interpretation level

(30) a. $\llbracket \text{feed} \rrbracket = \lambda x.\lambda y.\exists z_i \in D.feed'(y,x,z_i) \wedge food'(z_i)$

   b. $\llbracket \text{feed} \rrbracket = \lambda x.\lambda y.feed'(y,x,z_i) \wedge food'(z_i)$

   c. $\llbracket \text{feed} \rrbracket^{M,g':i \rightarrow x \in F} = \lambda x.\lambda y.\exists z_i \in D.feed'(y,x,z_i)$

   d. $\llbracket \text{feed} \rrbracket^{M,g':i \rightarrow x \in F} = \lambda x.\lambda y.feed'(y,x,z_i)$

Each of these four combinations differs in the level of the instantiation of *indefiniteness* and *domain restriction* of the UA. They also differ in their own meaning and the mechanism in which the UA is interpreted in semantics as mentioned earlier. Out of these four, (30a) and (30b) were shown in the derivation and will be discussed further.

4.4 Domain restrictive predicates

This thesis has chosen (22c) over (23) on the grounds that a UA is existentially instantiated in a restricted domain on the predicate's lexical level and that the former better fits our intuition and my hypothesis. The remaining question is regarding the level of existential instantiation. The three items in (31) and (32) are the denotation of the predicate, the denotation of TP, and the truth condition of *Kate fed Fido*, respectively.

(31) a. $\llbracket\text{feed}\rrbracket = \lambda x.\lambda y.\exists z_i \in D.feed'(y,x,z_i) \wedge food'(z_i)$

b. $\llbracket\text{TP}\rrbracket = cause'(k, \exists z_i.eat'(f,z_i) \wedge food'(z_i))$

c. $\llbracket\text{Kate fed Fido}\rrbracket^{M,g} = 1$ iff $\exists z_i \in D.feed'(y,x,z_i) \wedge food'(z_i) = 1$

(32) a. $\llbracket\text{feed}\rrbracket = \lambda x.\lambda y.feed'(y,x,z_i) \wedge food'(z_i)$

b. $\llbracket\text{TP}\rrbracket = cause'(k, eat'(f,z_i) \wedge food'(z_i))$

c. $\llbracket\text{Kate fed Fido}\rrbracket^{M,g:x \to d \in D} = 1$ iff $\exists d \in D$ such that $feed'(k,f,d) \wedge food'(d)$

Both (31) and (32) well capture the existence of a UA in a restricted domain. Irrespective of the level on which a UA comes to have existential force, semantics can revive syntactically unexpressed arguments in the denotation of their predicate, no matter which extreme point of derivation the domain restriction may be on.

As Fillmore et al. noted, the predicates that can have a UA in a restricted domain are lexically specific (Fillmore et al., 2003). When considering that not all verbs can show such distribution and Occam's advice to seek the most parsimonious explanation, the existential quantification on the lexical level in (31a) seems to be a simpler and better model to capture the property of these specific domain-restrictive predicates.

The following questions are beyond the scope that this thesis intends to cover, but the analysis suggested so far seems to be able to supply a small theoretical clue to the formal explanation of them. When a definite argument is unexpressed (definite null instantiation), it has a similar trait as variables such as pronominals and traces in that they can have an index that a variable assignment function can recognize and map it onto a proper denotation in a set. Even though such mapping is not called for in the case of indefinite null instantiation, this fact helps the discussion expand to definite null instantiation.

From the perspective of pragmatics, the question may arise as to which instantiation level would be more appropriate for the entailed meaning and the conversationally im-

plicated meaning, or the question as to which better captures natural (non-defeasible) meaning and non-natural (defeasible) meaning, but it would be safe to say that the UA in indefinite null instantiation is asserted or at least entailed.

Lastly, this thesis will briefly discuss the relationship among the lexicon and each grammar regarding indefinite null instantiation. The lexicon stipulates the maximal number valency of a predicate. Syntax may leave a domain-restricted argument unexpressed, but semantics gives it an existential force in a certain domain. In other words, semantic adicity can be maximally extended to the maximum number of syntactic valency, filtering out syntactically unexpressed arguments from pragmatics. This relationship may be schematically expressed as the following:

the Lexicon	syntax	semantics	pragmatics
maximal valency	$\varnothing$	$\exists x \in D$	~~implicature of x~~

Figure 1: The status of a UA

5 Conclusions

This thesis has conceptually and formally analyzed UAs of the ditransitive verbs in the data under the hypothesis that the existential instantiation of the unexpressed theme and its domain restriction is semantically encoded in the denotation of the predicate, and showed the full semantic derivation to test the hypothesis. Since a predicate is a relation of the arguments, the very nature of semantics requires itself to factor in all the necessary arguments comprising a predicate for the predicate to stand well-formed, while the realization of such arguments in syntax is reliant on the autonomy of syntax.

This thesis ultimately aims to give an explanation as to how the interlocutors readily recognize something syntactically unexpressed was *fed* to Fido, *paid* to Kate, and *served* to the guest. The matter of interpreting syntactically unexpressed arguments seems to be rooted in logic. From the traditional perspective, the semantics is to interpret the utterance, or the object language with pre-existing syntax. The semantics of some predicates, however, is not always merely compositional, but it can independently behaves based not only on the Logical Form but also on its own internal logic.

References

Baker, M. C. (1985). *Incorporation: A theory of grammatical function changing* (Unpublished doctoral dissertation). Massachusetts Inst. of Technology, Cambridge.

Baker, M. C., Aranovich, R., & Golluscio, L. A. (2005). Two types of syntactic noun incorporation: Noun incorporation in mapudungun and its typological implications. *Language*, 138–176.

Bhatt, R., & Pancheva, R. (2006). Implicit arguments. *The Blackwell companion to syntax*, *2*, 554–584.

Chierchia. (1985). Formal semantics and the grammar of predication. *Linguistic Inquiry*, *16*, 417-443.

Chung, S., & Ladusaw, W. A. (2004). *Restriction and saturation (linguistic inquiry monographs)*. MIT press.

Fillmore, C. J. (1986). Pragmatically controlled zero anaphora. *Berkeley Linguistics Society*, *12*, 95–107.

Fillmore, C. J., Johnson, C. R., & Petruck, M. R. (2003). Background to framenet. *International journal of lexicography*, *16*(3), 235–250.

Fillmore, C. J., & Petruck, M. R. (2003). Framenet glossary. *International Journal of Lexicography*, *16*(3), 359–361.

Grimshaw, J. (1990). *Argument structure*. Cambridge, Mass.: MIT Press.

Heim, I. (1982). *The semantics of definite and indefinite noun phrases dissertation*. UMass Amherst.

Huang, C.-T. J. (2006). Resultatives and unaccusatives: A parametric view. *Bulletin of the Chinese Linguistics Society of Japan*, *2006*(253), 1–43.

Kratzer, A. (1996). Severing the external argument from its verb. In *Phrase structure and the lexicon* (pp. 109–137). Springer.

Kripke, S. A. (1972). *Naming and necessity*. Springer.

Larson, R. K. (1988). On the double object construction. *Linguistic inquiry*, 335–391.

Levin, B. (1993). *English verb classes and alternations: A preliminary investigation*. Uni-

versity of Chicago press.

Levin, B. (2015). Semantics and pragmatics of argument alternations. *Linguistics (new in 2015), 1*.

Lewis, D. (1975). Adverbs of quantification. In E. L. Keenan (Ed.), *Formal semantics of natural language* (p. 3-15). Cambridge: Cambridge University Press.

Mithun, M. (1984). The evolution of noun incorporation. *Language*, 847–894.

Potts, C. (2005). *The logic of conventional implicatures*. Oxford: Oxford University Press.

Appendices

A. Instructions

Instruction: The online survey was conducted on Google Forms (https://forms.google.com). Fifteen undergraduate and graduate students who major in linguistics or philosophy at the University of California, Berkeley have participated in the survey. All participants are native speakers of English.

Some contexts were given for the questions that could cause grammaticality bias. For example: Question: Jack served Kate (The speaker means "Jack served Kate something," but "something" was not said). The following is the instruction[1].:

Thank you for taking my survey!

Before you start, please remember there is no right or wrong answer in native speaker's grammaticality judgment. Though some of the sentences you will read may not be acceptable in formal writing, please evaluate them based only on whether or not they sound "natural" to you. The sentences are about two people named "Jack" and "Kate". These two names strictly refer to people, not things or events of any sorts.

Please carefully read the sentences in the questionnaire and judge them based on the following criteria:

Bad (1): Sounds completely wrong and no one would say this. Marginal (2): Sounds kind of odd, but I would not be surprised to hear someone else say it. Good (3): Sounds completely natural and it is something I would say

The questionnaire contains 54 questions and should take about 15 minutes, but you can take as much time as you want. Please feel free to return to any question you have already completed if you have changed you mind on a judgment.

---

[1]The most of the instruction followed Collins, C., Guitard, S., & Wood, J.(2009). *Imposters: An online survey of grammaticality judgments (Tech. Rep.)*. NYU Working papers.

B. Grammaticality judgment by native speakers of English

Table 1: Grammaticality judgment by native speakers of English

	1 (Bad)	2 (Marginal)	3 (Good)
SERVE1			
Jack served Kate coffee.	0	0	15
Jack served coffee.	0	2	13
Jack served Kate.	1	4	10
FEED			
Jack fed the dog canned food.	0	0	15
Jack fed canned food.	12	3	0
Jack fed the dog.	0	0	15
GIVE			
Jack gave Kate a ring.	0	0	15
Jack gave a ring.	1	10	4
Jack gave Kate.	15	0	0
LEASE			
Kate leased her empty room to Jack.	0	2	13
Kate leased Jack her empty room.	1	1	13
Kate leased her empty room.	0	2	13
Kate leased Jack.	15	0	0
LEND			
Jack lent Kate his bike.	0	0	15
Jack lent his bike.	0	9	6
Jack lent Kate.	15	0	0
LOAN			
Jack loaned Kate his bike.	0	1	14
Jack loaned his bike.	3	6	6
Jack loaned Kate.	14	0	0

Table 2: Grammaticality judgment by native speakers of English (Continued)

	1 (Bad)	2 (Marginal)	3 (Good)
PASS			
Kate passed Jack the salt.	0	0	15
Kate passed the salt.	0	0	15
Kate passed Jack.	14	0	1
PAY			
Kate paid Jack ten dollars.	0	0	15
Kate paid ten dollars.	1	2	12
Kate paid Jack.	0	0	15
REFUND			
Jack refunded Kate ten dollars.	1	2	12
Jack refunded ten dollars.	4	7	4
Jack refunded Kate.	4	5	6
RENT			
Kate rented Jack her apartment.	1	3	11
Kate rented her apartment.	0	1	14
Kate rented Jack.	15	0	0
REPAY			
Jack repaid Kate twenty dollars.	0	0	15
Jack repaid twenty dollars.	5	5	5
Jack repaid Kate.	0	0	15
SELL			
Kate sold Jack her car.	0	1	14
Kate sold her car.	0	0	15
Kate sold Jack.	15	0	0