

EVIDENCE FOR A MIXED APPROACH TO E-TYPE ANAPHORA

by

Stefan Bartell

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ABSTRACT

The program of the field of semantics is to model or formally represent the meaning in natural language of sentences and discourses and of different constructions and interpretations. E-type anaphora constitutes a family of constructions and interpretations that have proved especially difficult to model formally. Previous approaches generally have aimed to analyze all E-type anaphora using similar semantic tools. This has resulted in models or representations that are complex in order to deal with the full range of E-type anaphora. We can trade off complexity of representation with number of different semantic tools that we are allowed to use to analyze different categories of E-type anaphora. In this work, I argue that E-type anaphora should receive a “mixed approach” in that different semantic tools should be applied to different categories of E-type anaphora to arrive at simpler analyses. Simpler analyses are preferable a priori. Though mixed approaches are not preferable a priori, a mixed approach to E-type anaphora is justified because different sorts of expressions in natural language are more aligned with certain subcategories of E-type anaphora. The use of choice functions to model a subset of E-type anaphora is one of the main novel theoretical contributions of this work. The main empirical contribution of this work is to show that indefinite syntax and semantics has a larger effect on interpretation of donkey sentences than definite or pronoun syntax and semantics. Therefore, an approach that traces differences in interpretation to the indefinite antecedent NP/DP in an E-type anaphoric dependency is best supported, contra previous works that focus only on anaphoric definite or pronoun.

Chapter 1

INTRODUCTION

Noun phrase (NP) or determiner phrase (DP) (NP/DP) anaphora is a relationship between an antecedent expression and a pronoun. A pronoun depends on an antecedent expression for its interpretation. One variety of NP/DP anaphora whose analysis is controversial was termed “E-type” anaphora originally by (Evans 1977); this term was adopted by subsequent authors (King & Lewis 2017). A typical definition of an “E-type pronoun” as shown in example (1) is a pronoun that is anaphoric with a DP but is neither a bound variable as shown in example (2) nor referential (free) as shown in example (3) (Heim & Kratzer 1998). E-type pronouns are also not c-commanded by their antecedent; this implies that they are not syntactically bound.¹ While the analysis of bound variable and referential pronouns is relatively uncontroversial, E-type pronouns are neither of these. I use the term “E-type” for both pronouns and anaphora.²

- (1) Every farmer who owns a donkey pets it.
- (2) No boy₁ loves his₁ mother.
- (3) John₁ was upset. He₁ complained.

E-type pronouns have only certain sorts of antecedents: they exclude “referential” antecedents such as proper names but include indefinites, e.g., ‘a donkey’ and non-indefinite quantifier phrases, e.g., ‘most senators’. The term “E-type” has been used in different ways. “E-type” is often used to refer to particular categories

¹ Whether semantic binding requires c-command (syntactic binding) is controversial (Barker 2012).

² Pronouns are just one sort of anaphor; there are also, e.g., VP anaphors.

of analyses (that may be applied to different constructions). I use the term “E-type” in a general sense to refer to pronouns in anaphoric constructions with certain syntax and commonly observed possible interpretations or semantics rather than to particular analyses. Below, I introduce different categories of E-type anaphora examined in this work.

1.1 A Division of E-Type Anaphora

E-type anaphora is a set of constructions and interpretations in natural language. In this work, I provide evidence that a mixed approach to E-type anaphora, with different analyses for different subsets of E-type anaphora, is empirically justified. The development of a mixed approach to E-type anaphora requires the division of E-type anaphora into several subcategories. Below I specify the criteria for making this division. These criteria include the syntax and semantics of the construction and interpretation in question.

1.1.1 Overview: Categories of E-Type Anaphora

In an anaphoric dependency, in some cases, a pronoun denotes individual(s) identical to its antecedent, and in other cases it denotes potentially different ones. E-type anaphora can be grouped into three main categories: donkey (example (4)), discourse (example (5)), and paycheck anaphora (example (6)) grouped together with bathroom anaphora (example (7)), under restricted definitions of these terms.

- (4) Every farmer who owns a donkey pets it.
- (5) A farmer owns a donkey₁. S/he pets it₁.
- (6) The woman who deposited her paycheck₁ in the bank was wiser than the woman who deposited it₂ in the Brown University Employees’ Credit Union.
- (7) Either this building doesn’t have a bathroom or it’s in a funny place.

Donkey anaphora *per se* has only indefinite antecedents, and pronouns can pick out either a different or the same group of individual(s) as their antecedent,

with either existential or universal force. Discourse anaphora can have indefinite or non-indefinite antecedents, but pronouns can pick out only the same group of individual(s) as their antecedent. With paycheck and bathroom anaphora, pronouns pick out a different group of individual(s) than their antecedent. In both constructions, a pronoun instantiates individual(s) that are either novel or distinct from what an antecedent denotes.

1.1.2 Donkey Anaphora/Pronouns

I adopt a distinction between two varieties of E-type anaphora based on [Nouwen \(2014\)](#): One variety, which ([Nouwen 2014](#)) calls “E1” type anaphora, is “intersentential” and involves “*maximal reference*”. I call this “discourse” E-type anaphora; an example is shown in example (5). [Nouwen \(2014\)](#)’s other variety is “E2” type anaphora, and this involves “*co-variation*”. I call this “donkey” anaphora. The terms “donkey pronoun” and “donkey anaphora” are typically reserved for a subset of E-type constructions including relative clause, as paraphrased in (8), and conditional (9); I also adopt this restricted definition. I focus on the relative clause construction in which an indefinite is embedded in a relative clause and is anaphoric with a pronoun in the matrix clause.

(8) Every farmer who owns a donkey pets it.

(9) If a farmer has a donkey, he pets it.

Such sentences have been analyzed as having three main syntactic parts that correspond to three parts of [Heim \(1982\)](#)’s semantic/logical representation (10). I refer to the determiner D in ‘D farmer(s)’ as a ‘farmer determiner’.

(10) $DP[D[Every] \text{ farmer } RelCP[\text{who owns [a donkey]}_i]] VP[\text{pets it}_i]$.

- a determiner (quantifier) (‘farmer’ determiner) that takes an embedded relative clause in its restrictor
- A restrictive relative clause CP (relative clause) that contains an indefinite NP/DP as a direct object. The NP/DP acts as an antecedent for the anaphor in the matrix clause. This NP/DP is the “antecedent indefinite”.

- The nuclear scope VP of the matrix clause, which contains an E-type pronoun as its direct object.

Donkey sentences have been claimed to have different readings or interpretations (Heim 1982, Chierchia 1992, Schubert & Pelletier 1989, Geurts 2002). Paraphrases for these readings are given below.³ One such interpretation (universal) is paraphrased in (11).

- (11) Every farmer who owns a donkey is such that s/he pets all the donkeys that s/he owns.

Another interpretation, as paraphrased in (12), recognized by, e.g., Schubert & Pelletier (1989), is often called the “existential reading”.

- (12) Every farmer who owns a donkey₁ is such that s/he pets at least one donkey_{1/2} that s/he owns.

In this paraphrase, a donkey pronoun is replaced with an indefinite NP/DP that is modified by a relative clause such as ‘that s/he owns’. This relative clause includes lexical items taken from the embedding relative clause.

1.1.3 Discourse E-Type Anaphora

A definition of “discourse” anaphora is given here based on King & Lewis (2017). Its features include the following. First, discourse anaphora is cross-sentential: it involves distinct matrix clauses, conjoined at level of text. Second, the same individual(s) are picked out by the antecedent and pronoun; there is necessary coreference between them. Third, the term “E-type pronoun” has also been applied

³ I refer to “the” readings as canonical interpretations, but there are variants of these (see (Champollion, Bumford & Henderson 2019) for details on homogeneity/heterogeneity.) I also do not consider truth value gaps as in (Champollion, Bumford & Henderson 2019).

to pronouns that are discourse anaphoric with certain types of antecedents. One such type of antecedent is an indefinite, as shown in example (13).⁴

(13) A farmer owns a donkey₁. S/he pets it₁.

Another variety of discourse E-type anaphora involves DP antecedents that are referred to by such terms as “quantificational”. These include DPs with determiners such as ‘few’ as shown in example (14) and ‘most’ as shown in example (15). The term “quantificational” as used to classify DPs is used here in the sense of [Dobrovie-Sorin & Beyssade \(2012\)](#) (p.9), that is, it refers to DPs with determiners such as ‘some’, ‘every’, and ‘most’. These are distinct from “indefinite” DPs with determiners such as ‘a’ and ‘some’. As noted by authors such as [Chierchia \(1992\)](#), non-indefinite DPs cannot co-vary with pronouns from the position in which a donkey pronoun can. For example, (16) shows that such co-variation is not possible.

(14) Few donkeys₁ wagged their₁ tails. They₁ fell.

(15) Most donkeys₁ wagged their₁ tails. They₁ fell.

(16) *Most farmers that see every donkey_i pet it_i.

Important for the characterization of E-type anaphora pursued in this work is the fact that the way of deriving existential readings via domain narrowing and universal reading of donkey anaphora as defined here are similar in that there is no necessary coreference between antecedent and definite or pronoun. On the other hand, the way of deriving existential readings via choice functions and discourse anaphora are similar in that there is necessary coreference between antecedent and pronoun.⁵

⁴ Some less straightforward varieties of anaphora, such as complement anaphora ([Nouwen 2003](#)) and “kind-level” anaphora ([King & Lewis 2017](#)), involve anaphors that occur in a different matrix clause but do not obviously pick out the same set of (token) individuals as their antecedent.

⁵ L. Champollion, p.c., points out that case of the with the “way of deriving existential readings via choice functions, coreference is necessary by definition rather than contingently.”

1.1.4 Paycheck and Bathroom Anaphora

Other constructions are also sometimes called “E-type”. These constructions include paycheck and bathroom anaphora. Paycheck and bathroom anaphora are named as such after the original example sentences provided to illustrate each. First, in “paycheck” sentences (originally discussed by (Karttunen 1969)), a pronoun functions similarly to a second instance of its antecedent. Further, the pronoun is embedded in a comparative clause, at least in the classic examples. Other variations might not include a comparative clause. The statement a paycheck sentence makes is also a generalization. Example (17) is based on Jacobson (2000). Here the indexation 1/2 indicates that there the pronoun can pick out the same or different individual(s) as its antecedent. A paycheck pronoun is one such example that seems to function similarly to a repetition of its antecedent.⁶

- (17) The woman who deposited her paycheck₁ in the bank was wiser than the woman who deposited it₂ in the Brown University Employees’ Credit Union.

A “bathroom sentence”⁷ involves anaphora between an indefinite under negation in one disjunct and a pronoun in the other disjunct (18). The meaning of such a pronoun is something along the lines of a repetition of its antecedent (with the meaning similar to ‘a/the bathroom that it has’), though this is less well established than with paycheck pronouns. In these cases a pronoun is not obviously anaphoric with an NP/DP denoting individual(s) whose existence has been asserted or presupposed.

- (18) Either this building doesn’t have a bathroom or it’s in a funny place.

1.2 Challenges in Analyzing E-Type Anaphora

There are many challenges in analyzing E-type anaphora. Six problems pertinent to E-type anaphora for which solutions in this work are pursued are described in the following section.

⁶ See Elbourne (2005)’s coverage of what he calls “neontological” pronouns.

⁷ This term is due to an example attributed to Barbara Partee.

1.2.1 The Unbound Variable Problem

What one could call the “unbound variable problem” of donkey anaphora is that on a Russellian treatment of indefinites, an indefinite in a donkey sentence introduces existential quantification of an individual (donkey). However, on the most straightforward translation of a donkey sentence into first-order logic, this variable occurs again outside the scope of the existential quantifier (as shown in bold), producing an formula that contains an unbound variable, as illustrated in example (20). This problem also extends to discourse anaphora and paycheck and bathroom anaphora; one might argue that dynamic theories have already addressed this problem. In this work, I attempt to address the problem in a different way than dynamic theories do.

(19) Every farmer who owns a donkey pets it.

(20) $\forall x[(Fx \wedge \exists y[Dy \wedge O(x, \mathbf{y})]) \rightarrow P(x, \mathbf{y})]$

1.2.2 The Source of Universal Readings Problem

A challenge in the literature is to explain how donkey pronouns can co-vary with an indefinite antecedent as if that antecedent were quantificational despite it not actually being quantificational, in particular, when a donkey sentence receives a universal reading. Indefinite expressions have traditionally been analyzed as existential quantifiers, as in (Russell 1905), and many subsequent authors have adopted this treatment. Another influential work, (Heim 1982), treats indefinites as free variables. For both of these types of analyses, it is a challenge to explain the mechanism by which indefinites acquire universal force or seem to act as universal quantifiers in donkey sentences. (Heim 1982) provides one mechanism (unselective binding of free variables), while other authors provide different mechanisms (e.g. rules of dynamic interpretation for existential quantifiers in (Groenendijk & Stokhof 1991)). Since the work of (Heim 1982) has not been adopted by everyone (e.g., Heim herself argued against (Heim 1982) in (Heim 1990)), it is still a matter of debate as to how universal readings should be generated. There are a number of different accounts of how they are generated, but there is not a clear consensus on the matter.

1.2.3 The Existential vs. Universal Interpretation Problem

Another challenge in research on donkey anaphora is how to account for existential readings. There are a number of accounts of how the existential readings of donkey anaphora arise such as (Groenendijk & Stokhof 1991), (Kanazawa 1994), and (Champollion, Bumford & Henderson 2019). However, there is not yet a clear consensus on which account the most empirically motivated. In this work, I will argue in favor of a particular account of existential readings in light of experimental and typological empirical trends. If a source of universal readings in donkey sentences (an expression with certain semantics) is identified, then we must explain why existential readings either still do arise with that expression or why they do not. That is, we need some way of explaining how universal readings are derived compositionally using the semantics of an expression in a donkey sentences and at the same time explain why that expression would or would not also give rise to existential readings.

1.2.4 Challenges in Analyzing Discourse Anaphora

One challenge in analyzing discourse anaphora is to explain why discourse anaphors (pronouns) are generally said to lack the existential via domain narrowing and universal readings that are present in donkey anaphora. Any approach that doesn't over-generate must explain why these readings are not present with discourse anaphora. One obvious candidate for lack of universal force is the lack of a former determiner in discourse anaphora.

Another challenge in the analysis of anaphora with indefinites is how reference is determined in the case of discourse anaphora. An antecedent indefinite doesn't necessarily denote some unique entity; this is a problem for definite descriptive (D-type theories) of pronouns that imply that indefinites do denote uniquely. For example, in the discourse (21), there may be more than one cat (as the indefinite does not denote 'exactly one cat'); if the pronoun *it* denoted uniquely, then there should be only one.

(21) A cat walked in. It meowed.

There is also the problem, pointed out by [Sainsbury \(2002\)](#), of indefinites not being “referential” in the sense of [Fodor & Sag \(1982\)](#) of denoting a known identity, similar to a proper name, but still being accessible in discourse anaphora. The problem is that we should not expect indefinites to be accessible in discourse anaphora if they are treated as existential quantifiers because existential quantifiers do not introduce an individual per se. This problem has been noted since at least ([Davidson 1968](#)). One way of addressing both of the above mentioned problems together defended in this work is to employ a repeated choice function, adapted from ([Kratzer 1998](#)), for both an antecedent indefinite and pronoun. A choice function picks out all and only those individual(s) that an antecedent denotes. This allows us to explain why universal readings are not present in discourse anaphora, and we do not run into the problem of existentially quantified antecedents.

A challenge in analyzing discourse anaphora with quantifier antecedents is exemplified below. For example, (22) cannot be translated into a logical representation such as same as (23); ‘they’ cannot be treated as a variable bound by ‘few’. A paraphrase that will work, on a definite descriptive approach, is shown in example (24). This problem was first observed by [Evans \(1977\)](#). See ([Brasoveanu 2008](#)) for further discussion.

(22) Few donkeys₁ wagged their₁ tails. They₁ fell.

(23) $FEWx[Dx \wedge WTx \wedge Fx]$

(24) Few donkeys wagged their tails. The donkeys (that wagged their tails) fell.

1.3 Competing Theories of E-type Anaphora

The fundamental problem of donkey anaphora is how an indefinite can appear to bind a donkey pronoun outside its syntactic and logical scope as delimited by the clause. Two major families of approaches to donkey anaphora are dynamic and D-type approaches. These two approaches provide solutions to said fundamental problem of donkey anaphora in different ways. For overviews and criticisms of current approaches

to donkey anaphora, including D-type and dynamic approaches, see (King & Lewis 2017) and (Moltmann 2006).

1.3.1 D-Type Approaches

First, there are (unique) D-type (definite descriptive) approaches such as (Evans 1977, Heim 1990, Elbourne 2005) (and these are sometimes called “E-type”).⁸ In D-type approaches an E-type pronoun has its reference secured via definite description. Thus, a donkey sentence may be paraphrased along the lines of (25). In the semantics literature, situations are similar to parts of possible worlds; they are also similar to events. One oft-cited D-type approach is (Elbourne 2005). In this approach, donkey pronouns are paraphrased as (unique) definite descriptions, and this uniqueness is relativized to minimal situations. These situations may be quantified over in donkey sentences, and this quantification produces universal readings. For instance, truth conditions for a donkey sentence using situations are provided in example (26). These truth conditions are based on (Elbourne 2001) (a uniqueness-based approach that is similar to (Elbourne 2005)). In this example, a universal quantifier quantifies over both individuals and minimal situations (e.g. in which a given farmer pets his/her donkey). Because of this, we obtain the universal force that is typically given in a paraphrase of a donkey sentence.

(25) Every farmer who owns a donkey pets the donkey (that s/he owns).

(26) For every part of an individual x and a minimal situation s_1 such that x is a farmer in s_1 and there is a y such that y is a donkey in s_1 and x owns y in s_1 , there is a situation s_2 such that $s_1 \leq s_2$ and x pets in s_2 the unique z such that z is donkey in s_1 (after (Elbourne 2001), ex. (28))

⁸ The term “D-type” was put forth by Neale (1990).

1.3.2 Dynamic Approaches

Second, there are dynamic approaches, e.g., (Heim 1982), (Groenendijk & Stokhof 1991), which are not uniqueness (definite descriptive) based but rely on dynamic rules of interpretation. Dynamic approaches are well suited to handling discourse anaphora using dynamic extension of the scope of existential quantifiers. Discourse anaphora involves dynamic “update” or extension of the scope of an existential quantifier ($\exists x[]$). For donkey anaphora, there are rules of dynamic interpretation, not extension of the scope of $\exists x[]$. Such dynamic update, extending the scope of an existential quantifier, does not work to model the universal reading of donkey anaphora. Such approaches employ this mechanism for the existential reading of donkey anaphora but employ a slightly different mechanism for the universal reading.

Dynamic approaches have also been developed to handle both the existential and universal readings using different rules of interpretation, e.g., (Groenendijk & Stokhof 1991), (Kanazawa 1994), (Brasoveanu & Dotlacil 2020). In the Discourse Representation Theory (DRT) of (Heim 1982), indefinites introduce free variables that receive their quantificational force from unselective binding of a quantifier in donkey sentences. For example, the farmer determiner ‘every’ in ‘every farmer’ binds free variables for a donkey indefinite and pronoun unselectively (separately). Dynamic systems stand in contrast to uniqueness-based systems in which there is no need to dynamically extend the scope of an existential quantifier.

1.3.3 Ambiguity Based Approaches

One ambiguity-based approach, which locates the source of readings in the donkey pronoun, has been advanced by Chierchia (1995). Chierchia (1995) derives existential readings in dynamic semantics and universal readings using a variant on the D-type approach (a unique/E-type way of deriving readings) where donkey pronouns are treated as functions from individuals to individuals. (Brasoveanu 2008) treats indefinites as (lexically) ambiguous or underspecified between a maximal or “strong” and a non-maximal or “weak” interpretation, and these give rise to universal and

existential readings respectively. Note also that (Kanazawa 1994) attributes different readings to the embedding determiner.⁹

1.3.4 Approaches Grouped by Source of Readings

Approaches to donkey anaphora can also be grouped by where they locate the source of the existential/universal ambiguity. This source of ambiguity may be located in the farmer determiner, the indefinite, pronoun, or some combination of these variables. A key question for developing a complete approach to donkey and discourse anaphora is to explain how all of these variables interact to produce one reading or lack thereof. As mentioned above, (Chierchia 1995) traces readings to the donkey pronoun, while (Brasoveanu 2008) traces them to the indefinite. With the exception of Brasoveanu (2008), most authors have focused on how definite or pronoun can give rise to existential vs. universal interpretations. Dynamic approaches such as (Groenendijk & Stokhof 1991) derive universal readings from the interaction of a donkey indefinite’s existential force and the universal force of the FD ‘every’. (Elbourne 2005) derives universal readings from the interaction of ‘every’ and the meaning of a donkey pronoun. One D-type approach that locates the source of readings in ambiguity at the level the donkey pronoun is (Neale 1990). Other works have addressed variables in reading availability such as farmer determiner (Kanazawa 1994) and nuclear VP predicate (e.g. *pet* in *pet it*) (Yoon 1996).

1.4 Outline of the Work

While E-type anaphora has a rich theoretical background, there is room for additional empirical backing. I provide cross-linguistic and experimental evidence to demonstrate that preferences for the use of forms of indefinite and pronoun differ among different interpretations of donkey anaphora. The main focus of the thesis is to

⁹ However, Kanazawa notes that he is merely modeling truth conditions rather than giving truth conditions themselves.

empirically justify the best way of formally representing the truth conditions of E-type anaphora constructions given natural language data.

Given that previous approaches to donkey anaphora have located the source of existential vs. universal interpretations in indefinites and pronouns, these two variables were manipulated to compare their effect on donkey anaphora interpretation. An important novel finding is that indefinite antecedent form plays a larger role than definite or pronoun form. Importantly, this greater effect is observed in both typological trends and experimental data. This effect of indefinite and a relative lack of effect of definite or pronoun justify an amendment to previous theories, which locate the existential/universal distinction in sources other than indefinite form. Another important finding is that existential readings were preferred overall, in contrast to the assumption common in the literature that universal readings are the default.

1.4.1 Theoretical Preliminaries: Indefinite NP/DPs and Definites/Pronouns

In this section, I outline assumptions about SS (surface structure) and LF (logical form) of indefinite NP/DPs and definites or pronouns that will be important for this work. SS includes the forms of expressions that are overt (pronounced), while LF is the structured semantic representation of both individual expressions and sentences or discourses. I assume that LF includes at least two semantic types for indefinite expressions: individual (type e) and predicate or property (type $\langle e, t \rangle$), similarly to (Heim & Kratzer 1998, Dobrovie-Sorin & Beyssade 2012).

The semantic type for individuals may be analyzed using a number of semantic tools, for example, choice functions (von Stechow 2011). LF also includes two main means of reference resolution: descriptive (uniqueness-based) and non-descriptive (familiarity-based). I assume that anaphoric dependencies consist of two main parts at surface structure (SS): an antecedent expression and anaphoric definite or pronoun. At LF, an anaphoric dependency also consists of two main parts: meanings of expressions including antecedents and means of anaphora resolution. An anaphoric dependency

is shown in example (27); here, there is an anaphoric link or dependency between the antecedent expression *a dog* and the pronoun *it*.

(27) A dog₁ is in here. It₁ is barking.

Correlations between SS and LF for components of anaphoric dependencies include the following. First, it is established in the literature that there is a correlation between SS and LF for indefinites (see e.g. (Dayal 2011)): bare noun NPs (no overt determiner) are more often (across languages and linguistic contexts) interpreted with narrow scope (first as type $\langle e, t \rangle$ and then as type $\langle et, t \rangle$ after existential closure) than DP (with overt determiner), while DP is more often interpreted with wide scope (and as type e) than NP. See section (3.2) for further discussion of the distinction between NP-like and DP-like indefinites. Second, within the literature, it is suggested that there is a correlation between syntactic structure present at LF for pronouns and means of reference resolution (see e.g. (Patel-Grosz & Grosz 2017)): less structure (DP) is correlated with unique resolution, while more structure (DeixDP) is correlated with familiar resolution; this distinction may be instantiated with, e.g., null vs. overt pronouns or personal vs. demonstrative pronouns.

The present investigation relies on some simplifying assumptions about the syntax-semantics mappings for indefinites and definites that aims to capture cross-linguistic tendencies. As for indefinites, “NP-like” indefinites (which lack an overt determiner in some languages and contexts) more often take narrow scope and are not readily analyzed using choice functions, while “DP-like” indefinites (which have an overt determiner in some languages and contexts) more often take wide scope and are well suited to choice functions. See section (3.2) for more details on how the terms “NP-like” and “DP-like” are used in this work. The notion of a choice function is introduced in section (4.2.4); a choice function is a function from a set of individuals to an individual. See, e.g., (von Heusinger 2011) on the topic of choice functions. As for pronouns, weaker or unique pronouns are DPs, while stronger or familiar pronouns

are DeixDPs. See section (3.3.0.2) on the distinction between weaker and stronger pronouns (i.e. pronouns that stand in a weak/strong contrast).

For both indefinites and pronouns, I examine contrasts, present at least at SS, which I define as shown in example (28). Taking direction from trends in the literature including a correlation between antecedent and pronoun structure or lack thereof in ellipsis (see e.g. (Bošković 2016)), definite DP-pronoun parallelism (Bi & Jenks 2019), ellipsis based views of pronouns such as that in (Elbourne 2005), and theories that posit differences in pronoun structure such as that proposed by Patel-Grosz & Grosz (2017), I posit an alignment between indefinites and pronouns, shown in (29). The distinction between weak and strong pronouns is based on the distinction between German unique and familiar definites as described by (Schwarz 2009), which was later extended to pronouns by Patel-Grosz & Grosz (2017).

- (28)
- indefinite syntax and semantics: more NP-like, aligned with narrow scope, not typically analyzed with choice functions vs. more DP-like, aligned with wider scope, analyzed using choice functions
 - definite or pronouns syntax and semantics: weak/strong contrast or more DP-like vs. more DeixDP-like (e.g. null/overt or personal/demonstrative) (see (Patel-Grosz & Grosz 2010))
- (29)
- “NP”-like or property denoting indefinites prefer NP ellipsis from a unique pronoun DP (which are not analyzed here using choice functions)
 - “DP”-like or individual denoting indefinites prefer DP ellipsis from a familiar DeixDP (which are analyzed here using choice functions)

Although not established, it has been suggested in the literature that there is also a correlation between SS and LF structure for pronouns and reference resolution, as shown in (30).

- (30)
- less structure, e.g., null: DP: unique
 - more structure, e.g., overt: DeixDP: familiar

For example, Mandarin Chinese demonstratives and overt pronouns such as *ta* are familiarity-based, while bare nouns and null pronouns are uniqueness-based ((Bi 2018), building on (Jenks 2018)). A key assumption here is that an NP/DP-like or weak/strong *contrast* between two SS forms in itself gives rise to a contrast of interpretation, i.e., two different LFs. Each member of the contrast maps to a different LF. Based on previous literature, e.g. (Cheng & Sybesma 1999), I assume that there can be disagreement between the SS of a particular form in a language and what its preferred LF would be expected to be based on cross-linguistic trends. I expect that a null pronoun has less structure than a demonstrative pronoun at LF because of a correlation with amount of overt structure. Also, if we adopt a simplified syntax-semantics mapping, then we might treat null pronouns that are unique as involving NP ellipsis from a smaller projection and overt pronouns that are familiar as involving DP ellipsis from a larger projection.

In the next chapter, I describe experiments on donkey anaphora. There, I will introduce challenges in analyzing donkey anaphora and discuss the main empirical contributions of this work (an effect of indefinite on donkey anaphora interpretation) and its implications for deciding between competing theories of donkey anaphora. The main empirical contribution of this work is to show that indefinite syntax and semantics has a larger effect on interpretation of donkey sentences than definite or pronoun syntax and semantics. Therefore, an approach that traces differences in interpretation to the indefinite antecedent NP/DP in an E-type anaphoric dependency is best supported, *contra* previous works that focus only on anaphoric definite or pronoun.

Chapter 2

EXPERIMENTS ON DONKEY ANAPHORA

In this chapter, I present two series of experiments (six in total) on the interpretation of donkey anaphora aimed at answering the research question of what the relative effect of indefinite form and definite/pronoun form on donkey anaphora interpretation are. The main hypotheses are that both indefinite form and definite form have an effect on interpretation. In one series of experiments (1A and 1B) (see section (C.1)), antecedent indefinite form was manipulated, and its effect on donkey sentence interpretation was observed. Based on the results of these experiments, a second series of experiments (2A, 2B, 3A, and 3B) was carried out (see section (2.2)). In this series of experiments, full definite DP/pronoun (anaphor) form was manipulated. Participants were allowed to complete only one of the experiments (1A, 1B, 2A, 2B, 3A, or 3B). It is possible that effect of form of definite/pronoun on interpretation is a result of effect of indefinite. The main purpose of this chapter as well as the next chapter is to disentangle the effects of indefinite and pronoun/definite on donkey anaphora interpretation. In the present chapter I will examine distinctions among forms of indefinite and definite present in English, while in the next chapter distinctions present in other languages will be examined.

The chapter is organized as follows. In the literature, the source of different interpretations of donkey anaphora (i.e. which variables affect interpretation most) is debated. Furthermore, the question of whether we should adopt an ambiguity-based approach to donkey anaphora such as (Chierchia 1995), as opposed to unified (e.g., uniqueness-based/D-type or familiarity based/dynamic), is debated.¹ Two broader

¹ Note, however, that D-type approaches and dynamic approaches might be extended to include either ambiguity or underspecification based accounts.

research questions concerning source of readings that have yet to be fully addressed in the literature concern what effect indefinite and definite form have on donkey anaphora interpretation. In the first part of the chapter, I will examine effect of indefinite (antecedent) form on donkey anaphora interpretation.

In the second part of the chapter, I will examine effect of anaphoric definite form on donkey anaphora interpretation. A more specific research question is whether indefinite form has an effect on interpretation independent of definite form. Another research question is whether tense/aspect has an effect on donkey anaphora interpretation. Since it does, a uniqueness based account that utilizes quantification over events or situations in order to account for effect of tense/aspect is better supported. Indefinite does have an effect on interpretation and exerts its effect independent of definite form, providing further support for the claim that indefinite form has a stronger effect on interpretation.

Some of the main goals of this chapter are to help us decide between competing theories of donkey anaphora (in particular, unified D-type, unified familiarity based or dynamic theories, or mixed approaches with both D-type and dynamic components) with reference to the behavior of indefinite form; this implication also serves to help motivate the research questions. Because indefinite form has a stronger effect on interpretation, with different forms of indefinite aligned with different accounts of donkey anaphora, an ambiguity-based or mixed approach is better supported. This follows if we assume that different forms of indefinite with different semantics are associated with different forms of anaphora resolution. Furthermore, accounts that locate the ambiguity in the indefinite are better supported.

2.1 Experiments on English Indefinite Determiners and *it*

In this section I present two experiments (1A and 1B) testing the effect of indefinite form of the antecedent on donkey anaphora interpretation. One experiment includes donkey sentences in present tense, and one experiment includes donkey

sentences in past tense. The design of each experiment was identical, except as described below. This section expands on earlier work (Bartell 2019).

2.1.1 General Introduction

Previous approaches to donkey anaphora (e.g., D-type approaches, such as (Elbourne 2005), and dynamic approaches, such as (Groenendijk & Stokhof 1991)) generally do not include discussion of the effect of forms of indefinite (e.g., the differences between indefinite determiners such as *some*, *a*, and *any*) and their associated differences in meaning on donkey sentence interpretations (existential and universal). A minority of accounts, such as (Brasoveanu 2008), posit an effect of indefinite determiner on donkey sentence interpretation. In (Brasoveanu 2008), indefinites are (lexically) ambiguous or underspecified between a maximal and a non-maximal interpretation, and these interpretations give rise to universal and existential readings respectively.

The precise mechanism by which donkey anaphora interpretations arise is also under debate. NP ellipsis accounts of pronouns such as (Elbourne 2005), which would predict that indefinite structure is carried over into a pronoun and then elided; the pronoun is a head of a maximal projection that at LF has an XP that is identical to the indefinite antecedent as a complement, and this is how structure is carried over. Furthermore, differences in pronoun structure have been associated with different pronoun semantics (Patel-Grosz & Grosz 2017). However, indefinite denotation *per se* has not factored into most accounts of donkey anaphora; for reviews, see (King & Lewis 2017) and (Brasoveanu & Dotlacil 2020). On Elbourne (2005)’s account, all pronouns as well as proper names are analyzed along the lines of *minimal* definite descriptions such as ‘the donkey’. They are analyzed as less similar to non-minimal ones such as ‘the donkey that s/he owns’.²

² Note that the formal representation of pronouns is more complex than a definite description alone in (Elbourne 2005).

Here, I put to test the hypothesis that donkey anaphora interpretations arise via some mechanism involving the denotation of an indefinite expression; that is, different forms of indefinite have different effects on donkey anaphora interpretation due to their different denotations (e.g., both individual and property denoting or just property denoting). I present experimental evidence for an effect of indefinite form on readings and discuss implications for deciding between competing theories of donkey anaphora and for informing how we should formulate LFs and truth conditions of donkey sentences.

[Bartell \(2018\)](#) observed an effect of indefinite form on donkey sentence readings in the Hungarian language. Donkey sentences with different forms of indefinite were presented to eight native speakers of Hungarian and speakers were asked to give introspective judgments about which interpretation(s) of donkey anaphora these sentences could have. Universal readings were preferred based on the judgments of these eight speakers according to pattern (31); see section (3.4.1.1) for this data. ‘a/one’ indefinites preferred existential readings; bare nouns did as well but to a lesser degree. Polarity indefinites preferred universal readings.

(31) Universal readings:

‘a/one’ < bare noun < polarity

Because there are similarities between English and Hungarian in that certain indefinite expressions may be treated as polarity indefinites (which take narrow scope) or as taking potentially wider scope (in the case of unmarked indefinites), it can be hypothesized that in English there will also be an effect of indefinite form on interpretation similar to the effect observed in Hungarian. In influential work by [Chierchia \(1995\)](#), existential readings are derived within dynamic semantics, a framework in which the scope of existential quantifiers may be extended beyond the clause, while universal readings are derived via a uniqueness based approach with no such dynamic extension of the scope of an existential quantifier.

However, the exact relationship between indefinite scope and donkey sentence interpretations is largely unexplored in the literature. If we assume that different forms of indefinite give rise to different forms of anaphora resolution, and we adapt [Chierchia \(1995\)](#)'s view that different forms of anaphora resolution lead to different interpretations of donkey anaphora, then it can be hypothesized that there will be an effect of indefinite form on interpretation such that those indefinites that prefer to be able to extend their scope beyond the clause (i.e. take either exceptional quantificational or binding scope as described in ([Charlow 2020](#))) are more aligned with existential readings. In particular, *some* indefinites will generate the least universal (most existential) readings, followed by *a*, followed by *any*; this hypothesis is illustrated in (32). This is because we expect *some* indefinites to be more biased toward an individual denotation and familiarity based resolution, while we expect *any* indefinites to have a property denotation and give rise to uniqueness based resolution; we expect *a* indefinites to fall midway between the two.

- (32) Universal readings:
some < *a* < *any*

The null hypothesis is that there will be no differences among indefinites with respect to readings generated.³ The hypothesis was based on the idea that indefinites that either can or prefer to take wider scope will yield more existential readings, while those that take prefer to take narrower scope will yield more universal readings. Another reason that the pattern (32) might hold is that there are similarities between English and Hungarian (though there may be qualitative differences) in terms of the semantics of certain categories of indefinite expressions that take narrow scope. For instance, free choice items in Hungarian display similar behaviors to those in English ([Halm 2016](#)), and *egy* indefinites in Hungarian are “unmarked”, similar to those with English *a* ([Farkas 2006](#)). It is thus possible that in English there will also be an effect

³ Note that the discussion here applies to unreduced *some* in English, which has been noted to behave differently than reduced *some*. ([Israel 1999](#))

of indefinite form on interpretation, similar to that observed in Hungarian, as shown in example (31).

Previous approaches to donkey anaphora have considered different variables that can bias toward existential vs. universal interpretations. Pragmatics/lexical item meaning/world knowledge that are related to the meaning of words and overall meaning of particular donkey sentences may have the strongest effect. See, for example, (Geurts 2002).⁴ Here I focus on syntactic and semantic variables and aim to abstract away from the effects of pragmatics/lexical item meaning/world knowledge on donkey anaphora interpretation by using different content words and sentence meanings among items in the experiments described in this work.

In the experiment with donkey sentences in the past tense described below, sentences included temporal modifiers such as ‘last year’. Consideration of past tense was included in order to put to test theories such as (Elbourne 2005) in which the universal interpretation of donkey sentences arises from universal quantification over situations. Since past tense, with non-iterative aspect in English, implies a single situation (or a single event that happens at a particular point in time), it can be hypothesized donkey sentences in the past tense will not receive the universal interpretation as readily. That is, there will be more universal readings with donkey sentences in present tense than with those in past tense because present tense will imply multiple situations (as in universal quantification over situations in (Elbourne 2005)f), while past tense will imply a single situation. The null hypothesis is that there will be no difference between present and past tense with respect to readings generated.

2.1.2 Method

2.1.2.1 Participants

Participants (age 18 or older) for both Experiment 1A and Experiment 1B were recruited via Amazon’s Mechanical Turk website platform (“MTurk”). Participants

⁴ For a treatment of pragmatics in producing existential/universal readings utilizing question under discussion (QUD), see (Champollion, Bumford & Henderson 2019).

were excluded (but still accepted on MTurk and paid) if they reported not speaking English as a first language or being from outside the US; a total of 19 were excluded. Participants were rejected if they answered seven or fewer of the 12 filler item comprehension questions correctly or took the same survey twice; a total of 50 were rejected. Note that these numbers for exclusion and rejection are rather high. Rejection criteria for participants are the same throughout the experiments described in this chapter. There were two separate experiments with 144 participants each, one with present tense and one with past tense. There were 288 participants included in total (neither rejected nor excluded) (mean age = 38.3 years, SD = 13.5, 158 identifying as female and 128 as male). Participants were paid \$0.40 for their participation.

2.1.2.2 Materials

Indefinite Form (*some* vs. *a* vs. *any*) was manipulated (within participants) in each experiment. Indefinite Form had three levels: *any*, *a*, and *some*. The method of the experiments described in this chapter was based on the method of the experiments described in (Geurts 2002). As in Geurts (2002)’s experiments, donkey sentences and corresponding scenarios were constructed. Scenarios represented potential truth conditions of the sentences. Participants were instructed to read a following donkey sentence and judge it to be either “True” or “False”. For the experiments presented here, 18 different donkey sentences and corresponding scenarios were constructed. All donkey sentences were of the same form and included a relative clause and a DP with the embedding (“farmer”) determiner *every* and the pronoun *it* but different lexical items (nouns, verbs, etc.). All scenarios were also of the same form. An example scenario (text story) is presented in example (33). All scenarios were of the same form and included three individuals (e.g. chefs) who performed an action (e.g. baking) on an object (e.g. cake); for the third individual, only one of two objects is affected by the action. This scenario was paired with a donkey sentence (34) for the experiment in present tense. This scenario was paired with a donkey sentence (35) for the experiment in past tense.

- (33) There were three different chefs. During the past week, chef number 1 baked one cake and moved it onto a table. Chef number 2 also baked one cake and moved it onto a table. Chef number 3 baked two cakes and moved only one of them onto a table.
- (34) Every chef who bakes a cake moves it onto a table.
- (35) Every chef who baked a cake moved it onto a table.

As in Geurts (2002)’s experiments, scenarios were compatible only with an existential reading such that a judgment “True” could be operationalized as corresponding to an existential reading and “False” to a universal reading. This is because in the scenarios, there is one individual (e.g. ‘chef’) that the determiner ‘every’ quantifies over, for whom the nuclear scope predicate (e.g. ‘bake’) is true of not all items in a set that the predicate takes as a direct object (e.g. ‘cakes’).⁵ Full materials are listed in Appendix (B). In an offline norming study including the judgments of 12 speakers, all items’ associated donkey sentences were judged as existential biased (that is, they were judged across speakers as more associated with an existential compared to a universal paraphrase.) There were also filler items that included stories as well. In these filler items, instead of donkey sentences, participants verified existential sentences. An example filler sentence is “True or False: There was a beetle that crawled into a cobweb.”

Eighteen lists were created as follows using the Turktools designed by (Erlewine & Kotek 2016) (made available online at <http://turktools.net/>). First, the 18 donkey sentences were split into three groups of six sentences. Then, for each group, six lists of six critical items (two each of *some*, *a*, and *any*) and the same 12 filler items were constructed. Lists were counterbalanced and were presented in a random order with at least one filler between each critical item using “lister.py” from the Turktools. Four participants were assigned to each list of the eighteen lists. This procedure was repeated twice for both the present and past tense conditions.

⁵ The scenarios were different in form than those in Geurts (2002)’s experiments.

2.1.2.3 Procedure

As in (Geurts 2002)'s experiments, participants read donkey sentences and then judged them as True or False in the context of corresponding scenarios. In the present experiments, donkey sentences included, e.g., example (34), and corresponding scenarios included, e.g., example (33). Accepted practices for implementing experiments and creating materials for use on MTurk as described in (Gibson, Piantadosi & Fedorenko 2011) were followed. In particular, experiments were posted on the Amazon Mechanical Turk platform. Subjects were presented with stimuli (questions) in different orders depending on the list they were working on. Stimuli differed according to the targeted manipulation (in this case form of indefinite). Subjects were accepted and paid for their participation if they appeared to be paying attention to the task.

All items were presented at the same time on a single webpage. Participants did not receive feedback for any of their responses. The entire task took approximately 10 minutes to complete.

2.1.3 Results

Participants' responses for each trial were coded as either "True" (1) or "False" (0). Mean proportions of universal readings including data from both Experiment 1A (present tense) and 1B (past tense) as illustrated in examples (33), (34), and (35) are presented in Table (4.3). Proportions of universal readings are equal to (1 - proportion existential readings) or proportion of responses "False". Proportion existential readings are equal to proportion responses "True".

Table 2.1: Mean Proportions of Universal Readings Across Indefinites for Experiments 1A and 1B

Indefinite/Tense	present (Exp. 1A)	past (Exp. 1B)	average
<i>any</i>	0.55	0.31	0.43
<i>a</i>	0.43	0.2	0.32
<i>some</i>	0.34	0.19	0.27
average	0.44	0.23	0.34

Data were analyzed separately for each experiment using logistic regression mixed effects models. Full (maximal), reduced, and minimal models were constructed.⁶ Reference level (simple) coding was employed in order to compare indefinite forms in terms of universal readings. The indefinite determiner *a* was treated as the reference level because it was hypothesized that the proportion of universal readings with *a* would fall midway between *some* and *any*.

2.1.3.1 Results: Experiment 1A (Present Tense)

The full and reduced models failed to converge; the results reported concern models that had only intercepts for random effects structure. Note that lack of convergence of models is not a cause for concern; it simply means that we have to select a model with a fewer terms. Coefficients for the minimal model and associated Standard Error, z values, and p values are presented in Table (2.2). Coefficients other than the intercept are associated with differences between indefinites in terms of proportion universal readings.⁷ There were more universal readings with *any* than with *a* ($z = -6.062, p < .0001$) and more universal readings with *a* than with *some*

⁶ See Appendix (C) for details on model construction. Full models included random slopes for both Subject and Item, reduced model included random slopes for only Subject, and minimal models did not include random slopes. In all three models, random intercepts for Subject and Item were included.

⁷ Significance codes for p values are 0: ***, 0.001: **, 0.01: *, >0.05: (none).

($z = 5.651, p < .0001$). We may infer from the above comparisons that there were more universal readings with *any* than *some*. Although there appears to be a bias for universal readings with *any* as the proportion of universal readings is above 0.5, it is unclear whether there is an absolute bias for universal readings with *any* when we take into account the bias for people to answer “True”; this is called “acquiescence bias” in the literature.

Table 2.2: Coefficients for Experiment on Indefinite Form, Present Tense

	Estimate (β)	Std. Error	z	p
(Intercept)	0.5625	0.3038	1.852	0.06
a vs. some	1.7497	0.3096	5.651	<.0001***
a vs. any	-1.8555	0.3061	-6.062	<.0001***

2.1.3.2 Results: Experiment 1B (Past Tense and Temporal Modifiers)

The full and reduced models failed to converge. Coefficients and associated values for the minimal model are presented in Table (2.3). There were more universal readings with *any* than with *a* ($z = -4.592, p < .0001$) and more universal readings with *a* than with *some* ($z = 2.747, p = .006$). We may infer from the above comparisons that with *any* there were more universal readings than with *some*. Similar logic for inferring differences between levels of variables is assumed in the following sections.

Table 2.3: Coefficients for Experiment on Indefinite Form, Past Tense

	Estimate (β)	Std. Error	z	p
(Intercept)	2.6906	0.4164	6.461	<.0001***
a vs. some	0.9461	0.3444	2.747	0.006*
a vs. any	-1.5103	0.3289	-4.592	<.0001***

2.1.3.3 Comparison of Experiments 1A and 1B: Effect of Tense on Readings

Data from Experiments 1A and 1B were combined and analyzed using logistic regression mixed effects models as described in Appendix (C). Note that there was no random effect structure for subjects (because the experiment was between subjects). However, there was random effect structure for items (because the items were the same across the two experiments other than differing in the tense manipulation.) Comparing present and past tense (and including only Tense as a fixed effect), the full model failed to converge. The reduced and simplest models did not differ in terms of fit for the data ($\chi^2(2) = .4, p = .8$). Coefficients and associated values for the minimal model are presented in Table (2.4). With respect to the minimal model, there were more universal readings with present than past tense. Significant terms are presented in bold.

Table 2.4: Coefficients for Comparison of Experiments on Indefinite Form with Present and Past Tense

	Estimate (β)	Std. Error	z	p
(Intercept)	2.3199	0.3134	7.403	<.0001***
Tense	-1.7473	0.3474	-5.03	<.0001***

2.1.4 General Discussion: Experiments 1A and 1B

The data from Experiments 1A and 1B provide support for the hypothesis (32), shown again in (36); we have reason to reject the null hypothesis that there will be no differences among indefinites with respect to readings generated.

(36) Universal readings:

some < a < any

One unexpected result is that existential readings were preferred overall, in contrast to the assumption common in the literature that universal readings are the default. This result might be attributed to subjects having a bias to respond with

“True”. However, it is not the case that subjects are totally unwilling to answer “False”; see results in Table (2.11) in which proportions of responses “False” (universal readings) are quite high. Results indicate that wide scope indefinites also generate more existential readings. Such indefinites include those with the determiners *a* and *some* in English. One potential implication of these results is that indefinites that take exceptional wide scope give rise to a similar form of reference resolution, e.g. dynamic or familiarity based, and it is this form of reference resolution that is responsible for generating more existential readings.

The results of these experiments are difficult to reconcile with approaches that are purely D-type or dynamic because such approaches do not have a ready way of accounting for how a difference in indefinite syntax and semantics could have an effect on readings. I argue that these results are best accounted for with a mixed approach inspired by (Chierchia 1995) in which a dynamic binding (or something like it) biases toward existential readings, while D-type resolution (or something like it) biases toward universal readings; I assume that these different forms of anaphora resolution arise from the form and semantics of the indefinite. It is possible that D-type and dynamic approaches could be extended to account for both readings, and such extensions have been proposed. However, I argue that such extensions are not preferable in that a mixed approach is the most parsimonious because it allows for simpler derivations and representations of truth conditions.

Further, a mixed approach is empirically motivated by experimental and typological trends described in this chapter and the next; that is, we are more justified in using different but simpler representations of truth conditions when we obtain empirical data showing that different forms of expression are more associated with certain interpretations. There is a fundamental trade-off in semantics between more uniform systems that use similar but more elaborate representations for different interpretations and less uniform systems that use different but simpler representations for different interpretations. A D-type approach in its simplest form is best suited to account for universal readings because we can state that there is universal quantification

over something (such as a situation) related to the denotation of a definite description, which is associated with an indefinite that takes narrow scope. A dynamic-inspired approach in its simplest form is best suited to account for existential readings because we can state that there is something related to an indefinite that takes wide scope, like extension of the scope of an existential quantifier. Extending D-type and dynamic approaches would lead to more complicated representations. Simpler representations are obtained by treating universal readings with quantification over something (such as a situation) and by treating existential readings with something similar to dynamic extension of existential quantifiers, and it is for this reason that a mixed approach (with such divergent representations) is more parsimonious.

We are more justified in using different approaches or forms of representations when differences in form of natural language data correspond to differences in interpretation, as shown in the present work. Also, unified approaches do not have a ready way of accounting for differences in interpretation due to form of indefinite, while a mixed approach does; it states that a difference in form of indefinite corresponds to a difference in representation of the indefinite at LF or the pronoun at LF or its reference resolution, and one of these is responsible for a difference in interpretation.⁸

In order to account for these results, I propose that determiners such as *some* bias toward dynamic binding-like resolution, generating more existential readings, while determiners such as *any* bias toward D-type resolution, generating more universal readings. I follow (Elbourne 2005) in assuming that universal quantification over situations in which uniqueness holds is responsible for generating universal readings.⁹

⁸ Another possible interpretation of the results presented here is that there is a three-way distinction in forms of anaphora resolution corresponding to the distinction among the determiners *any*, *a*, and *some*; I do not pursue this option but instead assume that *a* indefinites are ambiguous between the denotations of *any* and *some* and there is a mixture of the forms of anaphora resolution with *a* rather than a third form. This assumption is based on the work of Kratzer (1998), who posits an ambiguity for *a* indefinites between choice functional and non-choice functional. One might also argue that this three-way distinction among indefinite determiners cannot be captured by a two-way distinction among theories.

⁹ In the present experiments, a “situation” is operationalized as part of a scenario; each sentence corresponds to a scenario, while the entire story corresponds to a scenario.

It should be noted that there may be contextual factors other than the lexical items *some* and *any* that could bias toward either existential or universal readings; however, it was the aim of the present experiments to control for these factors by varying the context encoded in donkey sentences by including different content words and then averaging across sentences.

How exactly the association between indefinite scope and donkey sentence interpretation comes about is unclear. Here, I merely illustrate the association in the form of sentences that combine indefinite forms and their associated paraphrases of donkey sentence. (Note that these are not experimental stimuli.) The indefinite forms and paraphrases shown in examples (37) and (38) are more associated, while those in (39) and (40) are less associated.

(37) Every farmer who owns any donkey pets every donkey that s/he owns.

(38) Every farmer who owns a/some donkey pets a/some donkey that s/he owns.

(39) Every farmer who owns any donkey pets a/some donkey that s/he owns.

(40) Every farmer who owns a/some donkey pets every donkey that s/he owns.

Also, given the general alignment between indefinite syntax (less structure) and semantics (narrower scope) (e.g., (Dayal 2011)), the results suggest a mechanism relating indefinite and pronoun syntax and semantics to donkey anaphora interpretations via, e.g., NP as opposed to DP ellipsis. Future work (beyond the scope of this thesis) is required to establish if indefinite form affects resolution and reading independent of pronoun form.

There is support for the hypothesis that there will be more universal readings with donkey sentences in present tense than with those in past tense; we have reason to reject the null hypothesis is that there will be no difference between present and past tense with respect to readings generated. One possible interpretation of this result is that universal quantification over situations translates into a universal interpretation as in (Elbourne 2005). In the present study, present tense (marking) or imperfective (or iterative) aspect may have allowed for universal quantification over situations (as

in the account of (Elbourne 2005)) better than past tense with a temporal modifier or perfective aspect.¹⁰ Effect of indefinite form on readings was not as pronounced in Experiment 1B on past tense as in Experiment 1A on present tense. This could indicate that universal quantification over situations as in Elbourne’s theory in which uniqueness of definite descriptions is relativized is suppressed when past tense and a temporal modifier imply a single event or situation. ¹¹

2.2 Experiments on Full DP Donkey Anaphors

It seems fair to say that in the literature there has been more focus on accounting for donkey anaphora interpretation in terms of the semantics of the definite or pronoun more than in terms of the semantics of the indefinite antecedent. Given that the results of the experiments described in the previous section indicate that indefinite semantics is relevant for donkey anaphora interpretation, it is worthwhile to also test the effect of definite or pronoun form on donkey anaphora interpretation in experiments in order to decide whether accounting for donkey anaphora only in terms of the semantics of the definite or pronoun is warranted or whether indefinite semantics should also factor into an account; if definite or pronoun form has less effect on interpretation than indefinite form, then we might conclude that indefinite semantics should be the main factor in our account. In the following sections I present four such experiments (2A, 2B, 3A, and 3B) testing the effect of full definite DP or pronoun (anaphor) form on donkey

¹⁰ See also (Giannakidou & Merchant 1998) on the effect of aspect on donkey sentence readings.

¹¹ Effect of tense/aspect could also be attributed to the genericity associated with present tense in English, which is often analyzed as involving generic quantification over situations (by an operator *Gen*); see, e.g., (Carlson 2011). One reading of donkey sentences according to Schubert & Pelletier (1989) is a generic one. Thus, it is also possible that participants obtained a reading with generic quantification (over situations) (paraphrased in (41)) rather than a universal reading (paraphrased in (42)). It should be noted that indefinites with the determiner *some* lack generic readings; this may have contributed to the relative prevalence of existential (as opposed to universal or what were in fact generic readings) with such indefinites.

(41) Every farmer who owns a donkey generally pets it.

(42) Every farmer who owns a donkey pets every donkey that s/he owns.

anaphora interpretation; the upshot of these experiments is that definite form has some effect on interpretation but not as much of an effect as indefinite form.

2.2.1 General Introduction

In this section, I provide justification for experiments on full DP donkey anaphors. Although these experiments were carried out after the cross-linguistic surveys presented in section (3), they are presented here because of their similarity to the experiments described in the previous section (C.1). To give a summary and interpretation of the data presented above in section (C.1) as well as the data in Chapter (3), there is greater evidence for divergent readings of donkey anaphora being generated by different forms of indefinite rather than different forms of definite or pronoun. That is, there is more support for a mixed approach in which different indefinite semantics generates different readings. However, it is also possible that definite or pronoun semantics has an effect on readings.

Broader implications of some empirical trends in the thesis include potential evidence for a correspondence between indefinite (antecedent) and pronoun syntax (structural complexity) as well as semantics (indefinite denotation and definite denotation or means of reference resolution). A narrow scope indefinite may be resolved in terms of unique possession of that property, while a wide scope indefinite may be resolved via familiarity (not involving a property). Below, I will introduce some open questions for the account developed thus far. These questions will justify experiments on full DP donkey anaphors.

The experiments on indefinite form presented in the above section (C.1) and cross-linguistic data presented in Chapter (3) leave several questions open. First, why does indefinite form influence donkey sentence reading more than pronoun form? Second, do personal vs. demonstrative contrasts have different effects than null vs. overt contrasts? Third, do full definite DP anaphors as shown in example (43) and pronouns have different effects on donkey sentence readings? In the following sections, I justify and then present results from additional experiments that may help answer

these questions. Overall, indefinite form, at least in English, appears to have a stronger effect than full DP anaphoric form, and effect of full DP does not differ much from the pronoun *it*. There are effects of full definite DP form on reading, but they are mixed with respect to a hypothesis (44) about universal readings put forward here. The justification for this hypothesis is described in the next section.

(43) Every farmer who owns a donkey pets the donkey.

(44) *that* NP < *the* NP = *it* < *the* NP + RelC

2.2.2 Full Definite DPs with *a* Indefinites

2.2.2.1 Introduction

Here I consider donkey sentences with definite DP anaphors rather than pronouns. An example sentence used in the experiments under consideration is (45).

(45) Every farmer who owns a donkey pets the donkey.

The effects of indefinite form on donkey anaphora resolution presented in the above sections make plausible a mixed approach to donkey anaphora readings, similar to that of (Chierchia 1995), based on unique vs. non-unique reference resolution. Given this finding and the fact that different forms of definite DP are associated with different means of anaphora resolution (Schwarz 2009), it is also plausible that one could also find an effect of full DP form on readings. Note, however, that Schwarz's work was about different kinds of definites in German and does not necessarily extend straightforwardly to English. Definite descriptions may be underspecified or ambiguous in English between unique and non-unique meanings (Jenks 2018). The current study aimed to address the question as to whether non-unique or strong definites generate more existential readings more frequently. I expected demonstrative DPs with *that* to behave more like strong definites and thus generate more existential readings because they are associated with familiarity based resolution. If we associated familiarity based resolution with a dynamic approach, then familiarity based resolution is associated with

existential readings as is dynamic resolution in [Chierchia \(1995\)](#)’s work. See section (4.3.1.2) for a description of the similarity of strong definites and demonstratives.

It was also hypothesized that *the* with a relative clause modifier as in ‘the donkey that s/he owns’ would emphasize restricted (situational) uniqueness of, e.g., being a donkey owned by each farmer. Such a relative clause might be analyzed as the spell out a minimal situation containing a unique individual as in the account of [Elbourne \(2005\)](#) and thus may be used as a proxy for a “weak (uniqueness-based) definite”. Using such a DP, we can test the role of situational uniqueness in generating universal readings. Following ([Jenks 2018](#)), I assume that in English both pronouns and full definite DPs are ambiguous between unique and familiar reference resolution. Jenks assumes that the English definite article is ambiguous because English has a single definite article, while other languages have two with different semantics. Therefore, the English definite article would be expected to cover the denotations of both. That is, denotations of a definite description and pronoun may be provided as shown in example (46).

$$(46) \quad \llbracket \text{the donkey} \rrbracket = \llbracket \text{it} \rrbracket = \llbracket \text{the}_{\text{weak}} \text{ donkey} \rrbracket \text{ or } \llbracket \text{the}_{\text{strong}} \text{ donkey} \rrbracket$$

Given that English *the* may be underspecified between a unique and non-unique definite, I expected *the* to fall in between *that* NP and *the* NP + RelC in terms of universal readings. English also lacks a contrast in pronouns between unique and non-unique or familiarity based reference resolution. Given this lack of contrast, I hypothesized that *it* might act as underspecified as well and also fall between *that* NP and *the* NP + RelC in terms of universal readings. The hypothesis about universal readings is provided in (47).

$$(47) \quad \text{that NP} < \text{the NP} = \text{it} < \text{the NP} + \text{RelC}$$

It states that demonstrative phrases with *that* will generate fewer universal readings than definite descriptions and the pronoun *it*, which will in turn generate fewer universal readings than *the* NP + RelC (a modified definite description). This is because demonstrative phrases are expected to pick out only what their antecedent

denotes and nothing else. On the other hand, *the* NP + RelC is expected to act like a uniqueness-based definite and may thus generate universal readings through universal quantification over situations in which uniqueness is relativized. Unmodified definite descriptions are expected to act like either a demonstrative phrase (which seems to provide a good paraphrase of an existential reading) or a phrase with *the* NP + RelC (which is hypothesized to give rise to more universal readings due to emphasis of uniqueness). The null hypothesis is that there will be no differences among definites and the pronoun *it* with respect to readings generated. Demonstrative phrases have deictic readings; thus, it is plausible that they might point back to or reselect whatever their antecedent denotes and nothing else, generating an existential reading.

This study will also inform the question of whether donkey pronouns in English pattern with *minimal* definite descriptions as in (Elbourne 2005) in terms of the readings they generate.¹² I also hypothesized that there would be more universal readings with donkey sentences in present tense than with those in past tense; this is because past tense marking implies perfective aspect in English and a single situation or event (such as that of petting a donkey). The null hypothesis is that there will be no difference between present and past tense with respect to readings generated.

2.2.2.2 Method

Data were collected using the Amazon Mechanical Turk platform using a method analogous to the method of the experiments on indefinite form described in section (C.1). One experiment (2A) included donkey sentences in present tense, and another (2B) included donkey sentences in past tense. In these experiments, English full DPs functioning as anaphors were used instead of the pronoun *it*. These DPs included demonstrative phrase (*that* NP) (e.g. *that donkey*), “minimal” definite descriptions *the*

¹² Note that if the term “D-type” simply means “paraphrased via definite description”, then a pronoun might be paraphrased as a definite description in English and yet be resolved via familiarity. An approach that is “D-type” defined in this way would thus have more flexibility or power than a “D-type” approach such as (Elbourne 2005)’s that constrains itself to uniqueness. In this work “D-type” is used to refer to a uniqueness based approach.

NP (e.g. *the donkey*), and *the NP* + RelC restrictor property modifier (e.g. *the donkey that s/he owns*). All sentences contained indefinites with *a*. There were two separate experiments with 72 participants each, one with present tense and one with past tense. There were 144 participants included in total (mean age = 37.8 years (SD = 12.8), 72 female, 72 male). Participants were excluded (but still accepted on MTurk and paid) if they reported not speaking English as a first language or being from outside the US; a total of 14 were excluded. Participants were rejected if they answered seven or fewer of the 12 filler item comprehension questions correctly or took the same survey twice; a total of 17 were rejected.

The pronoun *it* was not included in the experiments; however, data with *it* were planned to be combined with these data later; this recombination is described below. All donkey sentences in the present experiment and in the experiments subsequently described were of the same form and included a relative clause and a DP with the embedding (“farmer”) determiner *every*. Example sentences are provided in (48, 49, 50, 51).

(48) Every farmer who owns a donkey pets the donkey that s/he owns.

(49) Every farmer who owns a donkey pets the donkey.

(50) Every farmer who owns a donkey pets that donkey.

(51) Every farmer who owns a donkey pets it.

2.2.2.3 Results

Proportions of universal readings were as presented in Table (2.5). Data for the pronoun *it* is taken from experiments 1A and 1B.

Table 2.5: Mean Proportions of Universal Readings Across Full Definite DPs and *it* for Experiments 2A and 2B

definite/Tense	present (Exp. 2A and 1A)	past (Exp. 2B and 1B)	average
<i>the</i> NP + RelC	0.58	0.35	0.47
<i>the</i> NP	0.49	0.31	0.4
<i>that</i> NP	0.55	0.35	0.45
<i>it</i>	0.43	0.2	0.32

Logistic mixed effect models were created and comparisons analogous to those described in section (2.1.3) were conducted. In these models, instead of indefinite form, definite form was included as a fixed effect. In these models, definite descriptions with the determiner *the* were treated as the baseline because *the* DPs were expected to fall midway between *that* NPs and *the* NP + RelC in terms of universal readings. Data from Experiments 1A and 1B were combined and analyzed using logistic regression mixed effects models as described in Appendix (C).

2.2.2.3.1 Results: Experiment 2A (Present Tense)

As for present tense, the full, reduced, and minimal models failed to converge. Coefficients and associated values for the fourth model are presented in Table (2.6). DPs of the form *the* NP were treated as the reference level because it was hypothesized that universal readings with such DPs would fall midway between universal readings with *the* NP + RelC and *that* NP. There were fewer universal readings with *the* NP than *the* NP + RelC. *the* NP and *that* NP did not differ.

Table 2.6: Coefficients for Experiment on Full Definite DP Form, Present Tense

	Estimate (β)	Std. Error	z	p
(Intercept)	-0.2984	0.4075	-0.732	0.4640
<i>the</i> NP vs. <i>the</i> NP + RelC	-0.8203	0.3832	-2.141	0.0323*
<i>the</i> NP vs. <i>that</i> NP	-0.1644	0.3765	-0.437	0.6624

2.2.2.3.2 Results: Experiment 2B (Past Tense)

As for past tense, the full and reduced models failed to converge. Coefficients and associated values for the minimal model are presented in Table (2.7). *the* NP and *the* NP + RelC and *the* NP and *that* NP did not differ in universal readings.

Table 2.7: Coefficients for Experiment on Full Definite DP Form, Past Tense

	Estimate (β)	Std. Error	z	p
(Intercept)	1.5540	0.4759	3.265	0.00109**
<i>the</i> NP (DD) vs. <i>the</i> NP + RelC	-0.2427	0.4177	-0.581	0.56119
<i>the</i> NP vs. <i>that</i> NP	-0.3530	0.4209	-0.839	0.40166

2.2.2.3.3 Comparison of Experiments 2A and 2B: Effect of Tense on Readings

Data from Experiments 2A and 2B were combined and analyzed using logistic regression mixed effects models as described in Appendix (C). Comparing present and past tense (and including only Tense as a fixed effect), the full model converged. The reduced model did not converge. Coefficients and associated values for the full model are presented in Table (2.8). There were more universal readings with present than past tense.

Table 2.8: Coefficients for Comparison of Experiments on Full Definite DP Form with Present and Past Tense

	Estimate (β)	Std. Error	z	p
(Intercept)	1.5331	0.4690	3.269	0.00108**
Tense	-1.8554	0.6219	-2.983	0.00285**

2.2.2.4 Discussion

There is partial support for the hypothesis about universal readings is provided in (47). We have reason to reject the null hypothesis that there will be no differences among definites and the pronoun *it* with respect to readings generated. One interpretation of these results is that a relative clause modifier may better allow universal quantification over situations. The fact that *the* NP + RelC elicited more universal readings than *the* NP calls for a modification to accounts such as [Elbourne \(2005\)](#)'s that takes into account the semantics of non-minimal definite descriptions explicitly. Some alternative explanations for the unexpected behavior of *that* NP are that participants might answer "False" because they get neither an existential nor a universal reading but, e.g., a reading in which some particular donkey is referred to (in which the indefinite takes widest scope). Because data for the pronoun *it* was taken from separate experiments, full definite DPs and *it* cannot be directly compared statistically. However, numerically, we see that *it* appeared to have fewer universal readings than full definite DPs; one explanation for this is that subjects were more likely to respond "True" to sentences with a pronoun rather than a full DP anaphor because full DP anaphors are generally less common than pronouns in the same position.

There is support for the hypothesis that there will be more universal readings with donkey sentences in present tense than with those in past tense. We have reason to reject the null hypothesis that there will be no difference between present and past tense with respect to readings generated. The effect of tense on donkey anaphora interpretation was as expected, as this effect was already observed in the above

experiments on indefinite form. The present tense pattern was contra expectation: *the* NP + RelC elicited more universal readings than *the* NP as expected due to the assumption that *that* NPs are associated with familiarity based resolution, but there were more universal readings with *that* NP than expected.

2.2.3 Comparison of Pronoun *it* and Full DPs with *a*

In the following section, I turn to a comparison between full definite DPs and *it* in terms of universal readings. The aim of this section is to address the part of hypothesis (47) stating that full definite DPs and *it* should behave similarly. In order to do so, I combined data from the experiment described in section (2.2.2) on full definite DPs and data from the experiment described in (C.1) on English indefinite determiners and the pronoun *it*. Because the data are combined and are drawn from different participant pools, we cannot perform statistical comparisons using mixed effect models. Thus, here, I do not describe results in terms of statistical significance.

2.2.3.1 Results

Data from the experiments described in section (C.1) on the pronoun *it* were combined with data from the present experiments on full definite DPs. These data came from different participants. Proportion universal readings (i.e. proportion of responses “False” by participants) were as presented in Table (2.5).

As for present tense, giving an approximation of the comparisons between definite DPs and *it*, there were fewer universal readings with *it* than *the* NP + RelC, while *it* did not differ from *the* NP and *that* NP. As for past tense, giving an approximation of the comparisons between definite DPs and *it*, there were fewer universal readings with *it* than with *the* NP + RelC and with *it* than with *that* NP. *it* and *the* NP did not differ. Numerically, giving an approximation of comparisons between present and past tense, there were more universal readings in present than in past tense.

2.2.3.2 Discussion

These results are compatible with both *the* NP and *it* being more similar to a strong definite than *the* NP + RelC, thus generating less universal readings. However, the behavior of *that* NP (if it is similar to a strong definite) calls this interpretation into question.

2.2.4 Competition Between Indefinite and Full DP Forms

Experiments in the previous sections indicate that indefinite form may have a stronger effect on donkey sentence interpretation; however, definite form also has some effect. These results do not provide decisive evidence as to whether indefinite or definite has a stronger effect on interpretation. In order to provide more decisive evidence, we might ask whether effect of definite form varies with form of indefinite. If effect of definite form varies with different indefinite form, then we will have more decisive evidence that indefinite has a stronger effect in that effect of definite form depends on or can be masked by form of indefinite. On the other hand, if effect of definite form remains the same across different indefinite forms, then there will be more support for the claim that definite form has an effect independent of indefinite form. Also, the effect of indefinite form might vary with different definite forms; by the same logic, this would show that the definite has a stronger effect in that the effect of indefinite form depends on it. In order to provide such evidence, it is necessary to conduct additional experiments with donkey sentences that include other indefinite determiners. In this section I present the results of two such experiments. One of these (3A) is on donkey sentences including full definite DP anaphors and *some*. The other (3B) is on donkey sentences including full definite DP anaphors and *any*.

2.2.4.1 Introduction

Another series of experiments was performed in order to address the question of whether indefinite form affects anaphora resolution and reading of donkey anaphora independent of pronoun or full DP anaphor form. Taking direction from previous

accounts that focus on the semantics of the definite or pronoun, I reasoned that indefinite form might affect donkey sentence reading but that this effect depends on pronoun form (i.e. affects reading indirectly via pronoun syntax and semantics), that is, indefinite form is not independent of pronoun or anaphoric definite form in terms of giving rise to interpretations. If indefinite form is not independent of pronoun form, then pronoun or anaphoric definite form may have a stronger effect than indefinite form. Thus, the effect of anaphoric expression can suppress the effect of indefinite. That is, indefinite form has the stronger effect when anaphoric expression does not itself bias toward one reading (is neutral), e.g., perhaps with *it* or *the* NP.

The hypothesis is that there will be differences among indefinites with determiners *some*, *a*, and *any* with respect to differences among definites and the pronoun *it* with respect to the pattern of readings generated. That is, for each indefinite determiner, there will be a different pattern among full DPs in terms of existential vs. universal reading preference. The null hypothesis is that there will be no differences among indefinites with determiners *some*, *a*, and *any* with respect to differences among definites and the pronoun *it* with respect to the pattern of readings generated. Comparison of the results of experiments testing hypothesis (47) on definite form and the experiments on effect of indefinite form in section (C.1) can help us evaluate the relative effect of definite anaphoric expression vs. indefinite form. MTurk studies crossing the variables of definite form (including English *it* and full DPs) with indefinite form that examine their effect on readings can help us determine which has a stronger effect.

2.2.4.2 Method: *some* and Full DPs and *it* (Experiment 3A)

First, a conceptual replication of the experiments described in section (2.2.2) with full definite DPs, *some*, and present tense (72 participants) (14 rejected, four excluded, mean age 36.9 years (SD = 12.8), 43 female, 27 male) was conducted. The method was analogous to the method for the experiment described in section (2.2.2.2). Participants read donkey sentences and judged them as True or False with respect to

scenarios. An example sentence is provided in (52). An example scenario is provided in (53).

(52) Every chef who bakes some cake moves it onto a table.

(53) There were three different chefs. During the past week, chef number 1 baked one cake and moved it onto a table. Chef number 2 also baked one cake and moved it onto a table. Chef number 3 baked two cakes and moved only one of them onto a table.

2.2.4.3 Results: *some* and Full DPs and *it* (Experiment 3A)

In this section and the following section, logistic mixed effect models were created and comparisons analogous to those described in section (2.1.3) were conducted; definite instead of indefinite was included as a fixed effect. Proportions of universal readings were as presented in Table (2.9).

Table 2.9: Proportions Universal Readings Across Full DPs vs. Pronoun with *some*

Definite	
<i>the</i> NP + RelC	0.37
<i>the</i> NP	0.32
<i>that</i> NP	0.38
<i>it</i>	0.34

The full and reduced models failed to converge. Coefficients and associated values for the minimal model are presented in Table (2.10). *the* NP and *the* NP + RelC and *the* NP and *that* NP did not differ in universal readings.

Table 2.10: Coefficients for Experiment on Full Definite DP Form with *some*

	Estimate (β)	Std. Error	z	p
(Intercept)	1.8690	0.6889	2.713	0.00666**
<i>the</i> NP (DD) vs. <i>the</i> NP + RelC	-0.3071	0.4925	-0.624	0.53294
<i>the</i> NP vs. <i>that</i> NP	-0.6694	0.4949	-1.352	0.17623

Data from the experiments described in section (C.1) on the pronoun *it* were combined with data from the present experiments on full definite DPs. These data came from different participants. Proportion universal readings were as presented in Table (2.9). Numerically, giving an approximation of the comparisons between definite DPs and *it*, *it* and *the* NP + RelC, *it* and *the* NP, and *it* and *that* NP did not differ in universal readings.

2.2.4.4 Method: *any* and Full DPs and *it* (Experiment 3B)

Next, a conceptual replication with full definite DPs, *any*, and present tense (72 participants) (eight rejected, three excluded, mean age 36.9 years (SD = 15.6), 42 female, 28 male) was conducted. The method was analogous to the method of the experiment described in section (2.2.2.2). An example sentence is provided in (54).

(54) Every farmer who owns any donkey pets the donkey.

2.2.4.5 Results: *any* and Full DPs and *it* (Experiment 3B)

Proportions of universal readings were as presented in Table (2.11).

Table 2.11: Proportions Universal Readings Across Full DPs vs. Pronoun with *any*

Definite	
<i>the</i> NP + RelC	0.78
<i>the</i> NP	0.72
<i>that</i> NP	0.81
<i>it</i>	0.55

The full and reduced models failed to converge. Coefficients and associated values for the minimal model are presented in Table (2.12). DPs of the form *the* NP produced fewer universal readings than *that* NP, while *the* NP and *the* NP + RelC did not differ.

Table 2.12: Coefficients for Experiment on Full Definite DP Form with *any*

	Estimate (β)	Std. Error	z	p
(Intercept)	-7.2559	1.7913	-4.051	<.0001***
<i>the</i> NP (DD) vs. <i>the</i> NP + RelC	-0.3437	0.6409	-0.536	0.5917
<i>the</i> NP vs. demonstrative	-1.5822	0.7216	-2.193	0.0283*

Data from the experiments described in section (C.1) on the pronoun *it* were combined with data from the present experiments on full definite DPs. These data came from different participants. Proportion universal readings were as presented in Table (2.11). Numerically, giving an approximation of the comparisons between definite DPs and *it*, there were fewer universal readings with *it* than *the* NP + RelC and with *it* than *that* NP, while *it* and *the* NP did not differ.

2.2.4.6 Discussion: *some* and *any* and Full DPs and *it*

There is support for the hypothesis that there will be differences among indefinites with determiners *some*, *a*, and *any* with respect to differences among definites and the pronoun *it* with respect to the pattern of readings generated. We have reason to reject the null hypothesis that there will be no such differences among indefinites. The determiner *some* seems to mask the effect of full DP on reading more than do other indefinite determiners. One explanation for this effect is that wide scope indefinites such as those with *some* introduce a stronger bias toward a familiarity based resolution of a pronoun and thus an existential reading. Results with the determiner *any* are mostly similar to those with the determiner *a*. However, the effect of full DP form was not as expected. In particular, results did not follow the hypothesized pattern as shown in example (44); DPs of the form *the* NP and *the* NP + RelC did not differ.

One explanation is that *any* is associated with D-type resolution and as in (Elbourne 2005) relatively strongly, no matter which definite form is used. In general, the pronoun *it* generates fewer universal readings than full DPs across different forms of indefinite. These results pose problems for accounts such as (Elbourne 2005) that treat pronouns similarly to full DPs. The present work does not have a ready way of explaining this difference either; in particular, the present results indicate that full DPs with relative clause modifiers are more associated with universal readings. However, if such DPs are also associated more with domain narrowing due to greater uniqueness within a given context, and domain narrowing is posited as the source of existential readings, then we have an apparent conflict. The explanation offered here is that relative clause modifiers are simply more associated with uniqueness-based resolution, which is more associated with universal readings.

2.2.4.7 Patterns of Effects of Indefinites Within Full DPs

Answering another research question may help us understand donkey anaphora better: does either variable, indefinite or definite (anaphor), exert an effect on reading that suppresses or masks the other variable? If so, then this would support the view

that the masked variable is not independent of the other that masks it. We can answer this question by asking whether readings across indefinites vary within definite anaphors more or readings across definite anaphors vary within indefinites more. The answer to this research question will help us understand donkey anaphora better by determining whether the variable of indefinite or definite form has a stronger effect on donkey sentence interpretation; if indefinite form has a stronger effect and masks the effect of definite form, then our account of donkey sentence interpretation should focus on form of indefinite; on the other hand, if definite form has a stronger effect, than our account need not focus on indefinite form.

We can compare indefinites in terms of readings within full definite DPs by combining results of the above experiments with *a* (experiments 2A and 2B, section (2.2.2)), *some* (experiment 3A, section (2.2.4.2)), and *any* (experiment 3B, section (2.2.4.4)). Because the participants are drawn from different pools, only descriptive statistics are provided. In the following, results from the experiments as listed above are combined for each indefinite and averaged. Across all full definite DPs, pattern (55) held. There were fewer universal readings with *some* than with *a* and fewer universal readings with *a* than with *any*. Proportion universal readings were as presented in Table (2.13).

$$(55) \quad \textit{some} < \textit{a} < \textit{any}$$

Table 2.13: Proportions Universal Readings Across Indefinites

Indefinite/Definite	<i>the NP</i> + RelC	<i>the NP</i>	<i>that NP</i>
<i>any</i>	0.78	0.72	0.81
<i>a</i>	0.58	0.49	0.55
<i>some</i>	0.37	0.32	0.38
average	0.58	0.51	0.58

The results shown in Table (2.13), as well as the results of Experiments 1A and 1B with the pronoun *it* described in section (C.1), indicate that effect of indefinite on reading appears to be relatively robust, present at least partially with full definite DPs as well as the pronoun *it*. Similar patterns of effect of indefinite form on reading are present with several different forms of definite DP as well as *it*. In particular, the pattern of universal readings with respect to indefinite determiner was always *some* < *a* < *any* in the data presented here. In contrast, there are slightly different patterns of effect of full DP or *it* on reading within each indefinite.

2.2.4.8 General Discussion: Experiments 2A, 2B, 3A, and 3B

The three main takeaways of this section on experiments on full definite DP donkey anaphors and *it* are as follows. First, there is some effect of full definite DP on donkey anaphora interpretation such that *the* NP + RelC (e.g. ‘the donkey that s/he owns’) gives rise to more universal readings than *the* NP and *it*, at least with present tense. Second, the effect of full definite DP form on readings was not as hypothesized; in particular, the hypothesized pattern (47), repeated below as (56), sometimes did not hold. The hypothesized pattern may also be illustrated with the sentences (57, 58, 59); universal readings were hypothesized to occur in increasing order among these sentences. Third, the effect of indefinite form on interpretation was similar for all definite DP forms. Thus, overall, there is some effect of definite DP form on interpretation; however, this effect is not as consistent as the effect of indefinite DP form.

(56) *that* NP < *the* NP = *it* < *the* NP + RelC

(57) Every farmer who owns a donkey pets that donkey.

(58) Every farmer who owns a donkey pets the donkey/*it*.

(59) Every farmer who owns a donkey pets the donkey that s/he owns.

Overall, these results indicate that indefinite form has a stronger effect than definite DP form on readings. Effect of indefinite form appears to be independent of

definite form. In fact, the opposite may be true; effect of definite form may depend on effect of indefinite form. Indefinite form sometimes *masks* the effect of definite form on reading, but definite form does not mask the effect of indefinite form. By “mask” I mean that one variable (A) makes another variable (B) depend on it, or that when variable A is present and has a certain value, variable B will always have a certain value; for example, indefinite form may mask definite form (i.e. either dampen or nullify effect of definite form) if a certain indefinite form causes a definite (or an entire sentence containing the definite) to have certain semantics, regardless of the semantics that a definite might contribute otherwise.

These results are compatible with an analysis of donkey anaphora in which indefinite syntax and semantics affects anaphora resolution and perhaps the structure of an anaphoric expression. These results also pose challenges for theories of donkey anaphora that take into account definite syntax and semantics but not indefinite syntax and semantics as a source of readings. It is important to note that generally speaking, the results of experiments presented in this chapter did not go against the hypothesized direction with respect to the experiments on definite form. They did go in the hypothesized direction with respect to the experiments on indefinite form in which indefinites that take narrow scope such as those with *any* are more associated with universal readings than those that can take wide scope such as those with *a* and *some*. In the next chapter, I discuss typological trends in the analysis of E-type anaphora. Significantly, these trends include a larger effect of indefinite form than definite form on donkey anaphora interpretation, which parallels what has been described in the above chapter.

Chapter 3

CROSS-LINGUISTIC SURVEYS ON E-TYPE ANAPHORA

In this chapter, I present cross-linguistic surveys on E-type anaphora. Within the literature, E-type anaphora in English has received considerable attention, while E-type anaphora in other languages has received more limited attention. There has been little research on E-type anaphora from a cross-linguistic (typological) perspective, in which the behavior of E-type anaphora in multiple languages is directly compared. One aim of the current research is to help fill this gap. The main motivation for the research questions presented in this chapter is to follow up on the experiments presented in the previous chapter. Given that we can observe effects of form of indefinite and definite or pronoun form on interpretation of donkey anaphora in English, it is worthwhile to consider the question whether it is possible to observe effects of indefinite and pronoun form on interpretation in other languages.

Here, I attempt to preserve as closely as possible the distinctions in English from the previous chapter. Overt DP forms in English were used in the previous chapter as a proxy for different forms of pronoun; in this chapter we have languages that can have different forms of pronoun, and so we can disentangle the effects of the factors of indefinite and pronoun on E-type anaphora interpretation. Despite the fact that other languages have slightly different semantic distinctions among indefinites compared to English, we can observe more or less the same results with other languages as with English that were presented in the previous chapter; that is, there is a relatively clear effect of indefinite form on donkey anaphora interpretation. In general, many languages do not show a clear pattern of results in terms of pronoun form; however, there are some that do; that is, we do not observe as consistent an effect of definite or pronoun

form on donkey anaphora interpretation. We also observe a somewhat consistent effect of indefinite and definite/pronoun compatibility effects.

The main reason I included different numbers of speakers in the surveys provided below was due to availability (either in terms of speakers I knew or could recruit from those known to my consultants). The main reason I included different sentences was that originally I tried to provide speakers with as literal word for word translations from English as possible; however, sometimes speakers in a given language told me that they would modify the sentences to sound more natural in their language in order to express what the English sentences seemed to express to them, and I followed their advice. The main reason there were different ways of providing a response (either grammatical/ungrammatical or on a scale) was that the survey method evolved over the course of collecting data in that speakers suggested to me that sentences could be judged as having gradient acceptability instead of binary grammaticality or ungrammaticality, and I followed their advice.

3.1 Cross-Linguistic Research on E-Type Anaphora

In this chapter, I will introduce and discuss several research questions asking whether we can observe a certain empirical trend related to E-type anaphora across languages. For each language and each research question, a statement about evidence for a trend that addresses the research question in the language is provided. I consider evidence for these empirical trends as negative (going against a prediction), neutral (lacking support for a prediction), positive (supporting a prediction), or mixed (both positive and negative).¹ I treat evidence as “neutral” if a trend cannot be established based on the examples provided, including cases where a comparison is not possible due to ungrammaticality or unacceptability. The purpose of this coding scheme is to give indications of the strength of typological trends in terms of proportion of languages for which evidence is “positive”. Nearly all of the language consultants who

¹ Note that each of the research questions introduced in the chapter could also be framed as a hypothesis, and we could describe evidence in terms of how consistent it is with that hypothesis.

provided judgments had at least some training in linguistics. Most of the evidence for grammaticality or acceptability and reading availability comes from the introspective judgments of single speakers of a language, unless otherwise noted. The generalizations stated here apply to object position only.²

Informants were presented with donkey sentences and paraphrases of the existential and universal readings of those sentences. Then, they were asked to introspect about what readings they thought these sentences could have. A limitation of this methodology is that judgments about the particular donkey sentences tested may not generalize to other donkey sentences. Also, for the most part, only a single speaker was consulted about any particular sentence. The predictions that are tested are described in section (3.2).

Languages were included and excluded from survey samples for the following reasons. Languages were included in part based on the availability of consultants (those who were known by the author or those who were known by consultants). For those languages for which consultants were not readily available, some examples and judgments were drawn from the literature. Languages were excluded if they lacked a contrast in indefinites or definites/pronouns that was comparable to those of other languages in the sample. For instance, German was excluded from surveys including a difference between forms of indefinite because it lacks a polarity indefinite that is comparable to English *any*; the determiner *irgendein* is only somewhat similar in meaning to English *any*; furthermore, *irgendein* was judged as degraded in a donkey sentence. See, e.g., (?).

Languages were excluded from surveys conducted later if indefinite or pronoun forms were judged ungrammatical or degraded in surveys conducted earlier. Mandarin was excluded from surveys due to the complications pointed out by two informants that indefinites in the sentences tested tended to be interpreted with kind readings. English was excluded from surveys on pronoun form because it lacks an overt contrast in

² Note that some of the languages examined allow subject drop, and object and subject position behave differently with respect to pronoun licensing.

pronouns and because it was investigated in the previous chapter. It was also excluded from surveys on discourse anaphora because *any* indefinites do not license discourse anaphora. Persian and Japanese as well as many other languages were not included in surveys because consultants were not readily available. Arabic was excluded from surveys involving form of pronoun after the first survey in which it was tested because it disallows null objects.

3.2 Empirical Research Questions

A number of research questions concerning indefinite form, definite or pronoun form, and construction or interpretation of E-type anaphora are pursued.³

More specific questions are grouped thematically into broader questions. One broad question is the following: how do the variables of indefinite and definite or pronoun form affect donkey sentence interpretation? The terms “NP-like” and “DP-like” for indefinites are defined as shown in (60). I use the terms “NP-like” and “DP-like” in order to describe a correlation between amount of overt structure and scope-taking ability. The distinction between narrow scope and wide scope indefinites is describe in sections (4.2.1) and (4.2.4) below.

- (60)
- I use the term “NP-like” for indefinites such as bare nouns (which lack an overt D(eterminer) at SS) and polarity indefinites that tend to take narrow scope in some languages and contexts.
 - I use the term “DP-like” for indefinites such as unmarked indefinites that have an overt indefinite article D(eterminer) at SS and ‘a/one’ indefinites that either can, tend to, or must take wide scope in some languages and contexts. Note that bare nouns are unmarked in some languages and contexts.

³ I use the term “form” to refer to overt syntax or morphology of an expression (present at surface structure (SS) but not necessarily LF).

- An NP-like indefinite lacks a D(eterminer) either at SS or LF, assuming a simple syntax-semantics mapping between NPs and narrow scope vs. DPs and wide scope.
- A DP-like indefinite has a D(eterminer) either at SS or LF, assuming a simple syntax-semantics mapping between NPs and narrow scope vs. DPs and wide scope.

Note that the correlation between structure and scope-taking ability described above is not an absolute one. There are cases in which indefinites with more overt structure (e.g., *any* indefinites in English) take narrow scope, and there are cases in which indefinites with less overt structure (e.g., bare nouns in some languages) can take wide scope. Chierchia (1998) and Boskovic (2008) argue that whether a covert determiner is present is parameterized across languages; whether overt determiners are present and when they are present is a matter of debate. The purpose of making the distinction here is only to provide a rough distinction among indefinite across languages and contexts. Note also that the distinction between singular and plural cuts across the distinction between “NP-like” and “DP-like”. For instance, in English, *donkeys* (on a non-kind reading) would be termed “NP-like” because it lacks a determiner and takes narrow scope, whereas *some donkeys* would be termed “DP-like” because it has a determiner and can take wide scope.⁴ Narrow scope indefinites are introduced in section (4.2.1), and wide scope indefinites are introduced in section (4.2.4).

Our understanding of donkey anaphora will improve if we can discover whether indefinite form or pronoun form has a stronger effect on donkey sentence interpretation. Specifically, the following research questions are pursued:

⁴ For related discussion in the context of donkey anaphora, see Brasoveanu & Dotlacil (2020), who note that the distinction between singular and plural cuts across the distinction between maximality and non-maximality. Also, Charlow (2015) points out that among indefinites, “the exceptional scope-takers seem to license non-maximal donkey anaphora”. Thus, an NP-like indefinite such as *donkeys* in English (which disallows exceptional scope) would tend to be interpreted maximally in anaphora resolution, while a DP-like indefinite such as *some donkeys* (which allows exceptional scope) can be interpreted maximally or non-maximally.

- (61) Is there an effect of pronoun form on donkey sentence readings: do pronoun forms that in some languages are morphologically weaker give rise to more universal readings, and do pronoun forms that in some languages are morphologically stronger give rise to more existential readings?
- (62) Is there an effect of indefinite form on donkey sentence readings: do “NP-like” indefinites give rise to more universal readings than “DP-like” indefinites?

Another broad question is as follows. How does the distinction between donkey anaphora and discourse anaphora relate to indefinite and pronoun syntax and semantics? Answering this research question will inform our understanding of the distinction between donkey and discourse anaphora. Specifically, the following research questions are pursued.

- (63) Are morphologically stronger pronouns more aligned with discourse anaphora and morphologically weaker pronouns more aligned with donkey anaphora?

A third broad question is: how does indefinite form interact with definite or pronoun form? Answering this question will inform our understanding of the mechanism by which E-type anaphora is resolved. The following specific research question is pursued.

- (64) Is there an interaction between indefinite antecedent form and pronoun form in donkey anaphora: are “NP-like” indefinites more compatible with morphologically weaker pronouns, and “DP-like” indefinites more compatible with morphologically stronger pronouns?

For instance, are bare nouns more compatible with null pronouns while unmarked (‘a/one’) indefinites more compatible with overt pronouns?

3.3 Effect of Pronoun Form on Donkey Sentence Readings

In this section, I provide some background on definite/pronoun form, a variable that is manipulated in the present study. A more in-depth description of this distinction

is provided in section (4.3.1). The motivation for asking whether pronoun form has an effect on donkey anaphora interpretation is to follow up on the effect of indefinite form on interpretation that was observed above. This effect is described in section (3.4). Different pronoun forms are aligned with different types of definite semantics. Furthermore, some approaches to donkey anaphora (such as that of (Chierchia 1995)) trace donkey anaphora interpretations directly to ways of analyzing the donkey pronoun and associated types of definite semantics. Therefore, asking whether pronoun form has a direct effect on donkey anaphora interpretation will help us decide whether such theories are empirically supported. First, I will provide background on different forms of pronoun. Next, I will describe how different theories of definiteness were extended by (Patel-Grosz & Grosz 2017) to provide different semantics of divergent forms of pronoun. For background on different theories of definiteness, see section (4.3.1.1). Finally, I will introduce the concept of relative strength of pronouns.

3.3.0.1 Weak and Strong Pronouns

The terms “weak” and “strong” have been used to refer to different classes of pronouns due to two distinct but correlated attributes. One attribute is syntactic behavior or distribution. Another attribute is amount of structure present at SS. For Cardinaletti (1994), this contrast is sometimes instantiated with “strong” and “weak” pronouns, respectively. Cardinaletti & Starke (1994) describe a number of morphosyntactic and semantic differences between weaker and stronger pronouns. Schwarz (2009) contrasts weak and strong definite DPs in German and pursues D-type and dynamic analyses respectively. Patel-Grosz & Grosz (2017) extend Schwarz (2009)’s analysis to German pronouns: they compare personal pronouns to unique definites and demonstrative pronouns to familiar definites. An example contrasting personal and demonstrative pronouns is provided below.

- (65) Paul_i wollte gestern mit Peter_j joggen gehen, aber
 Paul wanted to go running with Peter yesterday, but unfortunately
 der_{j/*i}/er_{i,j} war leider erkältet.
 he {DPro_{*i/j},/PPro_{i/?j}} had a cold. =

(([Hinterwimmer & Brocher 2016](#)), ex. (1))

‘Paul wanted to go running with Peter yesterday, but unfortunately, he had a cold.’

3.3.0.2 Pronoun Strength in Relative Terms

Pronoun strength can be conceived of in relative terms as a weak-strong contrast. This fact is relevant because in the present work I ask research questions concerning the effects of weak and strong pronoun contrasts. [Cardinaletti & Starke \(1994\)](#) describe a hierarchy of pronoun strength as shown in (66). For [Cardinaletti & Starke \(1994\)](#), the (<) relation corresponds to morphosyntactic size (number of projections). The (<) relation is also based on syntactic behavior and distribution of pronouns in different syntactic and semantic environments.

(66) clitic \leq weak \leq strong (ex. (157a))

[Patel-Grosz & Grosz \(2010\)](#), building on ([Cardinaletti & Starke 1994](#)), among other work, also propose a hierarchy of relative pronoun strength (67). A weak vs. strong contrast can be instantiated differently in different languages. These include German personal (weak) vs. demonstrative and Kutchi Gujarati null vs. overt.

(67) null < personal < demonstrative

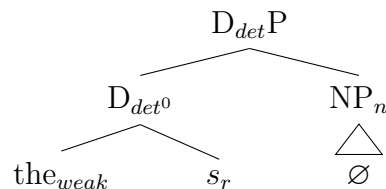
[Bi & Jenks \(2019\)](#) examine weak-strong contrasts in several languages. According to them, a three-way contrast with forms from hierarchy (67) is instantiated in Mandarin. For [Bi & Jenks \(2019\)](#), the (<) relation corresponds to morphosyntactic size and distribution.⁵ It is unclear whether contrasts between personal and demonstrative pronouns as unique and non-unique respectively can always be extended to null and overt pronouns. However, this extension is employed in this work means of

⁵ A question not explored here is precisely how the (<) relation in ([Bi & Jenks 2019](#)) might also be characterized semantically, for example, in echoing [Cardinaletti & Starke \(1994\)](#)’s characterization of how “referential” a pronoun is.

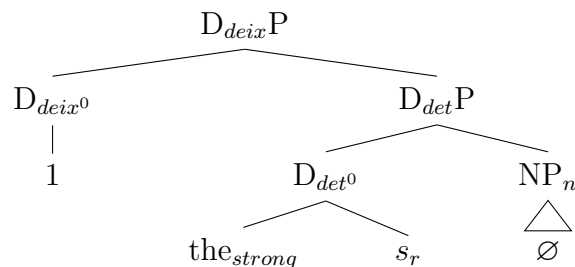
testing effect of pronoun strength on E-type anaphora well-formedness (acceptability/grammaticality) and interpretation.

Patel-Grosz & Grosz (2017) contrast personal vs. demonstrative pronouns in German, building on Elbourne (2005) and Schwarz (2009), among others. In their analysis, personal pronouns (PER) are analyzed as DPs and contain a restrictor situation s_r , which represents situational uniqueness, as shown in (68). In contrast, demonstrative pronouns (DEM) contain an additional projection $D_{deix}P$, as shown in (69). According to Patel-Grosz & Grosz (2017), the structure (68) is evaluated as in (70) and the structure (69) is evaluated as in (71).⁶ $D_{deix}D$ represents an index for a discourse referent. The definite articles the_{weak} and the_{strong} are not different grammatical categories but distinct lexical entries. The distinction is based on that of German, as described and analyzed by Schwarz (2009); in German, the weak definite article is associated with uniqueness, while the strong definite article is associated with familiarity (anaphoricity). Along with (Patel-Grosz & Grosz 2017), I assume that definite articles can also occur in the structure of pronouns. s_r is “the restrictor situation ... that has the NP property NP_n ” (Patel-Grosz & Grosz 2017) (p.261).

(68)



(69)



⁶ They state: “where s_r abbreviates $g(s_r)$, and $\llbracket NP_n \rrbracket^g$ represents the denotation of the null NP” (p.262).

$$(70) \quad \llbracket PER \rrbracket^g = \iota x [\llbracket NP_n \rrbracket^g(x)(s_r)]$$

$$(71) \quad \llbracket DEM \rrbracket^g = \iota x [\llbracket NP_n \rrbracket^g(x)(s_r) \wedge x = g(1)]$$

Research question (72) is based on previous research by [Schwarz \(2015\)](#) on the effect of pronoun form on donkey anaphora interpretation.

- (72) Is there an effect of pronoun form on donkey sentence readings: do pronoun forms that in some languages are morphologically weaker give rise to more universal readings, and do pronoun forms that in some languages are morphologically stronger give rise to more existential readings?

To answer this question, I tested a difference present at least at surface structure between forms of pronouns. In some languages, forms of pronouns stand in a weak vs. strong contrast. It may not be the case that in every language tested the contrast corresponds to a difference in distribution or syntactic structure (at LF). I reasoned that different semantics of pronouns arising from structure could correspond to [Chierchia \(1995\)](#)'s approach to donkey sentence readings. This idea was tested using mostly null vs. overt pronouns in several languages. Speakers were consulted about the preferred reading of translations of donkey sentences from English into other languages with different forms of pronoun.

The logic of selection of pronoun contrasts as weak and strong was the following. The contrasts were selected by analogy with weak vs. strong contrasts in languages such as German and Gujarati, mentioned in section (3.3.0.2). However, it should be noted that not all the contrasts in question are exactly alike. For example, in German, a “determiner pronoun” is homophonous with a demonstrative that functions as a definite article ([Patel-Grosz & Grosz 2010](#)) and is stronger, while in Greek a “determiner pronoun” is homophonous with a definite article and not a demonstrative and is weaker. Also, in Greek, there is no category for “personal pronouns” distinct from determiner pronouns as there is in German. Thus, the contrasts in question are taken from hierarchy (73), which is often only partially instantiated in the inventory of a given language; some languages do not make an overt distinction.

- (73) null < personal < definite determiner < demonstrative if distinct from definite determiner

More generally, a “determiner pronoun” is a pronoun that has the form of a definite determiner in a language. An example (74) is provided below. See, e.g., (Hinterwimmer & Brocher 2016) on the use of the term “DPro” for a determiner pronoun in German. Determiner pronouns stand in contrast to personal pronouns; DPros and PPros instantiate a weak-strong contrast on the hierarchy provided above in (73). Here different indices are provided by Hinterwimmer & Brocher (2016) in order to illustrate indexing possibilities that are different for determiner and personal pronouns.

- (74) Paul_i wollte gestern mit Peter_j joggen gehen, aber
 Paul wanted to go running with Peter yesterday, but unfortunately
 der_{j/*i/er_{i,j}} war leider erkältet.
 he {DPro_{*i/j},/PPro_{i/?j}} had a cold. =

((Hinterwimmer & Brocher 2016), ex. (1))

‘Paul wanted to go running with Peter yesterday, but unfortunately, he had a cold.’

Some of the languages in the sample, in which null pronouns were tested, or for which literature was cited, do not allow potentially definite object drop (null object pronouns), or ellipsis, while other languages in the sample do. I gloss over the distinction of null pronoun vs. ellipsis but refer to dropped objects as “potentially definite” as long as they can be used to refer to a previously introduced discourse referent. A summary of which languages in the sample allow null objects is provided in Table (3.1).

Table 3.1: Possibility of Null Objects Across Languages

Language	Null Objects?	Source
Arabic	No	Aidah Aljuran, p.c.
Armenian	Yes	(Khanjian 2013)
English	No	
German	No	L. Champollion, p.c.
Greek	No	(Giannakidou & Merchant 1997)
Hungarian	Yes	(Kiss 2012)
Japanese	Yes	(Tomioka 2003)
Korean	Yes	(Tomioka 2003)
Mandarin	Yes	(Tomioka 2003)
Persian	Yes	(Rasekhi 2014)
Turkish	Yes	(Şener & Takahashi 2010)

The measure tested was introspective judgment about reading availability. All informants had some training in linguistics. Informants were asked to reflect on whether sentences could be paraphrased with meaning A. or B. or both as shown in (75). Ideally, future research with other donkey sentences would help confirm informants' judgments with naive informants using field methods as described in ([Matthewson 2008](#)).

- (75)
- A. Every farmer who owns a donkey pets that one (and possibly others).
 - B. Every farmer who owns a donkey pets every donkey that s/he owns.

3.3.1 Languages

3.3.1.1 Hungarian

Donkey sentences were presented to 17 speakers of Hungarian in an anonymous survey using Google Forms. These speakers were recruited via [linguistlist.org](#). The first

six donkey sentences with the indefinite ‘a book’ were constructed with the intention of having a universal bias (based on pragmatics/world knowledge and the judgment of a speaker of Hungarian [Mai Ha Vu, p.c.]), while the latter six sentences with ‘a horse’ were constructed to have an existential bias. Speakers rated sentence acceptability using a 5-point Likert-type scale. They were instructed: “Please rate the following sentences of Hungarian on how acceptable you find them. 1 corresponds to a sentence that is completely unacceptable and 5 corresponds to a sentence that is completely acceptable. Do not be concerned if all of the sentences sound very good or very bad to you. They are randomly placed here.” Average Likert-type scale ratings across speakers for sentences grouped by pronoun form were computed and are listed in Table (3.2). Universal biased sentences were rated as follows. The average rating for the sentences with null pronouns (76, 77, 78) provided below was 3.3 (from 4.0, 4.0, and 1.9 respectively).

- (76) Akik vettek szamarat, mutassák meg nekem *pro*.
 who buy-PAST-3PL donkey-ACC show-IMP PRT me-DAT it.
 ‘Everyone who buys a donkey should show it to me.’
- (77) Akik vettek bármilyen szamarat, mutassák meg nekem *pro*.
 who buy-PAST-3PL any donkey-ACC show-IMP PRT me-DAT it.
 ‘Everyone who buys any donkey should show it to me.’
- (78) Akik vettek egy szamarat, mutassák meg nekem *pro*.
 who buy-PAST-3PL a donkey-ACC show-IMP PRT me-DAT it.
 ‘Everyone who buys a donkey should show it to me.’

The average rating for the sentences with demonstrative pronouns (79, 80, 81) provided below was 3.8 (from 4.9, 2.0, and 4.4 respectively).

- (79) Akik vettek szamarat, mutassák meg nekem *azt*.
 who buy-PAST-3PL donkey-ACC show-IMP PRT me-DAT that.
 ‘Everyone who buys a donkey should show it to me.’
- (80) Akik vettek bármilyen szamarat, mutassák meg nekem *azt*.
 who buy-PAST-3PL any donkey-ACC show-IMP PRT me-DAT that.
 ‘Everyone who buys any donkey should show it to me.’

- (81) Akik vettek egy szamarat, mutassák meg nekem azt.
 who buy-PAST-3PL a donkey-ACC show-IMP PRT me-DAT that.
 ‘Everyone who buys a donkey should show it to me.’

Existential biased sentences were rated as follows. The average rating for the sentences with null pronouns (82, 83, 84) provided below was 3.6 (from 4.0, 3.0, and 3.9 respectively).

- (82) Akinek volt lova, kölcsönadta *pro* a feleségének, hogy belovagolhasson a városba.
 Who had horse, lent it the wife, to ride the city.
 city.

‘Everyone who had a horse lent it to his wife to ride to the city.’

- (83) Akinek volt bármilyen lova, kölcsönadta *pro* a feleségének, hogy
 Who had any.FC horse, lent it the wife, to
 belovagolhasson a városba.
 ride the city.

‘Everyone who had any horse lent it to his wife to ride to the city.’

- (84) Akinek volt egy lova, kölcsönadta *pro* a feleségének, hogy belovagolhasson
 Who had a horse, lent it the wife, to ride
 a városba.
 the city.

‘Everyone who had a horse lent it to his wife to ride to the city.’

The average rating for the sentences with demonstrative pronouns (85, 86, 87) provided below was 4.0 (from 4.1, 3.6, and 4.3 respectively).

- (85) Akinek volt lova, kölcsönadta azt a feleségének, hogy belovagolhasson
 Who had horse, lent that the wife, to ride
 a városba.
 the city.

‘Everyone who had a horse lent it to his wife to ride to the city.’

- (86) Akinek volt bármilyen lova, kölcsönadta azt a feleségének, hogy
 Who had any.FC horse, lent that the wife, to
 belovagolhasson a városba.
 ride the city.

‘Everyone who had any horse lent it to his wife to ride to the city.’

- (87) Akinek volt egy lova, kölcsönadta azt a feleségének, hogy
 Who had a horse, lent that the wife, to
 belovagolhasson a városba.
 ride the city.
 ‘Everyone who had a horse lent it to his wife to ride to the city.’

We may infer reading preference through acceptability rating as follows. If sentences are highly rated with certain pronoun forms and bias (universal or existential), then sentences with those pronoun forms tend to display the bias the sentence has. The contrast between null and demonstrative pronouns was similar for universal and existential biased sentences (with bias based off the judgment of a speaker of Hungarian [Mai Ha Vu, p.c.]). Thus, there is neutral evidence for research question (72).

Table 3.2: Average Acceptability of Hungarian Donkey Sentences by Pronoun and Bias

pronoun/reading bias	universal	existential
null	3.3	3.6
demonstrative	3.8	4.0

E-type sentences and discourses were either drawn from the literature and modified or were translated from English. Sentences and discourses differed from the prototypical examples provided for English for the following reasons. Some donkey sentences in Hungarian were adapted from (Halm 2016) and did not contain ‘every’. In some cases, sentences were altered slightly if consultants found exact translations awkward. In section (3.3.1.1), sentences differed because they were constructed with the intention of creating a bias toward either an existential or universal reading. Note that different donkey sentences introduce different pragmatic factors and bias toward existential or universal interpretation (Champollion, Bumford & Henderson 2019);

ideally, future research would keep donkey sentences constant and have minimal pairs for all languages in question.

3.3.1.2 Armenian

As for Western Armenian, Hossep Dolatian (p.c.) rated sentence acceptability using a 5-point Likert-type scale from “completely unacceptable” (1) to “completely acceptable” (5) and provided judgments about readings. A bare noun and null pronoun (together) in example (88) biased toward a universal reading, an ‘a/one’ indefinite and null pronoun as shown in example (89) biased toward an existential reading, a bare noun and overt demonstrative pronoun in (90) were degraded, and an ‘a/one’ indefinite and demonstrative pronoun as shown in example (91) biased toward an existential reading. Thus, there is slight positive evidence for the research question presented in example (72).

- (88) Amen akaragaban vor ef uni, *pro* gə-foj-e.
every farmer who donkey has, *pro* PRES-pet-3SG.
‘Every farmer who has donkey pets it.’

Acceptability rating: 5 on a 5-point scale

- (89) Amen akaragaban vor ef mə uni, *pro* gə-foj-e.
Every farmer who donkey INDF has, *pro* PRES-pet-3SG.
‘Every farmer who has a donkey pets it.’

Acceptability rating: 5 on a 5-point scale

- (90) Amen akaragaban vor ef uni, ador gə-foj-e.
Every farmer who donkey has, it/that_{medial} PRES-pet-3SG.
‘Every farmer who has a donkey pets it.’

Acceptability rating: 3 on a 5-point scale

- (91) Amen akaragaban vor ef mə uni, ador gə-foj-e.
Every farmer who donkey INDF has, it/that_{medial} PRES-pet-3SG.
‘Every farmer who has a donkey pets it.’

Acceptability rating: 5 on a 5-point scale

3.3.1.3 German

As for German, Janina Boecher and three friends and family members (p.c.) provided judgments about several different pronoun forms, including personal and demonstrative. These sentences are nearly the same as [Patel-Grosz & Grosz \(2010\)](#)'s ex. (29) and use their glosses. Regardless of the form of pronoun, only an existential reading was available. Thus, there is neutral evidence for research question (72).

- (92) Jede Linguistin, die einen Esel hat, streichelt ihn.
every linguist, who a donkey has, pets him.
'Every linguist who has a donkey pets it.'
- (93) Jede Linguistin, die einen Esel hat, streichelt den.
every linguist, who a donkey has, pets DEM.
'Every linguist who has a donkey pets it.'
- (94) Jede Linguistin, die einen Esel hat, streichelt diesen.
every linguist, who a donkey has, pets this.
'Every linguist who has a donkey pets it.'
- (95) Jede Linguistin, die einen Esel hat, streichelt jenen.
every linguist, who a donkey has, pets that.
'Every linguist who has a donkey pets it.'

On the other hand, [Schwarz \(2015\)](#) notes that a donkey sentence in German (96) is grammatical with either a personal or demonstrative pronoun. If interpreted with a universal reading, (96) sounds fine with a personal pronoun but is considered odd with a demonstrative pronoun. Thus, it is possible that a demonstrative would produce an existential reading. Therefore, there might be positive evidence for research question (72).

- (96) Jeder Vater, der einen Sohn in der Abschlussklasse hatte, ging mit
 every father that a son in the graduating-class had went with
 ihm/dem nach vorne zum Dekan, um sein Zeugnis entgegenzunehmen.
 him/DEM to front to-the dean to his diploma receive.
 ‘Every father that had a son in the graduating class accompanied him to the
 front to receive his diploma.’ ((Schwarz 2015), ex.(27))

3.3.1.4 Greek

In Greek, null pronouns as well as bare nouns in donkey sentences were ungrammatical or degraded, as can be seen in examples (97, 98, 99, 101) (Myrto Grigoroglou and Dionysia Saratsli, p.c.). As for readings (Myrto Grigoroglou, p.c.), with ‘a/one’ DPs and regular (clitic/determiner) pronouns as shown in example (100), universal readings were more prominent, while with ‘a/one’ DPs and demonstrative pronouns as shown in example (102), existential readings were. Thus, there is positive evidence for research question (72).

- (97) *Káthe agrótis pou échei gaïduri chtypá.
 every farmer who owns donkey beats.
 ‘Every farmer who owns a donkey beats it.’
- (98) *Káthe agrótis pou échei éna gaïduri chtypá.
 every farmer who owns a donkey beats.
 ‘Every farmer who owns a donkey beats it.’
- (99) ?Káthe agrótis pou échei gaïduri to ktypá.
 every farmer who owns donkey it beats.
 ‘Every farmer who owns a donkey beats it.’
- (100) Káthe agrótis pou échei éna gaïduri to ktypá.
 every farmer who owns a donkey it beats.
 ‘Every farmer who owns a donkey beats it.’
- (101) Káthe agrótis pou échei gaïduri aftó chtypá.
 every farmer who owns donkey that beats.
 ‘Every farmer who owns a donkey beats it.’
- (102) ?Káthe agrótis pou échei éna gaïduri aftó chtypá.
 every farmer who owns a donkey that beats.

‘Every farmer who owns a donkey beats it.’

3.3.1.5 Korean

In Korean, null pronouns in examples (103, 104) were ungrammatical or considered odd (and could not be coreferential with their antecedent) (Jinwoo Jo, p.c.). On the other hand, overt pronouns in examples (105, 106) were well-formed. Thus, there is neutral evidence for research question (72).

- (103) #Tangnakwi-lul soywuha-n motun nongpwu-ka tha-n-ta.
donkey-Acc own-Rel all/every farmer-Nom ride-Pres-Decl.
‘Every farmer who owns a donkey rides it.’
- (104) #Tangnakwi-lul han mali soywuha-n motun nongpwu-ka tha-n-ta.
donkey-Acc one CL own-Rel all/every farmer-Nom ride-Pres-Decl.
‘Every farmer who owns a donkey rides it.’
- (105) Tangnakwi-lul soywuha-n motun nongpwu-ka kukes-ul tha-n-ta.
donkey-Acc own-Rel all/every farmer-Nom it-Acc ride-Pres-Decl.
‘Every farmer who owns a donkey rides it.’
- (106) Tangnakwi-lul han mali soywuha-n motun nongpwu-ka kukes-ul
donkey-Acc one CL own-Rel all/every farmer-Nom it-Acc
tha-n-ta.
ride-Pres-Decl.
‘Every farmer who owns a donkey rides it.’

3.3.1.6 Turkish

In Turkish, null pronouns were considered odd or ungrammatical in examples (107, 108), while overt pronouns as shown in examples (109, 110) were grammatical (Dursun Altinok and Bilge Palaz, p.c.). Thus, there is neutral evidence for research question (72).

- (107) *eşğ-i ol-an her çiftçi pro besl-er.
donkey-ACC have-REL every farmer pro feed-AOR.
‘Every farmer who has a donkey feeds it.’

- (108) *bir eṣeğ-i ol-an her çiftçi *pro* besl-er.
 a donkey-ACC have-REL every farmer *pro* feed-AOR.
 ‘Every farmer who has a donkey feeds it.’
- (109) eṣeğ-i ol-an her çiftçi on-u besl-er.
 donkey-ACC have-REL every farmer it-ACC feed-AOR.
 ‘Every farmer who has a donkey feeds it.’
- (110) bir eṣeğ-i ol-an her çiftçi on-u besl-er.
 a donkey-ACC have-REL every farmer it-ACC feed-AOR.
 ‘Every farmer who has a donkey feeds it.’

3.3.2 Results

The overall results of this survey are summarized in Table (3.3). As can be seen in the table, There is very weak positive evidence for the conclusion that pronoun forms that in some languages are morphologically weaker generate more universal readings. Note that there was no negative evidence in a given language; that, there were no cases in which universal readings were preferred with morphologically stronger pronouns and/or existential readings were preferred with morphologically weaker pronouns. Ideally, future research should use the same or similar numbers of speakers for each language to provide similar standards of evidence.

Table 3.3: Compatibility of Definite Form with Donkey Sentence Readings

language	evidence	source	forms tested
Hungarian	neutral	SB	null vs. overt (demonstrative)
Armenian	positive	SB	null vs. overt (demonstrative)
English	neutral	SB (MTurk experiments)	<i>the</i> NP+RelC, <i>the</i> NP, <i>it</i> , <i>that</i> NP
German	neutral	SB	personal vs. demonstrative
Greek	positive	SB	personal vs. demonstrative
Korean	neutral	SB	null vs. overt
Turkish	neutral	SB	null vs. overt

3.3.3 Discussion

The trend described in the above survey suggests that pronoun form by itself has little effect on donkey sentence readings. Instead, indefinite form may be what is ultimately responsible for bringing about different donkey sentence readings, though pronoun form may affect readings indirectly. The above trend also raises the question of whether indefinite antecedent form has an effect on donkey sentence readings that is parallel to the effect of pronoun form observed in some languages. In particular, perhaps “NP-like” indefinites will behave like morphologically weaker pronouns (as both are less structurally complex), while “DP-like” indefinites will behave like morphologically stronger pronouns (as both are more structurally complex). This research question is addressed in the following section.

3.4 Effect of Indefinite Form on Donkey Sentence Readings

In this section, I describe research testing the effects of syntax and semantics of indefinites on donkey sentence readings. In the next section, I first describe a contrast in the semantics of indefinites that correlates with differences in the form (syntax) of indefinites. Form of indefinite was manipulated in order to test its effect

on donkey sentence readings. The distinction is between “DP-like” and “NP-like” indefinites described in (60).

In the previous section, we saw that form of pronoun did not have much effect on the interpretation of donkey anaphora. Also, the effect of form of indefinite on donkey sentence interpretation remains relatively unexplored. Given these facts, it is worthwhile to ask whether form of indefinite has more of an effect on donkey anaphora interpretation than form of definite/pronoun. An additional research question I would like to address is presented in (111). To answer this research question, I tested at least a syntactic contrast; the contrast may be semantic as well. This research question was based on my judgment that in English *any* and *some* indefinites prefer universal and existential readings respectively. I employed the same survey method as described in section (3.3). Data from languages in the sample are provided below.

- (111) Is there an effect of indefinite form on donkey sentence readings: do “NP-like” indefinites give rise to more universal readings than “DP-like” indefinites?

3.4.1 Languages

3.4.1.1 Hungarian

In a survey of eight speakers of Hungarian, one speaker (Mai Ha Vu) was consulted in person, and seven were recruited via linguistlist.org and consulted over email.⁷ Sentences (112) with a bare noun and (113) with an ‘a/one’ indefinite were used to compare the effect of indefinite form on readings. In Hungarian, indefinites with *egy* ‘a/one’ are “unmarked” indefinites comparable to English *a* indefinites (see (Farkas 2006)).

- (112) Minden gazda, akinek van szamara, simogatja azt.
Every farmer, who has donkey, pets that.
‘Every farmer who has a donkey pets it.’

⁷ The other speakers were Dékány Éva, Tamás Halm, Éva Kardos, Monika Pukli, Péter Szűcs, and two anonymous.

- (113) Minden gazda, akinek van egy szamara, simogatja azt.
 Every farmer, who has a donkey, pets that.
 ‘Every farmer who has a donkey pets it.’

Table (3.4) summarizes judgments of reading availability across speakers. Sentences had an existential reading only (\exists), a universal reading only (\forall), or both. Informants are labeled as A-H.

Table 3.4: Hungarian Donkey Sentence Reading Frequency Across Informants

example/informant	A	B	C	D	E	F	G	H	Num. \exists	Num. Both	Num. \forall
112	B	\exists	B	\exists	B	B	B	B	2	6	0
113	\exists	\exists	B	\exists	\exists	\exists	\exists	B	6	2	0

Sentences (114) with a polarity indefinite and (115) with an ‘a/one’ indefinite were taken from (Halm (2016), p.268). They were also used to compare the effect of indefinite form on readings. Reading availability is summarized in Table (3.5).

- (114) Akik meg vettek bármilyen könyvet, mutassák meg nekem
 who PRT buy-PAST-3PL any book-ACC show-IMP PRT me-DAT
pro.
 it.
 ‘Everyone who buys any book should show it to me.’
- (115) Akik meg vettek egy könyvet, mutassák meg nekem *pro.*
 who PRT buy-PAST-3PL a book-ACC show-IMP PRT me-DAT it.
 ‘Everyone who buys a book should show it to me.’

Table 3.5: Hungarian Donkey Sentence Reading Frequency Across Informants

example/informant	A	B	C	D	E	F	G	H	Num. \exists	Num. Both	Num. \forall
114	B	B	\forall	\forall	\forall	\forall	\forall	\forall	0	2	6
115	B	B	\exists	\exists	\exists	\exists	B	\exists	5	3	0

Indefinite form had an effect on readings, as summarized in (116). Existential readings were preferred the most with ‘a/one’ indefinites, existential readings were preferred somewhat with bare nouns, and universal readings were preferred with FCI indefinites. Existential readings were more available overall, except with FCI indefinites. Thus, there is positive evidence for the research question presented in (111).

- (116) Universal Reading Availability Across Indefinite Form in Hungarian
‘a/one’ indefinite < Bare Noun < Free Choice Item indefinite

3.4.1.2 Arabic

In Arabic, a bare noun in example (117) allowed both existential and universal readings, while with an ‘a/one’ indefinite in (118) an existential reading was preferred (Abdullah Alghamdi, p.c.).⁸ For Aidah Aljuran (p.c.), a universal reading was preferred with a bare noun, while only an existential reading was possible with an ‘a/one’ indefinite. Thus, universal readings were more aligned with bare nouns and existential readings with ‘a/one’ indefinites. Therefore, there is positive evidence for the research question presented in (111).

⁸ B. Bruening (p.c.) points out that Arabic [in some cases] requires relative complementizers; however, these examples do not require complementizers according to my informant (Aidah Aljuran, p.c.). Additionally, B. Bruening points out the examples of bare nouns are not bare in that they lack case marking. However, they are bare in the sense that they lack an overt determiner.

- (117) Kl-u muzaria-t-i-n ta-mlek-u
 every-NOM farmer-3SG-FEM-GEN-INDEF 3SG-FEM-own-indicative
 hemar-a-n tu-dalel-uh-u
 donkey-ACC-INDEF 3SG-FEM-pet-it-INDIC
 ‘Every farmer who owns a donkey pets it.’
- (118) Kl-u muzaria-t-i-n ta-mlek-u
 every-NOM farmer-3SG-FEM-GEN-INDEF 3SG-FEM-own-indicative
 hemar-a-n wahid-a-n tu-dalel-uh-u
 donkey-ACC-INDEF one-MASC-ACC-INDEF 3SG-FEM-pet-it-INDIC
 ‘Every farmer who owns a donkey pets it.’

3.4.1.3 Armenian

See example sentences and observations presented in section (3.3.1.2). These sentences are repeated below. Based on these observations, one may infer that bare nouns were more aligned with universal readings than ‘a/one’ indefinites. Thus, there is positive evidence for the research question presented in example (111).

- (119) Amen akaragaban vor ef uni, *pro* gə-foj-e.
 every farmer who donkey has, *pro* PRES-pet-3SG.
 ‘Every farmer who has donkey pets it.’
 Acceptability rating: 5 on a 5-point scale
- (120) Amen akaragaban vor ef mə uni, *pro* gə-foj-e.
 Every farmer who donkey INDF has, *pro* PRES-pet-3SG.
 ‘Every farmer who has a donkey pets it.’
 Acceptability rating: 5 on a 5-point scale
- (121) Amen akaragaban vor ef uni, ador gə-foj-e.
 Every farmer who donkey has, it/that_{medial} PRES-pet-3SG.
 ‘Every farmer who has a donkey pets it.’
 Acceptability rating: 3 on a 5-point scale
- (122) Amen akaragaban vor ef mə uni, ador gə-foj-e.
 Every farmer who donkey INDF has, it/that_{medial} PRES-pet-3SG.
 ‘Every farmer who has a donkey pets it.’
 Acceptability rating: 5 on a 5-point scale

3.4.1.4 English

See section (C.1).

3.4.1.5 Greek

See example sentences presented in section (3.3.1.4). These sentences are repeated below.

- (123) *Káthe agrótis pou échei gaïduri chtypá.
every farmer who owns donkey beats.
'Every farmer who owns a donkey beats it.'
- (124) *Káthe agrótis pou échei éna gaïduri chtypá.
every farmer who owns a donkey beats.
'Every farmer who owns a donkey beats it.'
- (125) ?Káthe agrótis pou échei gaïduri to ktypá.
every farmer who owns donkey it beats.
'Every farmer who owns a donkey beats it.'
- (126) Káthe agrótis pou échei éna gaïduri to ktypá.
every farmer who owns a donkey it beats.
'Every farmer who owns a donkey beats it.'
- (127) Káthe agrótis pou échei gaïduri aftó chtypá.
every farmer who owns donkey that beats.
'Every farmer who owns a donkey beats it.'
- (128) ?Káthe agrótis pou échei éna gaïduri aftó chtypá.
every farmer who owns a donkey that beats.
'Every farmer who owns a donkey beats it.'

In Greek, bare nouns were ungrammatical in donkey sentences. Thus, there is neutral evidence for the research question presented in (111). However, in a survey of seven speakers recruited via email or in person, with a sentence with a polarity indefinite (129), neither reading was preferred (with one speaker reporting only existential readings, two speakers reporting both readings, one speaker reporting only universal readings, and three speakers being unable to decide). With a sentence

with an ‘a/one’ indefinite (130) neither reading was preferred slightly less (with two speakers reporting only existential readings, three speakers reporting both readings, and two speakers reporting universal readings). Thus, there is neutral evidence for the research question presented in (111).⁹

(129) Káthe agrótis pou échei opoiodípote gaíduri, to chaideúei.
 Every farmer who owns any.FCI donkey, it pets.
 ‘Every farmer who owns any donkey pets it.’

(130) Káthe agrótis pou échei éna gaíduri, to chaideúei.
 Every farmer who owns a donkey, it pets.
 ‘Every farmer who owns a donkey pets it.’

3.4.1.6 Korean

See example sentences presented in section (3.3.1.5). These sentences are repeated below.

(131) #Tangnakwi-lul soywuha-n motun nongpwu-ka tha-n-ta.
 donkey-Acc own-Rel all/every farmer-Nom ride-Pres-Decl.
 ‘Every farmer who owns a donkey rides it.’

(132) #Tangnakwi-lul han mali soywuha-n motun nongpwu-ka tha-n-ta.
 donkey-Acc one CL own-Rel all/every farmer-Nom ride-Pres-Decl.
 ‘Every farmer who owns a donkey rides it.’

(133) Tangnakwi-lul soywuha-n motun nongpwu-ka kukes-ul tha-n-ta.
 donkey-Acc own-Rel all/every farmer-Nom it-Acc ride-Pres-Decl.
 ‘Every farmer who owns a donkey rides it.’

(134) Tangnakwi-lul han mali soywuha-n motun nongpwu-ka kukes-ul
 donkey-Acc one CL own-Rel all/every farmer-Nom it-Acc
 tha-n-ta.
 ride-Pres-Decl.
 ‘Every farmer who owns a donkey rides it.’

⁹ The speakers were Konstantinos Aski, Maria Dimitropoulou, Katerina Drakoulaki, Stella Gryllia, Christos Makrodimitris, Dionysia Saratsli, and Marietta Sionti.

In a survey of five speakers recruited via email or in person comparing bare noun and numeral and classifier phrase indefinites, existential readings were preferred with bare nouns (with one speaker reporting only existential readings and four speakers reporting both readings) while existential readings were preferred more with Num + CIP indefinites (with three speakers reporting only existential readings, one speaker reporting both readings, and one speaker reporting universal readings).¹⁰ Thus, there is very slight positive evidence for the research question presented in (111).

3.4.1.7 Turkish

See example sentences presented in section (3.3.1.6). These sentences are repeated below. Two speakers (Dursun Altinok and Bilge Palaz, p.c.) indicated a slight preference for universal readings with bare nouns, as can be seen in examples (107, 109) and for existential readings with ‘a/one’ indefinite DPs, as can be seen in examples (108, 110). Thus, there is slight positive evidence for the research question presented in (111).

- (135) *eşğ-i ol-an her çiftçi *pro* besl-er.
 donkey-ACC have-REL every farmer *pro* feed-AOR.
 ‘Every farmer who has a donkey feeds it.’
- (136) *bir eşğ-i ol-an her çiftçi *pro* besl-er.
 a donkey-ACC have-REL every farmer *pro* feed-AOR.
 ‘Every farmer who has a donkey feeds it.’
- (137) eşğ-i ol-an her çiftçi on-u besl-er.
 donkey-ACC have-REL every farmer it-ACC feed-AOR.
 ‘Every farmer who has a donkey feeds it.’
- (138) bir eşğ-i ol-an her çiftçi on-u besl-er.
 a donkey-ACC have-REL every farmer it-ACC feed-AOR.
 ‘Every farmer who has a donkey feeds it.’

¹⁰ The speakers were Siewon Choi, Jinwoo Jo, Jooyoung Kim, Hyun Jin Hwangbo, and Myunghye Yoo.

3.4.2 Results

The overall results of this survey are summarized in Table (3.6). As can be seen in the table, there is positive evidence for the conclusion that “NP-like” indefinites give rise to more universal readings than “DP-like” indefinites. In the following tables, “SB” indicates data collected by the author. Note that one limitation is that the methodology of obtaining judgments about effect of pronoun form on interpretation in Hungarian was different for indefinite form as compared to pronoun form. The method for pronoun form was devised after the method for indefinite form in order to obtain more nuanced judgments from speakers (in terms of rating on a Likert-like scale instead of binary judgments). Also, the data were collected using acceptability judgments so that they could be used to test indefinite-pronoun compatibility independent of readings as described in section (3.5.2).

Table 3.6: Effect of Indefinite Form on Donkey Sentence Readings

language	evidence	source	forms tested
Hungarian	positive	SB (8 speaker survey)	polarity vs. bare noun vs. ‘a/one’, polarity vs. ‘a/one’
Arabic	positive	SB	bare noun vs. ‘a/one’
Armenian	positive	SB	bare noun vs. ‘a/one’
English	positive	SB (MTurk experiment)	‘any’ vs. ‘a’ vs. ‘some’
Greek	neutral	SB (6 speaker survey)	bare noun vs. ‘a/one’
Korean	very slight positive	SB (5 speaker survey)	bare noun vs. numeral ‘one’ and classifier
Turkish	positive	SB	bare noun vs. numeral ‘a/one’

3.5 Cross-Linguistic Surveys on Interactions Between Components of E-Type Anaphora

I present several cross-linguistic surveys in the following sections. These surveys examine the effects of indefinite form and pronoun form differ between donkey anaphora and discourse anaphora.

3.5.1 Interaction of Pronoun Strength and Construction (Donkey vs. Discourse Anaphora)

Given that there is a contrast between indefinites in terms of their ability to license donkey vs. discourse anaphora (see for example ([Giannakidou 2001](#))), it is worthwhile to ask whether we can observe a parallel difference in pronouns; that is, are pronouns that in some languages and contexts have more overt structure (like indefinites that have more overt structure) more aligned with discourse anaphora? In particular, a further research question is presented in example (139).

- (139) Are morphologically stronger pronouns more aligned with discourse anaphora and weaker pronouns with donkey anaphora (i.e. can we find cases in which stronger pronouns are better licensed in discourse anaphora and weaker in donkey anaphora)?

One reason for asking this research question is that a dynamic binding-like way of deriving readings (or familiarity-based resolution) might be required with discourse anaphora but not donkey anaphora. Thus, if stronger pronouns are resolved via a dynamic binding-like way of deriving readings (or familiarity-based resolution), then stronger pronouns could be preferred in discourse anaphora. Another reason is that pronouns with more structure might be better licensed in discourse anaphora. One could draw a parallel to forms of indefinite (“DP-like”) that are more aligned with discourse anaphora in that only they are licensed in discourse anaphora, in contrast to forms of indefinite (“NP-like”) that are not licensed in discourse anaphora. Both stronger pronouns and such indefinites appear to have more structure at SS, as in the case of null vs. overt (stronger) pronouns, or have been analyzed as having more structure at LF; see, e.g., ([Patel-Grosz & Grosz 2017](#)).

Research question (139) was also based on the trend that bound variable pronouns tend to be weaker ([Patel-Grosz & Grosz 2010](#)). Furthermore, [Ariel \(1991\)](#) observes that anaphora from a matrix to an embedded clause (as in donkey anaphora) tends to involve null pronouns more than anaphora across matrix clauses (as in

discourse anaphora). Thus, one could formulate a hierarchy of “anaphoric structural distance” (140) correlating with pronoun strength.

(140) bound variable < donkey < discourse

Research question (139) was also based on the work of Gundel, Hedberg & Zacharski (1993), who propose a “Givenness Hierarchy” for the form of anaphoric expressions in discourse (141) based on cross-linguistic trends. My reasoning for this prediction was as follows. Suppose that pronouns used in discourse anaphora are more similar to demonstratives than definite descriptions (DDs), and demonstratives are more similar semantically to strong pronouns, while DDs are more similar to weak pronouns. Thus, strong pronouns might be preferred to weak ones in discourse anaphora compared to donkey anaphora.

(141)

(1) THE GIVENNESS HIERARCHY:

in	>	activated	>	familiar	>	uniquely identifiable	>	referential	>	type identifiable
{it}				{that N}		{the N}		{indefinite this N}		{a N}
		{ that this this N								

Sentences tested were translations of (142) and (143) or were very similar. E-type pronouns were compared in object position only due to certain asymmetries that have been observed between object and subject position with respect to distribution of pronoun form (Bi 2018). Data from languages in the sample are provided below. In general, there was mixed (both positive and negative) evidence that morphologically stronger pronouns are more aligned with discourse anaphora compared to donkey anaphora.

(142) Every farmer who owns a donkey pets it.

(143) A farmer owns a donkey. S/he pets it.

3.5.1.1 Languages

3.5.1.1.1 Armenian

See example sentences presented in section (3.3.1.2) (donkey anaphora). These sentences are repeated below.

- (144) Amen akaragaban vor ef uni, *pro* gə-foj-e.
every farmer who donkey has, *pro* PRES-pet-3SG.

‘Every farmer who has donkey pets it.’

Acceptability rating: 5 on a 5-point scale

- (145) Amen akaragaban vor ef mə uni, *pro* gə-foj-e.
Every farmer who donkey INDF has, *pro* PRES-pet-3SG.

‘Every farmer who has a donkey pets it.’

Acceptability rating: 5 on a 5-point scale

- (146) Amen akaragaban vor ef uni, ador gə-foj-e.
Every farmer who donkey has, it/that_{medial} PRES-pet-3SG.

‘Every farmer who has a donkey pets it.’

Acceptability rating: 3 on a 5-point scale

- (147) Amen akaragaban vor ef mə uni, ador gə-foj-e.
Every farmer who donkey INDF has, it/that_{medial} PRES-pet-3SG.

‘Every farmer who has a donkey pets it.’

Acceptability rating: 5 on a 5-point scale

See also example sets of sentences presented below (discourse anaphora).

- (148) *akaragaban mə₁ ef₂ uni. *pro*₁ *pro*₂ gə-foj-e.
farmer INDF₁ donkey₂ has. *pro*₁ *pro*₂ PRES-pet-3SG.

‘A farmer has a donkey. S/he pets it.’

- (149) *akaragaban mə₁ ef mə₂ uni. *pro*₁ *pro*₂ gə-foj-e.
farmer INDF₁ donkey INDF₂ has. *pro*₁ *pro*₂ PRES-pet-3SG.

‘A farmer has a donkey. S/he pets it.’

- (150) *akaragaban mə₁ ef₂ uni. *pro*₁ ador₂ gə-foj-e.
farmer INDF₁ donkey₂ has. *pro*₁ it/that_{medial2} PRES-pet-3SG.

‘A farmer has a donkey. S/he pets it.’

- (151) akaragaban mə₁ ef mə₂ uni. *pro*₁ ador₂ gə-foj-e.
 farmer INDF₁ donkey INDF₂ has. *pro*₁ it/that_{medial2} PRES-pet-3SG.
 ‘A farmer has a donkey. S/he pets it.’

Donkey anaphora between bare nouns and null pronouns in example (88) and ‘a/one’ indefinites and null pronouns in example (89) was grammatical. On the other hand, discourse anaphora between either a bare noun or an ‘a/one’ indefinite and a null pronoun was ungrammatical in example (148, 149, 150). In contrast, discourse anaphora between an ‘a/one’ indefinite and an overt pronoun was grammatical (151). A morphologically stronger, overt pronoun was sometimes required only in discourse anaphora. Thus, there is positive evidence for research question (139).

3.5.1.1.2 German

In German, personal and demonstrative pronouns can be used in both donkey anaphora (152) and discourse anaphora (153). Thus, there is neutral evidence for research question (139).

- (152) Jede Linguistin, die einen Esel hat, liebt ihn/den/diesen/jenen.
 every linguist who a donkey has loves him/DEM/this/that.
 (= (Patel-Grosz & Grosz 2010), ex.(29))

‘Every linguist who has a donkey loves it.’

- (153) Maria hat einen netten Nachbarn. Er/Der gießt im Sommer ihre
 Maria has a nice neighbor he_{PER}/he_{DEM} waters in summer her
 Blumen.
 flowers

‘Maria has a nice neighbor. He (her neighbor) waters her flowers in the summer.’

((Patel-Grosz & Grosz 2017), ex.(4))

3.5.1.1.3 German Full DPs

In German, familiar definites can be used in discourse anaphora generally ((Schwarz 2009), p.27), while unique definites are more limited in this respect; see example (154).

- (154) Hans hat einen Schriftsteller und einen Politiker interviewt. Er hat
 Hans has a writer and a politician interviewed. He has
 #vom / von dem Politiker keine interessanten Antworten
 from-the_{weak} / from the_{strong} politician no interesting answers
 bekommen.
 gotten.
 ‘Hans interviewed a writer and a politician. He didn’t get any interesting
 answers from the politician.’ ((Schwarz 2009), ex.(23), p.30)

((Schwarz 2009), p.33) notes that the same contrast extends to donkey sentences, e.g. (155). Thus, there is neutral evidence for research question (139).

- (155) Jedes Mal, wenn ein Ornithologe im Seminar einen Vortrag hält,
 Every time when an ornithologist in-the_{weak} seminar a lecture holds
 wollen die Studenten #vom / von dem Mann wissen, ob
 want the students of-the_{weak} / of the_{strong} man know whether
 Vogelgesang grammatischen Regeln folgt.
 bird singing grammatical rules follows
 ‘Every time an ornithologist gives a lecture in the seminar, the students want
 to know from the man whether bird songs follow grammatical rules.’ ((Schwarz
 2009), ex.(31))

3.5.1.1.4 Hungarian

As for Hungarian, Mai Ha Vu (p.c.) rated sentence acceptability using a 5-point Likert-type scale. Donkey anaphora was acceptable with both null and demonstrative pronouns; see section (3.3.1.1). That is, if we assume that null pronouns are weaker and demonstrative (overt) pronouns are stronger, donkey anaphora was acceptable with both morphologically weaker and stronger pronouns. In contrast, discourse anaphora was unacceptable with morphologically weaker (null) pronouns in example (156, 157) but was acceptable with morphologically stronger (overt) pronouns in (158, 159) (Mai Ha Vu, p.c.). Thus, there is positive evidence for research question (139).

- (156) A gazdanak van szamara. Simogatja.
 The farmer has donkey. Pets.

‘The farmer has a donkey. He pets it.’

Acceptability rating: 1 on a 5-point scale

- (157) A gazdanak van egy szamara. Simogatja.
The farmer has a donkey. Pets.

‘The farmer has a donkey. He pets it.’

Acceptability rating: 2 on a 5-point scale

- (158) A gazdanak van szamara. Simogatja azt.
The farmer has donkey. Pets that.

‘The farmer has a donkey. He pets it.’

Acceptability rating: 4 on a 5-point scale

- (159) A gazdanak van egy szamara. Simogatja azt.
The farmer has a donkey. Pets that.

‘The farmer has a donkey. He pets it.’

Acceptability rating: 5 on a 5-point scale

3.5.1.1.5 Korean

In Korean (Jinwoo Jo, p.c.), null pronouns were ungrammatical in discourse anaphora, as can be seen in examples (160, 162); null pronouns were also ungrammatical in donkey anaphora (see data in section (3.3.1.5)). Thus, there is neutral evidence for research question (139).

- (160) *nongpwu-ka tangnakwi-lul₁ soywuha-ko iss-ta. ku-nun mayil *pro*₁
farmer-nom donkey-acc₁ own-conn prog-decl. he-top every.day *pro*₁
tha-n-ta.
ride-pres-decl.

‘A farmer owns a donkey. He rides it every day.’

- (161) nongpwu-ka tangnakwi-lul soywuha-ko iss-ta. ku-nun mayil kukes-ul
farmer-nom donkey-acc own-conn prog-decl. he-top every.day it-acc
tha-n-ta.
ride-pres-decl.

‘A farmer owns a donkey. He rides it every day.’

- (162) *nongpwu-ka [tangnakwi-lul han mali]₁ soywuha-ko iss-ta. ku-nun
 farmer-nom [donkey-acc one CL]₁ own-conn prog-decl. he-top
 mayil *pro*₁ tha-n-ta.
 every.day *pro*₁ ride-pres-decl.
 ‘A farmer owns a donkey. He rides it every day.’
- (163) nongpwu-ka tangnakwi-lul han mali soywuha-ko iss-ta. ku-nun mayil
 farmer-nom donkey-acc one CL own-conn prog-decl. he-top every.day
 kukes-ul tha-n-ta.
 it-acc ride-pres-decl.
 ‘A farmer owns a donkey. He rides it every day.’

3.5.1.1.6 Persian

In Persian, an overt pronoun is sometimes grammatical, and a null pronoun is ungrammatical, in donkey anaphora, as can be seen in example (164) (Modarresi 2015). The opposite is sometimes true of discourse anaphora (165). Thus, there is negative evidence for the research question presented in (139).

- (164) hær-ki khooneh be.khær.eh, pool.e-sh/*∅/ro hæm mi.de.h.
 anyone house subj.buys.3sg money.ez-that/*∅.ra also dur.give.3sg
 ‘Anybody who buys (a) house, pays the price of it.’
 ((Modarresi 2015), ex.(42))
- (165) mæn diruz ketab khærid.æm. emruz bord.æm-∅/*-esh/*-eshoon
 I yesterday book bought.1sg today took.1sg-∅/*-it/*-them
 mædreseh.
 school.
 ‘I bought (a) book yesterday. I took (it) to school today.’ ((Modarresi 2015),
 ex.(44))

3.5.1.1.7 Turkish

As for Turkish, Dursun Altinok (p.c.) rated sentence acceptability using a 5-point Likert-type scale. Null pronouns were acceptable, as can be seen in examples (107, 108), while overt pronouns were either unacceptable or interpretable marginally

as vague, as can be seen in examples (109, 110).¹¹ In contrast, in discourse anaphora, null pronouns were acceptable, as can be seen in examples (166, 167). Overt pronouns were also, as can be seen in examples (168, 169) (Dursun Altinok, p.c.). Thus, there is negative evidence for research question (139).

(166) Bir çiftçinin₁ eşeği₂ var. *pro*₁ *pro*₂ besler.
a farmer donkey owns. S/he₁ it₂ feeds.

‘A farmer owns a donkey. S/he feeds it.’

Acceptability rating: 5 on a 5-point scale

(167) Bir çiftçinin₁ eşeği₂ var. *pro*₁ onu₂ besler.
a farmer donkey owns. S/he₁ it₂ feeds.

‘A farmer owns a donkey. S/he feeds it.’

Acceptability rating: 5 on a 5-point scale

(168) Bir çiftçinin₁ bir eşeği₂ var. *pro*₁ *pro*₂ besler.
a farmer a donkey owns. S/he₁ it₂ feeds.

‘A farmer owns a donkey. S/he feeds it.’

Acceptability rating: 4 on a 5-point scale

(169) Bir çiftçinin₁ bir eşeği₂ var. *pro*₁ onu₂ besler.
a farmer a donkey owns. S/he₁ it₂ feeds.

‘A farmer owns a donkey. S/he feeds it.’

Acceptability rating: 5 on a 5-point scale

3.5.1.2 Results

The overall results of this survey are summarized in Table (3.7). As can be seen in the table, there is mixed (both positive and negative) evidence that morphologically stronger pronouns are more aligned with discourse anaphora compared to donkey anaphora. Languages differ in terms of alignment between pronoun strength and the distinction between discourse as opposed to donkey anaphora. Generally speaking, we

¹¹ These null pronouns would imply that every farmer could feed anything (either the donkey mentioned or some other one or a pig, a horse, etc.)

can state that if there is a restriction on the form of pronoun in discourse anaphora in a given language, the restriction is that a weaker pronoun form is blocked.

Table 3.7: Alignment of Pronoun Strength with Donkey vs. Discourse Anaphora

language	evidence	source	forms tested
Armenian	positive	SB	null vs. overt (demonstrative)
German	neutral	(Patel-Grosz & Grosz 2010)	personal vs. demonstrative
		(Patel-Grosz & Grosz 2017)	
German full DPs	neutral	(Schwarz 2009)	unique vs. familiar
Hungarian	positive	SB	null vs. overt (demonstrative)
Korean	neutral	SB	null vs. overt
Persian	negative	(Modarresi 2015)	null vs. overt
Turkish	negative	SB	null vs. overt

3.5.2 Interaction of Indefinite Antecedent Form and Pronoun Form in Donkey Anaphora

Let us assume a view in which pronouns differ in amount of structure present at LF (Patel-Grosz & Grosz 2017) and an ellipsis based view of pronouns (Elbourne 2005). Given these assumptions, we might expect amount of indefinite structure (at LF) to be correlated with amount of pronoun structure (at LF). Another research question I would like to address is presented in (170).

- (170) Is there an interaction of indefinite antecedent form and pronoun form in donkey anaphora: are “NP-like” indefinites more compatible (more acceptable) with morphologically weaker pronouns and “DP-like” indefinites more compatible (more acceptable) with morphologically stronger pronouns?

This research question, which is only about acceptability, is distinct from the research questions posed in sections (C.1), (3.3), and (3.4) that ask how suitable

certain indefinite and pronoun forms are with existential vs. universal donkey anaphora interpretations. A justification for this research question is that indefinite or pronoun structural parallelism is predicted by ellipsis theories such as (Patel-Grosz & Grosz 2017). One purpose of examining the interaction of indefinite form and pronoun form is that such an interaction would inform us about the mechanism by which donkey anaphora interpretations are derived. In particular, if an interaction is found, then it becomes more likely that donkey anaphora interpretations arise due to indefinite syntax and semantics being carried over into a pronoun. Data from languages in the sample are provided below.

3.5.2.1 Languages

3.5.2.1.1 Armenian

See example sentences presented in section (3.3.1.2). These sentences are repeated below.

- (171) Amen akaragaban vor ef uni, *pro* gə-foj-e.
 every farmer who donkey has, *pro* PRES-pet-3SG.
 ‘Every farmer who has donkey pets it.’

Acceptability rating: 5 on a 5-point scale

- (172) Amen akaragaban vor ef mə uni, *pro* gə-foj-e.
 Every farmer who donkey INDF has, *pro* PRES-pet-3SG.
 ‘Every farmer who has a donkey pets it.’

Acceptability rating: 5 on a 5-point scale

- (173) Amen akaragaban vor ef uni, ador gə-foj-e.
 Every farmer who donkey has, it/that_{medial} PRES-pet-3SG.
 ‘Every farmer who has a donkey pets it.’

Acceptability rating: 3 on a 5-point scale

- (174) Amen akaragaban vor ef mə uni, ador gə-foj-e.
 Every farmer who donkey INDF has, it/that_{medial} PRES-pet-3SG.
 ‘Every farmer who has a donkey pets it.’

Acceptability rating: 5 on a 5-point scale

A null pronoun was equally compatible with either a bare noun (88) or an ‘a/one’ indefinite (89), while a demonstrative pronoun was less compatible with a bare noun (90) than an ‘a/one’ indefinite (91). Thus, there is positive evidence for the research question presented in (170).

3.5.2.1.2 Greek

See example sentences presented in section (3.3.1.4). These sentences are repeated below.

- (175) *Káthe agrótis pou échei gaïduri chtypá.
every farmer who owns donkey beats.
‘Every farmer who owns a donkey beats it.’
- (176) *Káthe agrótis pou échei éna gaïduri chtypá.
every farmer who owns a donkey beats.
‘Every farmer who owns a donkey beats it.’
- (177) ?Káthe agrótis pou échei gaïduri to ktypá.
every farmer who owns donkey it beats.
‘Every farmer who owns a donkey beats it.’
- (178) Káthe agrótis pou échei éna gaïduri to ktypá.
every farmer who owns a donkey it beats.
‘Every farmer who owns a donkey beats it.’
- (179) Káthe agrótis pou échei gaïduri aftó chtypá.
every farmer who owns donkey that beats.
‘Every farmer who owns a donkey beats it.’
- (180) ?Káthe agrótis pou échei éna gaïduri aftó chtypá.
every farmer who owns a donkey that beats.
‘Every farmer who owns a donkey beats it.’

Null pronouns as well as bare nouns in donkey sentences were ungrammatical or degraded. Thus, there is neutral evidence for the research question presented in (170).

3.5.2.1.3 Hungarian

Data from the survey described in section (3.3.1.1) for the purpose of testing effect of pronoun on reading availability is described again in this section for the purpose of testing indefinite-pronoun compatibility. Average Likert-type scale ratings across speakers for sentences grouped by indefinite form and pronoun form are listed in Table (3.8). Null pronouns were more compatible with polarity indefinites as shown in examples (77, 83) (average rating: 3.5 from 3.0 and 4.0 respectively) than ‘a/one’ indefinites as shown in examples (78, 84) (2.9 from 3.9 and 1.9 respectively) but not bare nouns as shown in examples (76, 82) (4.0 from 4.0 and 4.0 respectively). On the other hand, demonstrative pronouns were more compatible with ‘a/one’ indefinites as shown in examples (81, 87) (4.3 from 4.3 and 4.4 respectively) and bare nouns as shown in examples (79, 85) (4.5 from 4.1 and 4.9 respectively) than polarity indefinites as shown in examples (80, 86) (2.8 from 3.6 and 2.0 respectively). These average ratings indicate that there was an interaction between indefinite form and pronoun form. This interaction is summarized in (181). Thus, there is positive evidence for the research question presented in (170).

Table 3.8: Average Acceptability of Hungarian Donkey Sentences by Pronoun and Indefinite

pronoun/indefinite	‘a/one’	bare noun	polarity
null	2.9	4.0	3.5
demonstrative	4.3	4.5	2.8

- (181) Interaction Between Indefinite Form and Pronoun Form in Hungarian
 null: ‘a/one’ indefinite < bare noun \approx polarity indefinite
 demonstrative: ‘a/one’ indefinite = bare noun > polarity indefinite

3.5.2.1.4 Korean

See example sentences and observations presented in section (3.3.1.5). These sentences are repeated below. Null pronouns could not be used felicitously in donkey sentences in Korean. Thus, there is neutral evidence for the research question presented in (170).

- (182) #Tangnakwi-lul soywuha-n motun nongpwu-ka tha-n-ta.
donkey-Acc own-Rel all/every farmer-Nom ride-Pres-Decl.
'Every farmer who owns a donkey rides it.'
- (183) #Tangnakwi-lul han mali soywuha-n motun nongpwu-ka tha-n-ta.
donkey-Acc one CL own-Rel all/every farmer-Nom ride-Pres-Decl.
'Every farmer who owns a donkey rides it.'
- (184) Tangnakwi-lul soywuha-n motun nongpwu-ka kukes-ul tha-n-ta.
donkey-Acc own-Rel all/every farmer-Nom it-Acc ride-Pres-Decl.
'Every farmer who owns a donkey rides it.'
- (185) Tangnakwi-lul han mali soywuha-n motun nongpwu-ka kukes-ul
donkey-Acc one CL own-Rel all/every farmer-Nom it-Acc
tha-n-ta.
ride-Pres-Decl.
'Every farmer who owns a donkey rides it.'

3.5.2.1.5 Turkish

See example sentences and observations in section (3.3.1.6). These sentences are repeated below. Null pronouns could not be used felicitously in donkey sentences in Turkish. Thus, there is neutral evidence for the research question presented in (170).

- (186) *eşğ-i ol-an her çiftçi *pro* besl-er.
donkey-ACC have-REL every farmer *pro* feed-AOR.
'Every farmer who has a donkey feeds it.'
- (187) *bir eşğ-i ol-an her çiftçi *pro* besl-er.
a donkey-ACC have-REL every farmer *pro* feed-AOR.
'Every farmer who has a donkey feeds it.'

- (188) eṣeğ-i ol-an her çiftçi on-u besl-er.
 donkey-ACC have-REL every farmer it-ACC feed-AOR.
 ‘Every farmer who has a donkey feeds it.’
- (189) bir eṣeğ-i ol-an her çiftçi on-u besl-er.
 a donkey-ACC have-REL every farmer it-ACC feed-AOR.
 ‘Every farmer who has a donkey feeds it.’

3.5.2.2 Results

The overall results of this survey are summarized in Table (3.9). As can be seen in the table, there is weak positive evidence for the conclusion that there is an interaction of indefinite antecedent form and pronoun form in donkey anaphora. “NP-like” indefinites are more compatible (more acceptable) with morphologically weaker pronouns, and “DP-like” indefinites are more compatible with morphologically stronger pronouns. In sum, there is weak positive evidence for indefinite and pronoun compatibility effects in donkey anaphora; however, there is positive evidence in Hungarian.

Table 3.9: Compatibility of Indefinite and Pronoun Forms in Donkey Anaphora

language	indefinites tested	pronouns tested
Armenian	bare noun vs. ‘a/one’	null vs. overt (demonstrative)
Greek	bare noun vs. ‘a/one’	personal vs. demonstrative
Hungarian	FC ‘any’ vs. bare noun vs. ‘a/one’	null vs. overt (demonstrative)
Korean	bare noun vs. numeral ‘one’ and classifier	null vs. overt
Turkish	bare noun vs. ‘a/one’	null vs. overt

language	evidence	source
Arabic	neutral	SB
Armenian	positive	SB
Greek	neutral	SB
Hungarian	positive	SB (17 speaker survey)
Korean	neutral	SB
Turkish	neutral	SB

3.5.2.3 Discussion

How can we explain the above correspondences or compatibility effects of indefinite and pronoun, both in terms of the semantics of antecedent indefinite and pronoun (e.g. reference resolution) and in terms of the syntax of the indefinite antecedent and pronoun? Also, how can we explain the above correspondences in conjunction with other effects of pronoun form, antecedent indefinite form, and construction (donkey anaphora compared to discourse anaphora)?

Some explanations are provided in section (2.1.4). One syntactic explanation is that indefinite form influences anaphora resolution structurally; that is, indefinites that are treated by the grammar as NPs give rise to NP ellipsis from pronouns, while indefinites treated as DPs give rise to DP ellipsis (taking inspiration from the work of [Elbourne \(2005\)](#) and [Patel-Grosz & Grosz \(2017\)](#)). Two semantic explanations are that indefinite form influences (donkey) anaphora resolution through pronoun semantics and that different indefinites and pronouns each prefer different forms of anaphora resolution independently. Note that the trend of indefinite-pronoun compatibility (3.8) parallels the pattern of reading preference with Hungarian indefinites (31). ‘a/one’ and bare noun indefinites preferred a demonstrative pronoun and existential readings. Free choice indefinites preferred a null pronoun and universal readings.

One interpretation of these results is that polarity indefinites and null pronouns prefer D-type resolution (e.g., ([Elbourne 2005](#))), while ‘a/one’ indefinites,

bare nouns, and demonstrative pronouns prefer a dynamic binding-like resolution (e.g., (Groenendijk & Stokhof 1991)). Hungarian null pronouns are weaker than demonstratives if we view pronoun strength as relative, following Patel-Grosz & Grosz (2010). This weak-strong contrast in Hungarian could correspond to more D-type vs. dynamic or familiarity-based resolution. Certain indefinites may be licensed in donkey but not discourse anaphora because discourse anaphora involves DP ellipsis, rather than NP ellipsis, while donkey anaphora is equally compatible with either DP or NP ellipsis. Correspondingly, in discourse anaphora, pronouns may prefer to be resolved via a dynamic binding rather than D-type resolution.

3.6 Summary of Results

Trends corresponding to the specific research questions mentioned above in section (3.2) are summarized in tables below grouped by broad research question. As summarized in Table (3.10), there is positive evidence for the conclusion that indefinite form and pronoun form have effects on donkey sentence interpretation. As summarized in Table (3.11), there is weak positive evidence for an interaction between indefinite and pronoun form. The research questions referenced above are repeated below.

Table 3.10: Effect of Indefinite and Pronoun Form on Donkey Sentence Interpretation

research question	direction and degree of evidence for trend
(190)	very weak positive
(191)	positive

(190) Is there an effect of pronoun form on donkey sentence readings: do pronoun forms that in some languages are morphologically weaker give rise to more universal readings, and do pronoun forms that in some languages are morphologically stronger give rise to more existential readings?

(191) Is there an effect of indefinite form on donkey sentence readings: do “NP-like” indefinites give rise to more universal readings than “DP-like” indefinites?

Table 3.11: Interaction Between Indefinite and Pronoun Form

research question	direction and degree of evidence for trend
(192)	weak positive

- (192) Is there an interaction between indefinite antecedent form and pronoun form in donkey anaphora: are “NP-like” indefinites more compatible with morphologically weaker pronouns, and “DP-like” indefinites more compatible with morphologically stronger pronouns?

3.7 Summary

To sum up, two variables, indefinite form (syntax) and definite/pronoun form (syntax) with correlated semantics were manipulated in order to determine their relative effect on the interpretation of E-type anaphora and alignment with different constructions that have been termed “E-type” anaphora in the literature. Three main takeaways of this chapter on cross-linguistic trends concerning E-type anaphora are as follows. First, indefinite antecedent syntax and semantics has an effect on donkey anaphora interpretation (readings). See section (3.4); there is positive evidence for research question (62). Second, indefinite form has a stronger effect than pronoun form on readings. Compare the results described in sections (3.3) and (3.4); there is very weak positive evidence for research question (61). Third, there are indefinite and definite or pronoun compatibility effects. See section (3.5.2); there is weak positive evidence for research question (64).

3.7.1 Limitations and Extensions of the Current Study

In this section, I discuss some limitations of the current study. These limitations can also be taken as providing direction for future studies. The landscape of indefinites is very complex. For a review of this complexity, see, e.g., (Kratzer 2005). There are

many different varieties of indefinite expressions with correlated morphosyntactic and semantic distinctions across languages. In this work, I have attempted to make a first cut of the landscape into two main categories: narrow scope and wide scope indefinites. Narrow scope indefinites (such as indefinites with *any* in English) more often have less overt structure and so are referred to here as “NP-like”; indefinites that can take wide scope (such as indefinites with *a* and *some* in English) typically involve more overt structure and so are referred to here as “DP-like”. At one extreme of this landscape is Salish indefinites. As described by [Matthewson \(2008\)](#), a series of indefinites in Salish take obligatory widest scope. Additionally, [Collins \(2014\)](#) describes a three-way distinction among indefinites in Samoan, labeled there as “wide scope”, “narrow scope”, and “stubborn narrow scope”. Future work might test the interpretation of a wider range of indefinites (other than polarity and bare noun indefinites and other than unmarked indefinites, ‘a/one’ indefinites, and indefinite with *some* in English) that fall into finer grained distinctions in donkey and other E-type anaphora.

Furthermore, tests of the ability of different indefinites to participate in donkey anaphora might help to inform the question of how we should treat such indefinites. If donkey anaphora is in some sense intermediate between property anaphora and discourse anaphora, then it is possible that there would be indefinites licensed either in both property anaphora and donkey anaphora but not discourse anaphora or in both donkey anaphora and discourse anaphora but not property anaphora. See section [\(4.3.2.1\)](#) for further discussion.

As with indefinites, the landscape of definites is complex as well. For a review, see [\(Schwarz 2013\)](#). In this work I have made a first cut into this landscape as well, focusing mostly on a distinction between null and overt pronouns, taking inspiration from [Schwarz \(2009\)](#)’s seminal work distinguishing unique and familiar definites. A question for future research is whether semantic distinctions other than narrow scope and wide scope for indefinites and unique and familiar for definites would give rise to universal, existential, or some other interpretation of donkey anaphora. Novel findings relating to forms of indefinite and pronoun that might be analyzed with semantic

values other than those targeted in this work could provide new ways of analyzing E-type anaphora as well as other phenomena.

Another limitation of this work is that none of the typological trends cited in the chapter are absolute; all are gradient. From a typological perspective, I have aimed to test whether a pattern emerges or not. A further limitation of this work is that it is not a large typological work; the number of languages included is rather limited. A larger typological survey is needed in order to establish more firmly the empirical trends presented in this work.

A prediction based on the empirical generalizations laid out in this work, namely, of greater effect of indefinite form than definite form on interpretation, would be that if a language doesn't have a distinction between different forms of pronoun, then indefinite may have more of an effect. This seems to be the case, for example, with English. Because definites in English are arguably ambiguous (based on comparison to other languages), their interpretation may be more subject to influence from their antecedent because one interpretation of the same overt form can be selected over the other. On the other hand, if a language does have a distinction between forms of pronoun, then indefinite may not exert its effect as strongly. Future work is required to test this prediction.

It is worth pointing out here that in this work I have a methodological contribution. In particular, there is a convergence of empirical findings in experiments in English and cross-linguistic surveys. In the next chapter, I develop analyses of different E-type anaphora constructions and interpretations that attempt to explain the empirical trends described above that have received support in this chapter and Chapter (2). An explanation of these trends together will serve to improve our understanding of E-type anaphora.

Chapter 4

ANALYSES OF E-TYPE ANAPHORA

4.1 Overview

In this chapter, I will propose analyses of E-type anaphora. The E-type constructions and examined include donkey anaphora, discourse anaphora, and paycheck and bathroom anaphora. The analyses are based on empirical trends described in chapters (2) and (3). In the previous two chapters, we saw that indefinite form has more of an effect on interpretation than definite or pronoun form in experiments on English and cross linguistic surveys; we also saw in one cross-linguistic survey that there are indefinite-definite correspondence effects. In this chapter I aim to account for the aforementioned effects of form of indefinite (syntax) and correlated indefinite semantics on the interpretation of donkey anaphora using semantic compositional tools that are well suited to certain syntax and semantics of indefinites and interpretations of donkey anaphora. I propose a novel analysis in which choice functions representing an antecedent (indefinite) and pronoun are coindexed, and this is what guarantees coreference between the individuals introduced by an antecedent and those picked out by a definite or pronoun.

A major objective of the chapter is to demonstrate that it is possible to readily analyze E-type anaphora by placing E-type constructions and interpretations into two main categories using empirical justification from cross-linguistic surveys and experiments. The main hypothesis tested in the work presented above was that indefinite form will have an effect on interpretation of donkey anaphora. First, experiments and cross-linguistic surveys in English indicate that indefinite form has a stronger effect on donkey anaphora interpretation than definite DP or pronoun form in

that more results of experiments are statistically significant and typological trends are quantitatively larger. The interpretations of donkey anaphora, an example of which is shown in (193), are provided in examples (194) and (195).

(193) Every farmer who owns a donkey pets it.

(194) Universal: ‘every farmer who owns a donkey pets all the donkeys that s/he owns.’

(195) Existential: ‘every farmer who owns a donkey pets at least one donkey that s/he owns.’

More specifically, narrow scope or “weak” indefinites such as those with *any* in English are more aligned with universal readings of donkey anaphora, though they can generate existential interpretations with some regularity. In addition, indefinites that are compatible with wide scope or “strong” indefinites such as those with *some* are more aligned with the existential interpretation. Second, donkey anaphora with weak indefinite antecedent tends to take a form that is more suited to express uniqueness-based definiteness, namely a weaker pronoun form. On the other hand, a strong indefinite requires a pronoun that is more suited to express familiarity-based semantics or is more directly referential, namely a stronger pronoun form. This difference is hard to detect in English, but other languages that have two different forms of pronouns show this tendency.

Third, there seem to be further correspondences with non-donkey E-type pronouns. Paycheck and bathroom pronouns tend to take the form that is related to uniqueness-based definiteness, namely, a weaker pronoun form. Discourse anaphora shows the opposite tendency, as its form is more often related to referential/familiarity-based definiteness, which is realized in the form of a stronger pronoun. While these effects await a full explanation, a partial explanation of certain facts is provided in this chapter. These facts are that indefinite form has a larger effect on interpretation than definite form and that there are indefinite-definite correspondence effects.

Based on these empirical findings, our account of how interpretations of donkey anaphora and other E-type anaphora constructions are derived should focus on the syntax and semantics of the indefinite antecedent. However, our account should also be able to explain indefinite and definite or pronoun correspondence effects. Antecedent indefinite and definite or pronoun appear not to be independent factors in that indefinite interpretation may have an effect on definite or pronoun interpretation; see section (3.5.2) for discussion.

First, in section (4.2.2), I will show how narrow scope indefinites would tend to give rise to universal readings as well as a way of deriving existential readings via domain narrowing. Next, in section (4.2.5), I will show how wide scope indefinites would tend to give rise to a way of deriving existential readings derived via choice functions. In section (4.4) I will discuss empirical trends presented in the thesis and how they support the particular analyses presented in this chapter.

As for universal readings and existential readings derived via domain narrowing, I propose that both readings are readily available with a single LF; there is a pragmatic ambiguity. This is the case with indefinites that take narrow scope; it is also sometimes the case with other indefinites. This may be the case when wide scope indefinites are not interpreted as choice functional. On the other hand, there is a different LF for existential readings via choice functions; this is the case with wide scope indefinites.

Below I provide an outline of the analyses that are presented in this chapter. Donkey sentences such as (193) have been argued to display an ambiguity between existential and universal readings (Elbourne 2005). First, I will lay out what I think the truth conditions of the universal and existential reading are for the sentence (193). A research question that is not yet totally resolved in the literature is how this ambiguity comes about.

Next, I will show how one can derive truth conditions for the universal and existential readings. I argue that there are two ways to derive the existential reading; I show what those two are following the derivations of truth conditions. One way of deriving the existential reading that is aligned with narrow scope indefinites involves

the LF for the universal reading but with the mechanism of domain narrowing from (Krifka 1996) applied to it to derive distinct truth conditions. In order to account for this way of deriving the existential reading, we need a level that maps LFs onto truth conditions. It is at this level that domain narrowing applies. Domain narrowing involves excluding individuals from the domain under consideration (e.g. donkeys that are both owned and petted by every farmer in the domain under consideration).

Another way of deriving the existential reading that is aligned with wide scope indefinites involves the use of a choice function that picks out the same individual(s) in the case of both the antecedent indefinite and the anaphora site (pronoun or definite). The difference between the two ways of deriving readings is that it is only in the case of the way of deriving existential readings via choice functions that coreference is guaranteed between antecedent and definite/pronoun; coreference is not guaranteed when readings are derived via domain narrowing. I will show how all three derivations work for the sentence (193) below.

4.2 Truth Conditions and Derivations

I propose that truth conditions for the universal reading and existential reading derived via domain narrowing should be represented in the same way; the only difference is in whether domain narrowing has been applied to them. Truth conditions and derivations of these truth conditions are presented in the following sections.

4.2.1 Narrow Scope Indefinites

In this section and in section (4.2.4), I will introduce a semantic distinction among indefinites that is present in some languages, namely the distinction between narrow scope and wide scope indefinites. This distinction represents a first cut of the landscape of indefinites; note that finer grained distinctions can be made, as well. This distinction is one variable manipulated in the present study and will be important for justifying the empirical research questions that follow. For our purposes, the distinction

of two main subsets of indefinites can also be referred to as NP-like vs. DP-like, as described in section (1.4.1).

Here I introduce background on a subset of indefinites that are empirically more aligned with a way of deriving existential readings via domain narrowing and with universal readings. These indefinites take narrow scope within the minimal clause that contains them. Such indefinites include those indefinites with the determiner *any* and some instances of bare nouns. Due to this behavior of being interpreted with narrow scope, we may analyze such indefinites with a property denotation. Note that “property denotation” is a theory dependent term; there are other ways to represent narrow scope. In this work, I treat narrow scope indefinites as denoting properties such that they can compose with a VP predicate and yield a relation via Restrict from (Chung & Ladusaw 2004); this relation may then be existentially closed.

I use the term “property denotation” here similarly to how the meaning of a predicate, e.g., ‘being a cat’, is provided in (Heim & Kratzer 1998) (there represented as type $\langle e, t \rangle$). For more on the notion of a property denotation, see, e.g., (Cyrino & Espinal 2015). The connection between property denotation and narrow scope has been illustrated traditionally in terms of several semantic behaviors of indefinites, for example, in terms of scope options with respect to attitude predicates. Narrow scope indefinites are typically not analyzed with the use of choice functions.

Taking direction from previous authors (e.g., (Giannakidou 2001)), I assume that English *any* phrases have a property denotation. If *any* phrases are interpreted as existential, then they must take narrow scope with respect to their licenser. I follow Kadmon & Landman (1993) in assuming that *any* phrases may be treated similarly to other indefinites. The denotation of a narrow scope indefinite is provided in example (196).

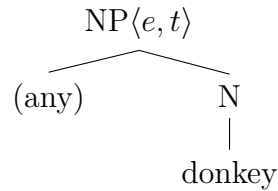
$$(196) \quad \llbracket \text{any donkey} \rrbracket = \lambda x. Dx$$

I propose that wide scope indefinites are DPs at LF; in contrast, narrow scope indefinites are NPs at LF. This proposal is motivated by a correlation between

possible interpretations in terms of scope and amount of structure across languages; in particular, bare nouns in some languages and contexts take narrow scope. The distinction is important in accounting for the different effects non-bare DPs vs. bare nouns on interpretation of donkey anaphora. A proposed syntactic representation is provided in example (197).

Here *any* is in parentheses to indicate that it is not projected like other determiners are; this is a theoretical option that would be important for maintaining a simplified syntax-semantics mapping with property denoting indefinites having less structure. This proposal is more easily motivated with bare nouns (bare nouns) than indefinites with *any*.

(197)



4.2.2 Derivation of Truth Conditions for Universal Reading and Existential Readings via Domain Narrowing

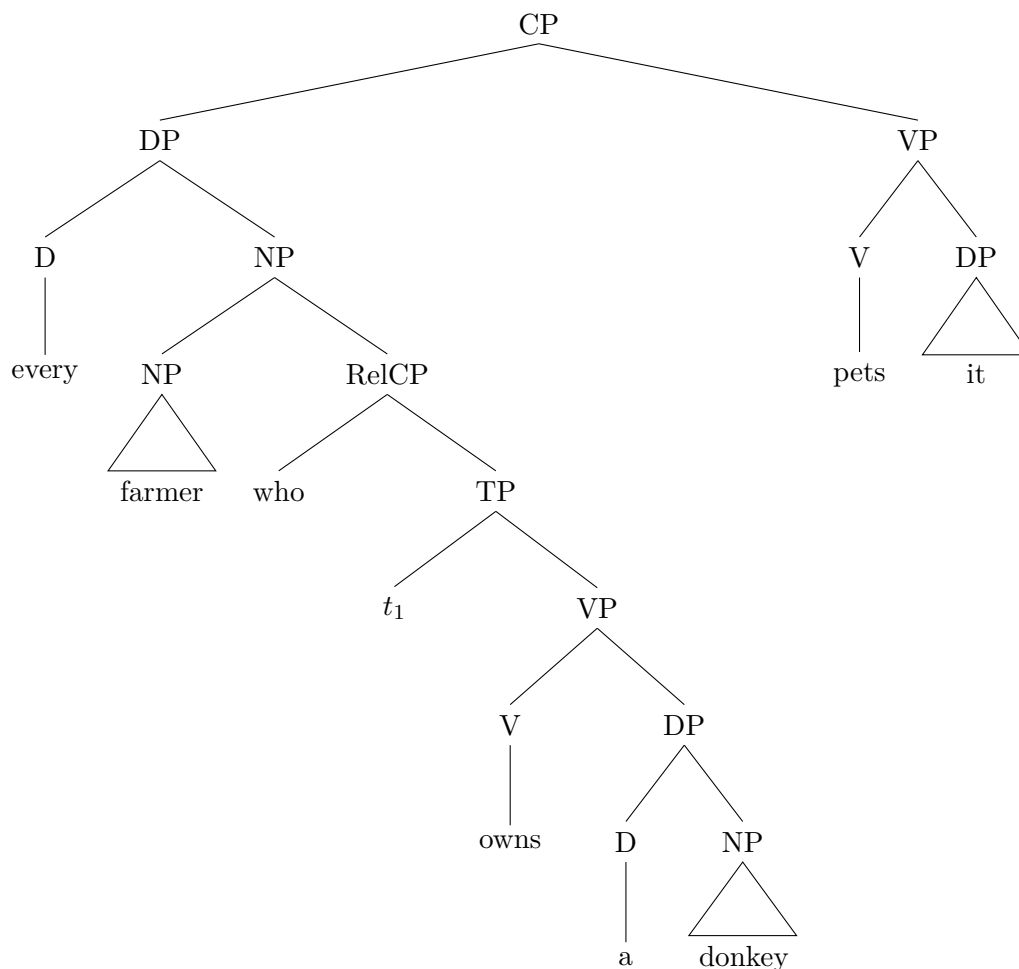
In the following section, I will show how donkey sentences with narrow scope indefinites can be analyzed using the semantic tool of Restrict from Chung & Ladusaw (2004) and an extension of previous accounts that make use of situational uniqueness in order to derive truth conditions from a common LF for existential readings via domain narrowing and a universal reading. These accounts include (Heim 1990) and (Elbourne 2001, 2005). A situation is a part of a possible world. It can contain a varying amount of information. A minimal situation is one that contains only as much information as is required for a certain purpose. For example, a minimal situation might contain only a farmer and donkey in the case of donkey anaphora. Situational uniqueness is employed in theories of anaphora resolution such as (Heim 1990), (Elbourne 2005) in order to

accommodate the uniqueness presuppositions of definite descriptions. Uniqueness is also employed in those works as a way of establishing an anaphoric relationship. In this work, I employ situation semantics for the same purpose; I follow Heim and Elbourne in treating pronouns as disguised definite descriptions. Note that with uniqueness-based resolution (as opposed to familiarity-based resolution), there is no necessary coreference between an antecedent expression and a definite/pronoun. This is because a phrase that denotes uniquely may take as an argument the descriptive content of its antecedent (property denotation) only, or the descriptive content may be inferred; the determiner/pronoun then picks out a novel individual. See ([Schwarz 2009](#)) on the distinction between unique and anaphoric definites. Thus, uniqueness-based resolution is appropriate for the interpretations of donkey anaphora examined here, namely a universal reading and a way of deriving existential readings via domain narrowing, as well as paycheck and bathroom anaphora.

Here I show the LFs that I posit for a way of deriving existential readings via domain narrowing and a universal reading and how these LFs are interpreted to arrive at truth conditions. A donkey sentence such as ([198](#)), for example, has an LF as shown in example ([199](#)).

(198) Every farmer who owns a donkey pets it.

(199)



Furthermore, the LF shown in example (199) contains additional information, as provided in examples (26) and (27) in (Elbourne 2001). This additional information includes situation variables that occur at particular positions. Using the rule provided in example (200), I will show how we can arrive at the desired truth conditions. Note that the rule introduces quantification over pairs of individuals and situations.

- (200) $\llbracket \llbracket \text{every}_{s_1} \alpha \rrbracket_{s_2} \beta \rrbracket^g = \text{True}$ iff, for every pair of an individual x and a minimal situation s_1 such that $x \in \llbracket \alpha \rrbracket^{gs_1 \setminus s_1}$, there is a situation s_2 such that $s_1 \leq s_2$ and $x \in \llbracket \beta \rrbracket^{gs_1 \setminus s_1, s_2 \setminus s_2}$ (= (Elbourne 2001), ex. (26))

Here, I will switch to a situation sensitive language. This implies that we should add a situation to denotations. I will employ a relatively standard rule for composition

based on Daniel Gallin’s two-sorted intensional language (Gallin 1975) adapted for use with situations. The rule is provided below in example (201). Using this rule, we can provide a derivation of truth conditions for a way of deriving existential readings via domain narrowing and a universal reading. The rule (201) states that the result of composing expressions that take situation variables as arguments is another expression that takes a situation variable as an argument (namely the same situation variable taken as an argument by individual expressions).

(201)

- $A = \langle s, \langle a, b \rangle \rangle. B = \langle s, a \rangle$
 $A(B) = \lambda s'. [A(s')](B(s'))$
- $A = \langle s, \langle a, b \rangle \rangle. B = a$
 $A(B) = \lambda s'. [A(s')](B)$

(202) $\llbracket \text{farmer} \rrbracket = \lambda s. \lambda z. z \text{ is a farmer in } s.$

(203) $\llbracket \text{own} \rrbracket = \lambda s. \lambda z. \lambda u. u \text{ owns } z \text{ in } s.$

(204) $\llbracket \text{pet} \rrbracket = \lambda s. \lambda z. \lambda u. u \text{ pets } z \text{ in } s.$

Restrict is a rule introduced by (Chung & Ladusaw 2004) in order to analyze incorporated indefinites. These indefinites include those that involve bare nouns. Restrict is a semantic compositional tool that operates by taking taking a two-place predicate and a one-place predicate and producing a two-place predicate (a relation) and one-place predicate that share an argument.¹

¹ Chung & Ladusaw (2004) introduce Restrict for incorporated objects in order to resolve a type mismatch. In particular, they treat incorporated objects as predicates. Two expressions that are both predicates cannot compose via function application; Chung and Ladusaw introduce Restrict as an alternative. Using Restrict to analyze donkey sentences is justified because Restrict has been used to analyze incorporated VP (e.g. ‘donkey-own’) meanings and because the meaning of a donkey sentence restrictor VP such as ‘owns a donkey’ (with a property denoting indefinite) is not substantially different in meaning from the meaning of an incorporated VP such as ‘donkey-own’. The purpose of using Restrict here is simply to capture the fact that with a narrow scope indefinite (which can be analyzed as denoting a predicate), using Restrict offers us one way of explaining why an indefinite-like paraphrase would tend to arise.

First, I will provide a non-situation sensitive version of Restrict. An application of Restrict as a rule is provided in example (205). This application of Restrict is based on the introduction of the rule by example in (Chung & Ladusaw 2004) (p.20, ex.(12)). The meaning of ‘own any donkey’ derived via Restrict is provided in example (206).

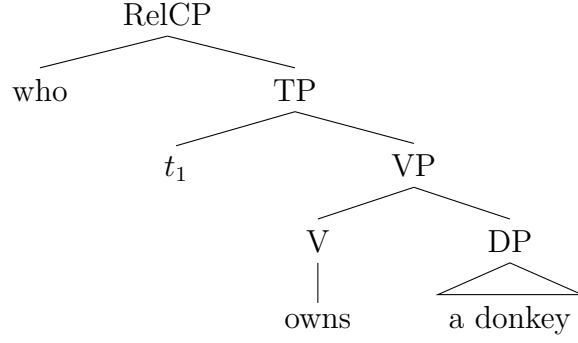
$$(205) \quad \text{Restrict}(\lambda x \lambda y \llbracket V \rrbracket(y, x), \lambda z \llbracket NP \rrbracket(z)) = \lambda x \lambda y \llbracket V \rrbracket(y, x) \wedge \llbracket NP \rrbracket(x)$$

$$(206) \quad \text{Restrict}(\lambda x \lambda y \llbracket \text{own} \rrbracket(y, x), \lambda z \llbracket \text{donkey} \rrbracket(z)) = \lambda x \lambda y \llbracket \text{own} \rrbracket(y, x) \wedge \llbracket \text{donkey} \rrbracket(x)$$

I propose that a way of deriving existential readings via domain narrowing as well as universal readings should be analyzed with the use of Restrict. Only property denoting indefinites can compose via Restrict to yield a denotation of a relation. Additionally, it will be important that we are able to derive a relation in order to explain similar effects of narrow scope indefinites and modified definites on the interpretation of donkey anaphora, as described in section (4.4). One such relation is shown in example (207). Here I use an indefinite with *any* in order to emphasize the fact that on the current account, it is property denoting indefinites that are more likely to give rise to modified definites. Denotations of modified definites are similar to the result of applying Restrict to an indefinite NP and a verb in that both have a relational denotation. An example of a modified definite is ‘the donkey that s/he owns’. VP-level existential closure is an operation provided by (Heim 1982) and adopted by subsequent authors, including (Chung & Ladusaw 2004), in their use of Restrict.

$$(207) \quad \llbracket \text{owns a donkey} \rrbracket = \lambda z. \lambda y. (Dy \wedge O(z, y))$$

$$(208)$$



(209)

- a. $\llbracket DP \rrbracket = \lambda x \in D_e. donkey(x)$
- b. $\llbracket V \rrbracket = \lambda y \in D_e. \lambda z \in D_e. z \text{ owns } y$
- c. $\llbracket VP \rrbracket = \lambda y \in D_e. \lambda z \in D_e. donkey(y) \wedge own(y)(z)$
- d. $\exists \llbracket VP \rrbracket = \lambda z \in D_e. \exists y [donkey(y) \wedge own(y)(z)]$

Here, we also need to provide a situation sensitive version of Restrict as shown in example (210) in order to complete the derivation, which utilizes situation semantics.

$$(210) \quad \llbracket VP \rrbracket = \text{Restrict}(\lambda s. \lambda x. \lambda y. \llbracket own \rrbracket(x)(y)(s), \lambda s. \lambda z. \llbracket donkey \rrbracket(z)(s)) \\ = \lambda s. \lambda x. \lambda y. \llbracket own \rrbracket(x)(y)(s) \wedge \llbracket donkey \rrbracket(x)(s)$$

$$(211) \quad \llbracket VP \rrbracket = \lambda s. \lambda x. \lambda y. own(x)(y)(s) \wedge donkey(x)(s)$$

$$(212) \quad \exists \llbracket VP \rrbracket = \lambda s. \lambda y. \exists x [own(x)(y)(s) \wedge donkey(x)(s)]$$

$$(213) \quad \llbracket IP \rrbracket = (\lambda s. \lambda y. \exists x [own(x)(y)(s) \wedge donkey(x)(s)])(g(3)) \quad (\text{via Function Application}) \\ = \lambda s. \exists x [own(x)(g(3))(s) \wedge donkey(x)(s)]$$

$$(214) \quad \llbracket Rel.CP \rrbracket^{g[3 \rightarrow y]} = \lambda s. \lambda y. \exists x [own(x)(y)(s) \wedge donkey(x)(s)] \quad (\text{via Predicate Abstraction})$$

$$(215) \quad \llbracket NP \rrbracket = \lambda s. \lambda y. \exists x [own(x)(y)(s) \wedge donkey(x)(s) \wedge farmer(y)(s)] \quad (\text{via Predicate Modification})$$

Note that the denotation of ‘every’ as provided in example (216) is close in form to the truth conditions that are provided in example (217). Here, I introduce

a situation sensitive version of the quantifier ‘every’ taken from [Elbourne \(2001\)](#) that quantifies over pairs of individual and situations.

$$(216) \quad \llbracket \text{every} \rrbracket = \lambda P. \lambda Q. \forall y, s' [P(y)(s') \rightarrow \exists s''. s' \leq s'' [Q(y)(s'')]]$$

(217) For every pair of an individual x and a minimal situation s_1 such that x is a man in s_1 and there is a y such that y is a donkey in s_1 and x owns y in s_1 , there is a situation s_2 such that $s_1 \leq s_2$ and x pets in s_2 the unique z such that z is donkey in s_1 (after [\(Elbourne 2001\)](#), ex. (28))

$$(218) \quad \llbracket \text{every NP} \rrbracket = \lambda Q. \forall y, s' [\exists x [\text{own}(x)(y)(s') \wedge \text{donkey}(x)(s') \wedge \text{farmer}(y)(s')] \rightarrow \exists s''. s' \leq s'' [Q(y)(s'')]] \text{ (via Function Application)}$$

Note that the denotation (219) contains a free variable for a situation (s') that is bound by a higher operator that corresponds to the embedding determiner such as ‘every’. This is important for making the truth conditions come out right; otherwise, the truth conditions would contain a situation s'' distinct from s' . Here I assume that a pronoun has internal structure as in the work of [\(Elbourne 2005\)](#); in particular, a pronoun is analyzed along the lines of a definite article. The pronoun is treated as a head D^0 that takes an NP as an argument; this NP is elided. For an example of this structure, see [\(255\)](#).

$$(219) \quad \llbracket \text{it} \rrbracket = \lambda P_{\langle s, et \rangle}. \iota u [\lambda s. \lambda x. P(s)(x)(s')(u)] \text{ (Strawsonian, situation sensitive version)}$$

Following [Elbourne](#), a pronoun is treated here along the lines of a definite determiner that encodes uniqueness and that can take an NP as an argument; I assume that it is possible for just an NP to be recovered in an ellipsis-based account of pronouns, e.g., in example [\(220\)](#). However, I also leave open the possibility that a larger constituent can be recovered.

$$(220) \quad \llbracket \text{it donkey} \rrbracket = \iota u. [\text{donkey}(s')(u)] \text{ (via Function Application)}$$

$$(221) \quad \llbracket \text{pet} \rrbracket = \lambda s. \lambda x. \lambda y. \text{pet}(s)(x)(y)$$

$$(222) \quad \llbracket \beta \rrbracket = \llbracket VP_{NS} \rrbracket = \lambda s. \lambda y \text{ pet}(\iota z[\text{donkey}(z)(s')])(y)(s)$$

Note that in the following step, a second situation s'' that contains material copied from the restrictor situation s' is existentially quantified. This step corresponds to the copying of a relation derived via Restrict and subsequent existential closure of that relation. We can see that the end result of the derivation (223) follows the rule (200) and meets the description of truth conditions provided in example (217).

$$(223) \quad \llbracket \text{every } NP \text{ } VP \rrbracket = \llbracket \text{every } NP \rrbracket(\llbracket VP \rrbracket) \\ = \forall y, s' [\exists x [\text{own}(x)(y)(s') \wedge \text{donkey}(x)(s') \wedge \text{farmer}(y)(s')] \rightarrow \exists s''. s' \leq s'' [y \text{ pets} \\ \text{in } s'' \iota z[\text{donkey}(z) \text{ in } s']]] \text{ (via Function Application)}$$

The representation of truth conditions provided in example (223) is typically interpreted as implying a universal reading; however, this representation leaves open the possibility that the reading is existential; that is, the representation is technically underspecified as either existential or universal. It is technically underspecified because it is possible to exclude situations from the domain of consideration. That is, for example, for every farmer, not all situations are considered.

In the next section, I will show how this is possible. Either the existential or universal reading for this representation can be derived using the tool of domain narrowing from (Krifka 1996).

4.2.3 Domain Narrowing from (Krifka 1996)

Domain narrowing is necessary in order to provide a way of generating the existential quantificational force that is present with donkey sentences that are interpreted with a way of deriving existential readings via domain narrowing. The use of Restrict on its own does not provide a source of quantificational force.

Below, I illustrate how an account employing domain narrowing could work using a given model. As for a way of deriving existential readings via domain narrowing (which may be paraphrased by ‘every farmer who owns a donkey pets a donkey that s/he owns’), we narrow the domain of quantification such that we only consider a single

situation in which the nuclear scope predicate holds of an individual with certain properties, e.g., one in which there is owning of a donkey. We exclude the other situations from the domain. On the other hand, as for a universal reading (which may be paraphrased by ‘every farmer who owns a donkey pets every donkey that s/he owns’), we employ a non-narrowed or widened domain, and we consider as many situations as there are in which a certain property holds of an individual denoted by an embedding DP, for example, owning of a donkey by a farmer. For example, let us consider a model in which farmer A owns donkey 1 in situation s1, donkey 2 in s2, and donkey 3 in s3, farmer B owns donkeys 4 in s4 and 5 in s5, and farmer C owns donkeys 6 through 10 in s6 through s10. This model is illustrated in Table (4.1). In this case, for an existential reading, we would consider only situations 1, 4, and 6 (one per farmer) and exclude the rest (2, 3, 5, 7-10). For a universal reading, on the other hand, we would consider all 10 situations.²

² (Geurts 2002) uses domain narrowing to explain why existential readings arise with upward-entailing farmer determiners.

Table 4.1: A Model for Different Readings of Donkey Anaphora

		Farmer-Donkey-Situation Triples in Model	
Farmer	Donkey	Universal	Existential
a	1	<a,1,s1>	<a,1,s1>
a	2	<a,2,s2>	
a	3	<a,3,s3>	
b	4	<b,4,s4>	<b,4,s4>
b	5	<b,5,s5>	
c	6	<c,6,s6>	<c,6,s6>
c	7	<c,7,s7>	
c	8	<c,8,s8>	
c	9	<c,9,s9>	
c	10	<c,10,s10>	

One aim of the current account is to adapt and improve upon previous accounts, such as (Heim 1990), (Elbourne 2001), and (Elbourne 2005), by providing a source of existential readings in the form of domain narrowing. Because existential via domain narrowing and universal interpretations pattern together in terms of the forms of indefinite and pronoun that are preferred with each (and pattern differently from an existential via choice functions interpretation), as suggested by data shown in section (5.5.1), I propose that these interpretations share a single LF. However, the two interpretations are truth conditionally distinct. If truth conditions are read off of LFs, then it should not be possible for two distinct interpretations to correspond to the same LF. In order to resolve this apparent conflict, I propose that the mechanism of domain narrowing applies after a level or stage at which LFs are interpreted (i.e. a level at which the syntax-semantics mapping is relevant). This implies that domain narrowing is a purely semantic mechanism. That is, the input to this level is LF, and

the output from this level is truth conditions.

Here domain narrowing is shown to operate on the domain of quantifiers in donkey sentences such as ‘every’. The domains of quantifiers are narrowed such that only a subset of situations are considered. In the implementation of domain narrowing pursued here, one is able to exclude not farmers but only donkeys from the domain under consideration. For additional details of how domain narrowing works, see (Krifka 1996) and subsequent works. A crucial point for making the current account work is that we can state that there is an asymmetry between subjects on the one hand and situations and objects on the other in donkey sentences. In particular, what the subject denotes (e.g., farmers) cannot be restricted (excluded from the domain under consideration), while situations, and what the object denotes (e.g., donkeys) in those situations, can be. We may consider only relevant situations (one in which a farmer owns a single donkey) and exclude others from the domain.³

To give a summary of what has been accomplished so far in the chapter, narrow scope indefinites were introduced. We saw how it is possible to employ the denotations of such indefinites in order to arrive at truth conditions of the universal reading of donkey anaphora as well as an existential reading derived via domain narrowing from (Krifka 1996). Universal and existential readings via domain narrowing involved pronouns with uniqueness-based semantics that may be handled using the systems of (Heim 1990) and (Elbourne 2005). These pronouns are more aligned with narrow scope indefinites, which can be composed to yield relations via Restrict from (Chung & Ladusaw 2004), which in turn give rise to pronouns with modified definite denotations. In the remainder of the chapter, we will see how existential readings may be derived using a different semantic tool, namely the tool of coindexed choice functions.

4.2.4 Wide Scope Indefinites

In this section, I introduce a subset of indefinites that are empirically more aligned with existential readings of donkey anaphora. A subset of indefinite expressions

³ Note that it is by stipulation that domain narrowing treats farmers and donkeys differently.

can take scope outside the minimal clause that contains them (Dobrovie-Sorin & Beyssade 2012) (p.27), as noted by many authors including Fodor & Sag (1982), Reinhart (1997), Kratzer (1998), and Ruys (2006).⁴ Often, “unmarked” indefinites, which are glossed with the article ‘a’ (sometimes homophonous with ‘one’) display such characteristics. In English, indefinites with the determiners *a* and *some* also display such characteristics. Such indefinites can take wider scope than clause level; their scope options are variable, ranging from narrowest to widest.⁵ For example, the scope options for example (224) include those listed in (225) but not those listed in example (226). ‘every’ cannot take scope over 2, while ‘a’ can take scope anywhere.⁶

(224) Two professors knew whether every student had read an eighteenth century writer. (after (Dobrovie-Sorin & Beyssade 2012), ex.(52), p.27).

(225) $a > 2 > \text{every}, 2 > a > \text{every}, 2 > \text{every} > a$

(226) $a > \text{every} > 2, \text{every} > a > 2, \text{every} > 2 > a$

There are a wide variety of different approaches to indefinites’ exceptional quantificational scope (i.e. scope wider than the clause) and binding scope (licensing discourse anaphora). Several authors have analyzed indefinites that display the ability to take wide scope with the use of choice functions. For a review, see (von Heusinger 2011) (p. 1038). A choice function is a function from a set of individuals to an individual; it selects one member from a set. The following definition of a choice function is taken from (Reinhart 1997): “A function f is a choice function ($CH(f)$) if it applies to any non-empty set and yields a member of that set.” (p.372). (Its domain is a set of sets of entities, while its range is a set of entities. (L. Champollion, p.c.)). I treat those indefinites that can take exceptional scope as denoting individuals and analyze them with the use of choice functions. On the other hand, I treat those

⁴ In this work I do not consider kind readings of expressions that are otherwise indefinite. For how to treat these readings, see, e.g., (Chierchia 1998) and subsequent work.

⁵ I do not consider indefinites that must take wide scope here.

⁶ There are a wide variety of different approaches to indefinites’ exceptional scope.

indefinites that take narrow scope and that do not license discourse anaphora as denoting properties and without choice functions. Note that “individual denoting” and “choice functional” are theoretical labels for expressions due to certain empirical behaviors such as scope-taking ability, licensing of discourse anaphora, and specificity.

One prominent approach to the wide scope of indefinites, (Kratzer 1998), utilizes choice functions that are not existentially closed but rather contextually determined and pragmatically recoverable. (Kratzer 1998) is one among several choice functional approaches that can handle what has been referred to as “apparent” intermediate scope as opposed to genuine intermediate scope (von Heusinger 2011). Another such approach is Matthewson (2008). Unlike Kratzer (1998), Matthewson (2008) proposes that choice functions are existentially closed at the highest level. This feature is unlike Kratzer’s approach. Matthewson’s approach is like Kratzer’s, however, in that intermediate scope that is apparent rather than genuine (which we might argue occurs in donkey sentences) is achieved by a choice function that does not take true intermediate scope but rather is either scopeless or takes highest scope. While there is not yet a consensus in the literature that there is a clear empirical advantage between Kratzer’s and Matthewson’s approaches, Matthewson’s approach will be adopted here. Furthermore, in the current account, the choice function occurs twice, once at the site of the indefinite and once at the site of the pronoun; it is pragmatically recovered at the site of the pronoun. This feature is inspired by the free variable choice function approach of (Kratzer 1998).

One potential advantage that Matthewson (2008)’s approach has over Kratzer (1998)’s is that in Matthewson’s framework it is easier to capture the insight of the novelty condition introduced in (Heim 1982) stating that indefinites and definites are similar but that when two instances of an NP/DP are introduced in a discourse context, the first is treated as novel and the second as familiar. As in Heim’s approach, an existential quantifier occurs in Matthewson’s. An existential quantifier serves to indicate that a novel discourse referent has been introduced; the first instance of an NP/DP within its scope is treated as novel and the second instance as familiar. Without an existential quantifier, as in Kratzer’s approach, an unbound free variable (even the

first that occurs in a certain context) is more likely to be treated as familiar, and we assume that its value can be assigned based on the discourse context. The same principle applies to two instances of a choice function; as in Heim’s approach, in the current account, the two have similar semantics.

An ambiguity based approach to indefinites between referential and quantificational readings as in (Fodor & Sag 1982) became untenable due to the challenge of intermediate scope readings pointed out by (Abusch 1993–1994). However, an ambiguity-based approach becomes tenable again if we assume that choice functions along with Skolemization be used to derive intermediate scope as well as other scope possibilities. Kratzer (1998) proposes that the determiner *some* in English is choice functional, while *a* is ambiguous between quantificational and choice functional readings. I adopt an ambiguity-based approach based on Kratzer’s approach here.

The Skolemized choice function approach is an amendment to the plain choice function approach that was introduced due to certain inadequacies with the plain choice function approach (von Heusinger 2011). Skolemization is an operation that adds an argument to a choice function; this allows the function to pick out different individuals that vary with the additional argument. For example, a reading of sentence (227) in which girls co-vary with boys can be represented as in (228) with a Skolemized choice function; the representation in (229) without Skolemization does not allow this co-variation; that is, it means that every boy kissed the same girl.⁷

(227) Every boy kissed a girl.

(228) $\forall xB(x)[K(x, f(G)(x))]$

(229) $\forall xB(x)[K(x, f(G))]$

In Kratzer’s view, choice functional indefinites introduce free variables (they are not existentially closed), and they are pragmatically recoverable. Kratzer (1998)’s

⁷ A division of indefinites between quantificational and choice functional readings is also proposed in (Reinhart 1997). Two other prominent approaches are CFs that are existentially closed at different positions, e.g., scope sites (Winter 1997) and CFs that are existentially closed at the discourse level (Matthewson 2008).

approach is a non-movement approach (i.e. one in which indefinites remain in situ). Furthermore, in (Kratzer 1998), indefinites are ambiguous between quantificational and choice functional readings; Kratzer (1998) contends that quantificational indefinites act like quantifiers, displaying roughly clause-bounded scope and pseudoscope (i.e. what appears to be scope at a certain position but which is not in fact scope at that position); on the other hand, choice functional indefinites often display pseudoscope rather than true scope, and this scope is not clause-bounded. A non-Skolemized CF is of type $\langle et, e \rangle$, while a Skolemized CF is of type $\langle et, ee \rangle$. Note that in Kratzer’s approach, choice functional indefinites are of type e (individual denoting); this captures the insight of Fodor & Sag (1982) that wide scope indefinites are in some sense referential.

The exceptional wide scope of indefinites typically is not discussed in the context of donkey anaphora because an interpretation of a donkey sentence with an indefinite taking widest scope is not one that we are usually concerned with in the context of donkey anaphora. An example whose most natural interpretation is with widest scope of an indefinite is provided in (230).

(230) Every farmer who saw some donkey admired it, namely Joe’s donkey.

A challenge taken up here is to explain how the wide scope potential of indefinites would be associated with an existential reading of donkey anaphora. We should note that there is no reason not to use choice functions to analyze donkey anaphora. Importantly, choice functions may be used to model not only widest scope but also other scope possibilities. One main point for the current approach is that choice functions are needed independently of problems related to donkey anaphora, but we may utilize choice functions productively to analyze donkey anaphora. When we do use choice functions in the context of donkey anaphora, an existential reading is produced. Thus, choice functions can help to explain why the wide scope potential of indefinites would be associated with an existential reading of donkey anaphora.

A key insight for the current approach is that the semantics of a choice function used to analyze an indefinite is not unsuited for use with a pronoun (in anaphora

resolution). The notions of coindexation and coreference have usually been applied to individuals. I propose a novel analysis in which choice functions are coindexed, and this is what guarantees coreference between the individuals introduced by an antecedent (indefinite) and those picked out by a definite or pronoun.

Here I employ a device of coindexing choice functions by stipulation. Nothing guarantees that two choice functions are coindexed; however, placing the same index on two choice functions, we assume that they are. On the current account, they must be, or we would not have any guarantee of the same donkey being picked out by antecedent and definite/pronoun. Coindexing choice functions is inspired by but distinct from a proposal provided by (Heim 1982) that indefinites and definites have identical semantic content; the proposal in this work also draws on Heim's proposal that indefinites and definites are treated as free variables; however, they have different felicity conditions. In particular, indefinites must be novel, while definites must be familiar; a definite occurs in the case of a familiar free variable. Note however that (Heim 1982) is a dynamic framework, while the current work is not. The semantics of choice functions is neither uniqueness-based nor referential; therefore, it provides another means of reference resolution that can explain how a way of deriving existential readings via choice functions or reference resolution in discourse anaphora is achieved.

It is an advantage of a pragmatically recoverable choice functional approach that the indefinite can be interpreted in two different positions: once in situ and once again at the anaphora site. I propose that with wide scope indefinites, an antecedent denoting individual(s) is recovered via a choice function coindexed with a choice function for an indefinite antecedent such that what the two choice functions denote are coreferential.

Thus, the same individual(s) that are introduced by an indefinite antecedent are also picked out by a pronoun upon anaphora resolution. Such recovery occurs with existential readings derived of donkey anaphora via choice functions as well as discourse anaphora. However, with discourse anaphora, existential closure with widest scope is not necessary. Thus, for example, a sentence such as (231) with a CF indefinite *some donkey* tends to be interpreted similarly to the paraphrase provided in (232).

This paraphrase with a demonstrative phrase is intended to capture the fact that an existential reading is possible. In Elbourne’s account, only a universal reading is generated; however, an existential reading can be generated if we extend Elbourne’s account to include domain narrowing.

(231) Every farmer who owns some donkey pets it.

(232) Every farmer who owns a donkey pets that one (and possibly others).

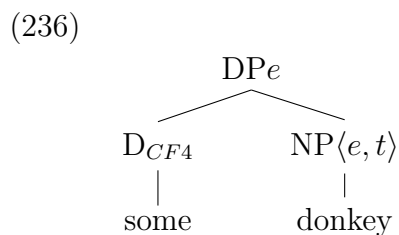
The denotation of a CF indefinite that I propose is a CF that has taken a property as an argument. The denotation proposed for a non-Skolemized choice functional indefinite article is provided in (233). A denotation for a Skolemized choice function is provided in example (234).

(233) $\llbracket \text{some} \rrbracket = \lambda P. CF_4(\lambda x.P(x))$

(234) $\llbracket \text{some} \rrbracket = \lambda P.\lambda y. CF_5(\lambda x.P(x))(y)$

The denotation of CF indefinite is provided in example (235). The structure non-Skolemized indefinite CF DPs I propose is provided in example (236). In example (235), the variable y corresponds to the index on another expression such as an embedding DP in a donkey sentence with which the indefinite co-varies.

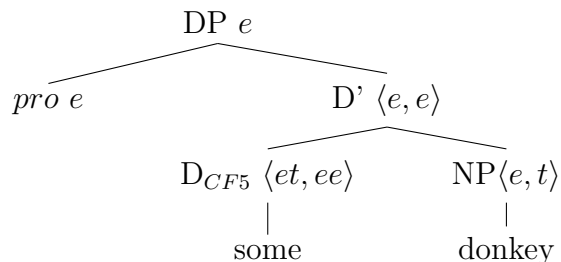
(235) $\llbracket \text{some donkey} \rrbracket = CF_4(\lambda x.Dx)$ (for a non-Skolemized choice function)
 or $\lambda y.CF_5(\lambda x.Dx)(y)$ (for a Skolemized choice function) where y is a variable corresponding to some higher operator, e.g., a subject quantifier in a donkey sentence



The structure of Skolemized CF indefinite DPs I propose is provided in example (237). Thus, I propose that in contrast to narrow scope indefinites, which are NPs,

wide scope indefinites are DPs or have additional structure, and they are of type e because a determiner acts as a function of type $\langle et, e \rangle$. Here situations are left out for representational clarity.⁸

(237)



Following (Kratzer 1998), I assume that “unmarked” indefinites in the sense of (Farkas 2006) are ambiguous between choice functional and non-choice functional denotations, which I treat as individuals and properties respectively. The denotation of an indefinite headed by the determiner a may be provided as shown in example (238). Note that non-Skolemized choice functions are appropriate for discourse anaphora, while Skolemized ones are appropriate for donkey anaphora.

(238) $\llbracket \text{a donkey} \rrbracket = \lambda x.Dx$ or $CF_1(\lambda x.Dx)$ (for a non-Skolemized choice function) or $CF_1(\lambda x.Dx)(y)$ (for a Skolemized choice function) or $\lambda x.Dx$ (for a property denotation).

4.2.5 Derivation of Truth Conditions for Existential Readings via Choice Functions

In this section, I turn to the question of how the truth conditions for an existential interpretation of donkey anaphora may be derived with the use of choice functions. I propose that when a choice function is repeated from an antecedent in the

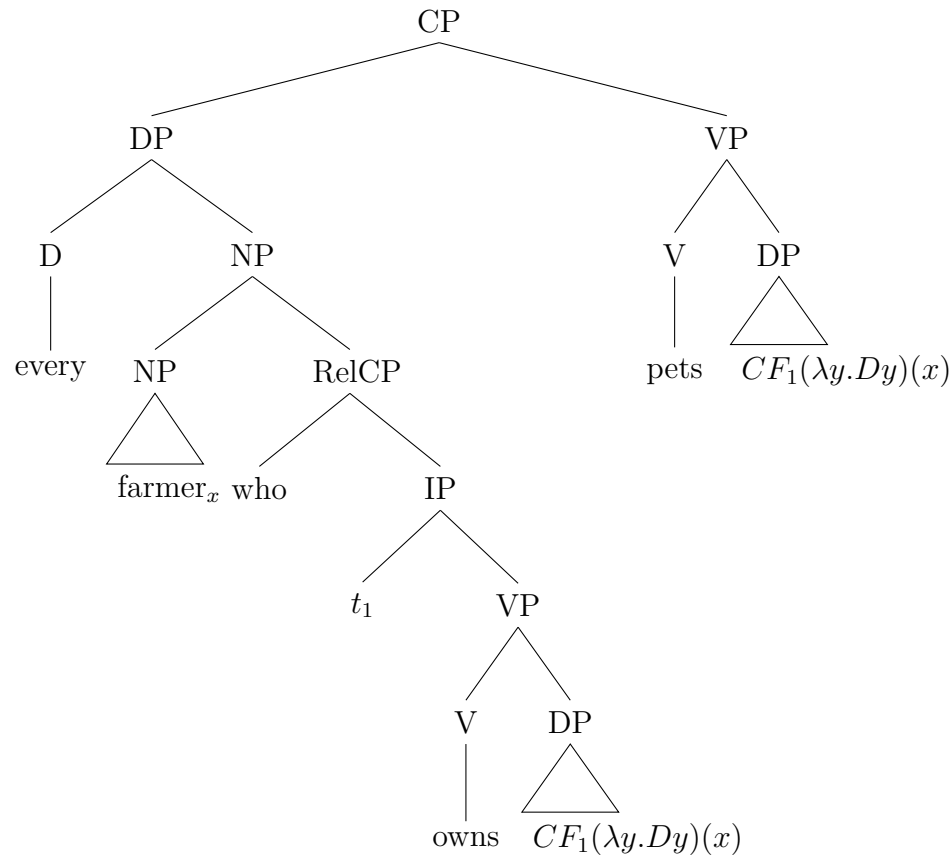
⁸ Note that in a dynamic binding-like framework, one could propose a binding relationship between the two instances of a choice function. However, dynamic binding is not adopted here because of problems associated with it. Some of these problems are covered in (Heim 1990). A repeated choice function is a semantic tool that allows us to avoid the use of dynamic binding. A repeated choice function account is naturally extended from donkey anaphora to discourse anaphora.

form of a pronoun, as in the case of deriving existential readings via choice functions, exactly the same material is recovered at the anaphora site as was introduced by an antecedent. This mechanism produces an existential reading rather than a universal reading of donkey anaphora because the repetition of a choice function guarantees that only those individuals picked out by an antecedent (and no others) are also picked out by a pronoun.

Truth conditions for a derivation of existential readings via choice functions of sentence (239) with a corresponding syntactic representation (240) are provided in example (241).⁹

(239) Every farmer who owns a donkey pets it.

(240)



(241) $\exists CF_1 \forall x [(Fx \wedge O(x, CF_1(\lambda y.Dy)(x))) \rightarrow P(x, CF_1(\lambda y.Dy)(x))]$

⁹ Note that in the trees provided here, the projection of IP/TP is omitted.

Using the LF provided in the previous section in example (240), we can derive the truth conditions that exemplify a way of deriving existential readings via choice functions as follows. In this example, u will be used to represent the variable of a Skolemized choice function that is bound by the operator ‘every’.¹⁰

(242) Every farmer who owns some donkey pets it.

(243) $\llbracket \text{owns some donkey} \rrbracket = (\lambda x. \lambda y. y \text{ owns } x)(CF_1(\lambda z. Dz))(u)$
(via Function Application)

(244) $\llbracket \text{who } t_1 \text{ owns some donkey} \rrbracket = \lambda x. x \text{ owns some donkey} = \lambda x. x \text{ owns } CF_1(\lambda y. Dy)(u)$
(via Predicate Abstraction)

(245) $\llbracket \text{farmer who owns some donkey} \rrbracket$
 $= \lambda x. x \text{ is a farmer and owns } CF_1(\lambda y. Dy)(u)$ (via Predicate Modification)

(246) $\llbracket \text{every farmer who owns some donkey} \rrbracket$
 $= \llbracket \text{every} \rrbracket(\llbracket \text{farmer who owns some donkey} \rrbracket)$
(via Function Application)
 $= (\lambda P. \lambda Q. \forall u [Pu \rightarrow Qu])(\lambda x. x \text{ is a farmer and owns } CF_1(\lambda y. Dy)(u))$
 $= \lambda Q. \forall u [u \text{ is a farmer and owns } CF_1(\lambda y. Dy)(u) \rightarrow Qu]$

Here I leave open the possibility that, following (Elbourne 2005), pronouns may be treated along the lines of a definite determiner. This determiner may encode a choice function and may take an NP as an argument; I assume that it is possible for just an NP to be recovered in an ellipsis-based account of pronouns, e.g., in example (247).

(247) $\llbracket \text{pets it} \rrbracket = \llbracket \text{pets} \rrbracket(\llbracket \text{it} \rrbracket)$
 $= (\lambda x. \lambda y. y \text{ pets } x)(CF_1(\lambda z. Dz))(u) = \lambda y. y \text{ pets } CF_1(\lambda z. Dz)(u)$

¹⁰ Note that there are different options for how we might represent the syntax-semantics mapping of a pronoun that involves a choice function. Two different options are provided in examples (273) and (274) below.

(via Function Application)

(248) \llbracket every farmer who owns some donkey pets it \rrbracket

= \llbracket every farmer who owns some donkey \rrbracket (\llbracket pets it \rrbracket)

(via Function Application)

= $(\lambda Q.\forall u[(Fu \wedge O(u, CF_1(\lambda y.Dy)(u)) \rightarrow Qu])(\lambda a.P(a, CF_1(\lambda z.Dz)(u)))$

= $\forall u[(Fu \wedge O(u, CF_1(\lambda y.Dy)(u)) \rightarrow P(u, CF_1(\lambda z.Dz)(u))]$

(249) $\forall u[(Fu \wedge O(u, CF_1(\lambda y.Dy)(u)) \rightarrow P(u, CF_1(\lambda z.Dz)(u))]$

At this step of the derivation we add existential closure into the derivation; the indefinite acts as an existential quantifier that takes widest scope as in (Matthewson 2008), in particular, a choice function that maps individuals to donkeys that they own. It is important that we let the CF's argument only contain donkeys owned by the individual in question.

(250) $\exists CF_1 \forall u[(Fu \wedge O(u, CF_1(\lambda y.Dy)(u)) \rightarrow P(u, CF_1(\lambda z.Dz)(u))]$

Here we have an existential reading because exactly the same material is repeated at the anaphora site as was introduced by the pronoun. Note that a universal reading is not produced because the choice function is a free variable; the intention of this representation is that the universal quantifier doesn't bind the choice function as a variable.

With a derivation of an existential reading via choice functions, we obtain exactly the same truth conditions using a repeated choice function as we do using domain narrowing. The point of using different derivations is to model the alignment of the reading via domain narrowing with narrow scope indefinites and the reading via choice functions with wide scope indefinites, as described in section (5.5.1).¹¹ A model

¹¹ Another theoretical option pointed out by L. Champollion, p.c., would be to just use choice functions for both ways of deriving an existential reading, and disallow Skolemization in the case of narrow scope indefinites. This would be preferable in some ways to a mixture of a situation and choice function based framework.

that exemplifies the existential reading is provided in Table (4.2). This table partially reproduces the Table (4.1) provided above.

We can see that an existential reading can be obtained using a Skolemized choice function and that we obtain the same result as with the use of domain narrowing as described in section (4.2.2). The output of the choice function is the number individuals from a set (in this example, donkeys) that are both owned and petted by each individual (in this example, farmers). For a choice function CF_5 , for example, we might have the following pairs of inputs and outputs in accordance with the model provided in Table (4.2):

$$CF_5(\text{donkey})(a) = 1, CF_5(\text{donkey})(b) = 4, CF_5(\text{donkey})(c) = 6.$$

Table 4.2: A Model for the Existential Reading of Donkey Anaphora

		Farmer-Donkey Pairs in Model
Farmer	Donkey	Existential
a	1	<a,1>
a	2	
a	3	
b	4	<b,4>
b	5	
c	6	<c,6>
c	7	
c	8	
c	9	
c	10	

L. Champollion, p.c., points out that with the truth conditions provided above, an issue one might raise is that there is no guarantee that CF1 will map any given

individual to a donkey he/she owns, and so if we pick a CF that doesn't do so then the antecedent will be vacuously true.

Note, however, that the problem we are running into here is not necessarily specific to donkey anaphora. It is also not a problem that is specific to the approach being advocated for here. The problem of vacuous truth is rather a problem that occurs with wide scope indefinites that contain a conditional or a universal quantifier in their scope. An example sentence that displays this problem is seen in example (251). A translation into first-order logic is provided in (252). This sentence is true merely by virtue of the existence of a student who does not cheat (if $C(x) = 0$).

(251) There is some student such that if he cheats on the exam, I will be fired.

(252) $\exists x[S(x) \wedge [C(x) \rightarrow F(\text{me})]]$

Another example is provided in (253). A translation into first-order logic is provided in (254). This sentence becomes true when there is a student who is admired by no one (if $A(x)(y) = 0$).

(253) There is some student such that everyone who adores him praises him.

(254) $\exists x[S(x) \wedge \forall y[A(x)(y) \rightarrow P(x)(y)]]$

Thus an account that utilizes choice functions to model wide scope indefinites runs into the same problem. We can avoid this problem by utilizing a choice function that is existentially quantified and takes scope outside the restrictor and specifying that this choice function maps individuals to donkeys that they own.

4.2.6 A Morphological Form Problem for CF Indefinites vs. CF Definites and Pronouns

A question raised by the use of choice functions for both indefinites and pronouns is why there are differences in morphological form between indefinite and definite or pronoun CFs. Part of an answer is to appeal to (Heim 1982)'s novelty condition. A speaker keeps track of discourse referents introduced into the discourse context (or

corresponding items stored in working memory). A speaker will use a morphologically definite form for a CF (in order that a hearer will recognize intended familiarity) only if there is a discourse referent in the context (or if a search in memory returns an item). In this case, there is no novelty in the sense of (Heim 1982)). If a CF merely chooses an individual (without resolving reference), and this may have a side effect of making an individual salient, then an indefinite form is chosen; on the other hand, if a CF (definite or pronoun) resolves reference, then a definite form is chosen.

I propose that morphological form of a choice function reflects the status of the index of a choice function. The first occurrence of an index is mapped to an antecedent expression (e.g. an indefinite), while the second occurrence is mapped to an anaphoric definite or pronoun. Indices are thus “distinguished” in terms of the number of times they have occurred in a given discourse context (making them novel or familiar indices in the sense of Heim (1982)). (We might represent this, e.g., with an index on an index that counts its occurrences, e.g., 1_1 vs. 1_2). I assume such indices as a primitive that relates to keeping track of discourse referents in memory, as described above. Another potential partial answer to the morphological form problem is that CF determiners differ in form due to (in)definiteness, that is, what they accomplish: CF indefinite determiners do not resolve reference. On the other hand, CF definite determiners resolve reference.

4.2.7 Interim Summary

In the previous section, the following objectives were accomplished. First, we provided background on indefinites and pronouns that allowed us to provide derivations of truth conditions for donkey sentences. These included narrow scope indefinites being treated as properties and wide scope indefinites being treated with the use of choice functions. Distinct derivations of truth conditions for one way of deriving an existential reading (using choice functions for both indefinites and definites). Additionally, another way of deriving an existential reading and a universal reading using domain narrowing were provided. To my knowledge, this is the first work to successfully employ Restrict

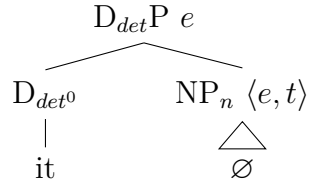
from (Chung & Ladusaw 2004) in the analysis of donkey anaphora for a principled reason, namely, to explain why narrow scope indefinites and modified definites such as ‘the donkey that s/he owns’ have a similar effect on interpretation.

One main advantage of a choice functional approach to anaphora is that we can employ only a single semantic device for both an antecedent or definite/pronoun that may have different realizations. With a choice function, we have at least two options for how an NP/DP surfaces. First, we may have an NP/DP elided and have only a determiner for a novel choice function remain. In this case we have an indefinite determiner such as *a* or *some*. Second, we may have an NP/DP elided and have only a determiner for a familiar choice function; in this case we obtain a definite determiner or pronoun. As discussed in section (5.1), an advantage of a CF approach is that with the use of a CF, we don't need to specify in a formal way how coreference is established between the individuals that an antecedent and pronoun pick out. What is coindexed is functions rather than individuals per se. In the following section, implications of the above discussion for the syntax-semantics mapping of indefinites and pronouns will be discussed.

4.3 Implications: Syntax-Semantics Mapping for Indefinites and Pronouns

In the following sections, I will discuss some implications of this work for the syntax-semantics mapping of indefinites and pronouns. First, it is necessary to review some background on definites and pronouns. Below, I provide syntactic representations and semantics (denotations) of the two main sorts of pronouns that will be the focus of this work. In the following, we will see how these sorts of pronouns are aligned with different interpretations of donkey anaphora. First, we have uniqueness-based pronouns as shown below. These sorts of pronouns are aligned with narrow scope indefinites and with universal readings of donkey anaphora.

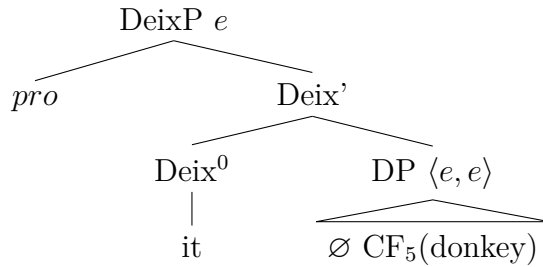
(255)



(256) $\llbracket it \rrbracket = \lambda P_{\langle s, et \rangle}. \iota u [P(s')(u)]$

Second, we have familiarity-based pronouns as shown below. These sorts of pronouns are aligned with wide scope indefinites and with existential readings of donkey anaphora. Background on these two sorts of pronouns is provided in the sections below. Here *pro* is included in the tree in (257) following (Patel-Grosz & Grosz 2017).

(257)



(258) $\llbracket it_D \rrbracket = \lambda P. \lambda y. CF_5(\lambda x. P(x))(y)$

4.3.1 Background on Definites and Pronouns

In the following sections, I will introduce semantic distinctions among definites and pronouns. These distinctions will be used to explain the analyses presented above. In particular, they help to explain similar effects of narrow scope indefinites and unique definites on donkey anaphora interpretation as well as similar effects of wide scope indefinites and familiarity-based definites on donkey anaphora interpretation. As shown by the results of experiments in Chapter (2) and cross-linguistic surveys in Chapter (3), narrow scope indefinites and pronouns are more aligned with uniqueness-based semantics tend to give rise to universal readings, while wide scope indefinites and pronouns are more aligned with familiarity based semantics tend to give rise to existential readings. These similar effects will be discussed further in the context of a

syntax-semantics mapping for indefinites and pronouns. In particular, we can explain why certain indefinites and pronouns would tend to give rise to similar interpretations of donkey anaphora by stating that certain indefinite syntax and semantics give rise to certain definite/pronoun syntax and semantics. Competing theories of definiteness are introduced in section (4.3.1.1), and the distinction between unique and familiar definites is introduced in section (4.3.1.2). These distinctions are relevant for the distinction between weak and strong pronouns introduced in section (4.3.1.3).

4.3.1.1 Competing Theories of Definiteness

In order to help describe the motivation for making a distinction between different forms of pronoun with different sorts of definite semantics, we need to describe competing theories of definiteness. There are a number of competing theories of definiteness that originate from analyses of definite descriptions (full definite DPs). These theories are introduced here to illustrate the origin of some competing theories of donkey anaphora. First, there are uniqueness-based theories, originating from [Russell \(1905\)](#)'s seminal work, in which definite DPs refer based on unique possession of a property. Second, there are familiarity-based theories such as ([Heim 1982](#)), in which definite DPs refer to something that has been made familiar or salient via introduction into a discourse context. Third, there are mixed approaches including both uniqueness and familiarity such as ([Roberts 2003](#)). These competing theories of definiteness were extended from full definite DPs to pronouns in subsequent literature such as ([Patel-Grosz & Grosz 2017](#)).

4.3.1.2 Unique and Familiar Definites

The distinction between unique and familiar definiteness as described in the previous section is grammaticalized in some languages. For example, in German, there are unique and familiar full definites, observable with contractions of the definite article, as described in ([Schwarz 2009](#)). The environments in which the two may be used overlap only partially. In German, only unique definites have “immediate situation” uses (as

defined by (Schwarz 2009)) (where we can infer that there is something that possesses a property uniquely in the immediate context) (e.g., (259)), while only familiar ones have anaphoric uses (where they must be coreferential with some previously introduced discourse referent) (e.g., (260)).

(259) Das Buch, das du suchst, steht im / #in dem Glasschrank.
 the book that you look for stands in-the_{weak} / in the_{strong}
 glass-cabinet.
 ‘The book that you are looking for is in the glass-cabinet.’ ((Schwarz 2009), ex.(40), p.39)

(260) Hans hat einen Schriftsteller und einen Politiker interviewt. Er hat
 Hans has a writer and a politician interviewed. He has
 #vom / von dem Politiker keine interessanten Antworten
 from-the_{weak} / from the_{strong} politician no interesting answers
 bekommen.
 gotten.
 ‘Hans interviewed a writer and a politician. He didn’t get any interesting answers from the politician.’ ((Schwarz 2009), ex.(23), p.30)

For our purposes, a key feature distinguishing unique and familiar definites is that only familiar definites must be coreferential with a previously introduced discourse referent. Because of this, one could ask, what is the consequence of using a unique or familiar definite for the interpretation of donkey anaphora? In particular, does using a familiar as opposed to a unique definite give rise to an interpretation that is more easily characterized in terms of coreference between individuals that are selected from some domain of potential discourse referents or the means by which such individuals are chosen (e.g. via choice functions)? In the analyses under consideration, such an interpretation is an existential reading derived via choice functions, as opposed to an existential reading derived via domain narrowing or a universal reading. An extension of this research question with strong pronouns instead of familiar definites is pursued in section (3.3). The distinction between unique and familiar definites is extended to weak and strong pronouns in the next section.

4.3.1.3 Weak and Strong Pronouns

The terms “weak” and “strong” for pronouns have been used to refer to different classes of pronouns due to two distinct but correlated attributes.¹² One attribute is syntactic behavior or distribution. Another attribute is amount of structure present at SS. A difference in syntactic structure at LF is one hypothesis that can account for differences in distribution. According to [Cardinaletti \(1994\)](#), “Natural languages have two categories of pronouns: some essentially behave like full DPs, the others display special syntactic properties” (p.1). For [Cardinaletti \(1994\)](#), this contrast is sometimes instantiated with “strong” and “weak” pronouns, respectively.

[Cardinaletti & Starke \(1994\)](#) maintain that “clitic” and “null” pronouns also behave in ways that are distinct from “strong” pronouns. These authors describe a number of morphosyntactic and semantic differences between weaker and stronger pronouns. One relevant feature of weaker pronouns is that “Deficient personal [weaker] pronouns must have an antecedent prominent in the discourse” (p.10), while the same is not true of strong pronouns. In one sense, then, the weak-strong distinction for pronouns is different from the weak-strong distinction for definites described in section (4.3.1.2) (where the terms “unique” and “familiar” were used instead of weak and strong; the two are on par) and the weak-strong distinction for indefinites. [Patel-Grosz & Grosz \(2010\)](#) point out another relevant feature: strong pronouns are more subject to the formal link condition (requiring an overt syntactic antecedent) than weak ones. An example is provided in (261) (their example (35)); here a weaker pronoun (a null pronoun) is marginally acceptable in Kutchi Gujarati when there is no syntactic antecedent; an overt pronoun is not. In a different sense, then, the weak-strong distinction for pronouns is similar to the weak-strong distinction for definites described in section (4.3.1.2). In particular, weak definites don’t always require a syntactic antecedent, and the same is true of weaker pronouns.

¹² The terms “weak” and “strong” for pronouns are not the same as “weak” and “strong” for definites; however, there are some parallels between the two, as described below.

- (261) *ji penelo manas gare aave, tho i ?pro / *ene bak bharave*
 if married man home comes then 3.sg.nom 3.sg.acc hug makes
 ‘If a married man comes home, he hugs his wife.’

One main correspondence between weak and strong definites and different sorts of pronouns that we are interested in is semantic and relates to reference resolution; in this section, I am primarily concerned with how pronouns rather than full definite DPs give rise to different interpretations of donkey anaphora. Schwarz (2009) contrasts weak and strong definite DPs in German and pursues D-type and dynamic analyses respectively. Patel-Grosz & Grosz (2017) extend Schwarz (2009)’s analysis to German pronouns: they compare personal pronouns to unique definites and demonstrative pronouns to familiar definites.¹³ The idea of a different amount of structure being present in a pronoun is extended to the current account in the form of a claim that there is more structure for a pronoun that is analyzed as involving a projection for a (repeated) choice function.

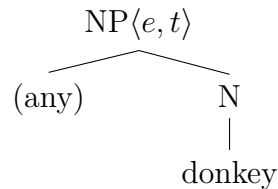
4.3.2 Syntax-Semantics Mapping for Indefinites and Definites/Pronouns

In the following sections, I will discuss some of the implications of this work for the syntax-semantics mapping of indefinites and pronouns in general and with respect to E-type anaphora in particular. I will also review material presented in the sections above concerning indefinites and definites/pronouns and present additional material concerning definites and pronouns. To review what was accomplished in the first half of the chapter, I introduced two different sorts of pronouns; see section (4.3.1.3). These two sorts of pronouns differ based on the syntax and semantics of the antecedent involved. In particular, NP-like or narrow scope indefinites tend to give rise to weaker pronouns with uniqueness-based semantics. On the other hand, DP-like or wide scope indefinites tend to give rise to stronger pronouns with familiarity-based semantics;

¹³ Note that with pronouns, a mapping between unique/familiar and overt structure is not transparent (at SS). On the other hand, full definites show a more straightforward mapping in some languages in that bare nouns may also function as unique definites, while non-bare DPs may function as familiar ones; the distinction is similar to one in German (Jenks 2018).

together, wide scope indefinites and familiarity-based pronouns may be analyzed by utilizing a choice function repeated from an antecedent indefinite at the anaphora site. A proposed syntactic representation (tree) for an NP-like indefinite (i.e. one that prefers to take narrow scope that empirically tends to have less overt structure) is repeated below in example (262). The denotation of a narrow scope indefinite (the interpretation of a phrase that exemplifies the above tree) is provided in example (263). Here situations are left out for representational clarity.

(262)



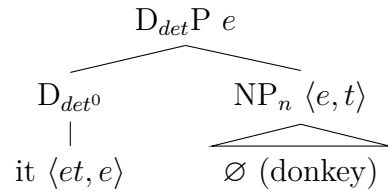
(263) $\llbracket \text{(any) donkey} \rrbracket = \lambda x.Dx$

I adopt an ellipsis based view of pronouns as in [Elbourne \(2005\)](#) in which pronouns are treated as determiners; Elbourne’s account is based ultimately on the idea of [Postal \(1966\)](#) that pronouns can be treated along the lines of determiners. Note that an ellipsis based account is compatible with a choice function based account if we assume that a choice function represents a projection in a pronoun in which DP ellipsis occurs. In the syntax-semantics mapping proposed in this work, a narrow scope indefinite antecedent with a determiner such as *any* as shown in example (264) tends to give rise to a weak pronoun interpreted with uniqueness-based semantics, a tree (at PF) of which is repeated below in example (265), adapted from [Patel-Grosz & Grosz \(2017\)](#). A reason for providing this analysis is the indefinite/definite correspondence effects described in section (4.4.3); when less structure is carried over from the antecedent into the pronoun, the pronoun also has less structure, and pronouns with less structure tend to be interpreted as unique rather than familiar. The denotation of a weak (uniqueness-based) pronoun corresponding to a determiner denotation in a structure $[\text{DP } it_D [\text{NP } e]]$ is provided below in example (266). In the denotation provided, s' is a

situation bound by a higher operator, such as a quantifier in a donkey sentence. Such a denotation can work for English, German, or another language. Here the subscript *det* is copied from Patel Grosz and Grosz’s representation to indicate a determiner pronoun.

(264) Every farmer who owns any donkey pets it.

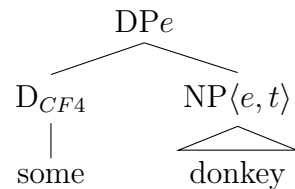
(265)



(266) $\llbracket it_D \rrbracket = \lambda P_{\langle s, et \rangle} . \iota u [P(s')(u)]$

I have proposed to analyze both wide scope indefinites and pronouns with familiarity-based semantics using choice functions, which are adapted from [Kratzer \(1998\)](#). A proposed tree for a DP-like indefinite (i.e. one that prefers to take wide scope and that empirically tends to have more overt structure, namely, having an overt determiner, as opposed to a bare noun)s is repeated below in example (267). I propose that non-Skolemized choice functional definite DPs are represented in the same way. The denotation of wide scope indefinite (the interpretation of a phrase that exemplifies the tree above given above) is provided in example (268).

(267)



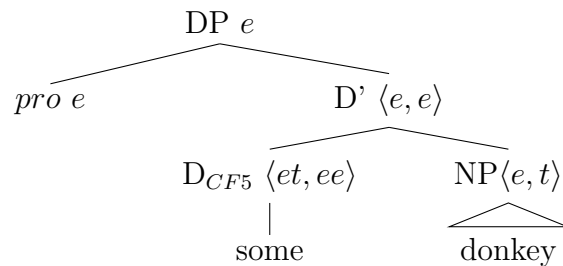
(268) $\llbracket some \ donkey \rrbracket = CF_4(\lambda x. Dx)$ (for a non-Skolemized choice function)

For Skolemized choice functions (relevant to both indefinites and definites/pronouns), we need to explain how an additional argument for a variable

bound by a higher operator is syntactically represented; the Skolemized CF cannot take only an NP as an argument. A potential solution to this problem is that the argument for a variable to be bound is adjoined to a higher projection that is a copy of what would otherwise be the highest projection of the tree. A tree illustrating this option (for both indefinites and definites/pronouns) is provided in example (269). The denotation of wide scope indefinite (the interpretation of a phrase that exemplifies the tree above given above) is provided in example (270).

The purpose of positing an additional projection is to provide an additional layer of structure. This allows us to explain why a wide scope indefinite would have additional structure, similarly to a strong pronoun. The head *pro* corresponds to a variable that co-varies in a donkey sentence, denoted by the subject DP (e.g. *every farmer*). That is, we can provide parallel treatments of both.

(269)



(270) $\llbracket \text{some donkey} \rrbracket = \llbracket \text{DP} \rrbracket = \lambda y. CF_5(\lambda x. Dx)(y)$ (for a Skolemized choice function) where y is a variable corresponding to some higher operator, e.g., a subject quantifier in a donkey sentence. Here *pro* is a Skolem variable.

Note that with this option, we are able to provide a functional projection that corresponds to the additional structure present in morphologically stronger pronouns that is an alternative to the analysis of (Patel-Grosz & Grosz 2017); the additional projection is for *pro* rather than DeixD. In the proposed syntax-semantics mapping, a wide scope indefinite as shown in example (271) tends to give rise to a pronoun

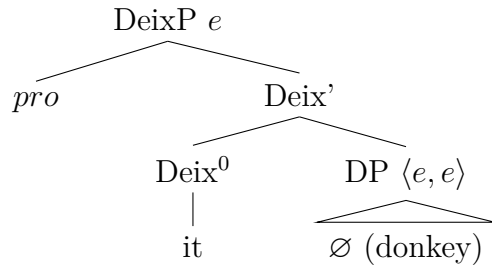
with familiarity-based semantics. Because we have a pronoun with familiarity-based semantics, that pronoun that picks out the same material that its antecedent does (that is, the antecedent and pronoun are coreferential).

The proposed structure of CF definite DPs is parallel to the structure of CF indefinite DPs. The denotation of Skolemized CF pronoun in a structure $[e [DP it_D [NP e]]]$ (e.g. ‘the donkey’) is provided in example (272). The semantic representation of anaphora for a Skolemized choice function $CF(P)(y)$, where y is a variable to be bound (for example, by a subject quantifier in a donkey sentence). A tree that illustrates this option is provided in example (273). A more general representation of the same tree with a functional projection FP of which DeixP is an example is provided in example (274). Here the DP *some donkey* is evaluated and has the denotation $\lambda x.CF_5(donkey)(y)$. The determiner D_{CF_5} is of type $\langle et, ee \rangle$.

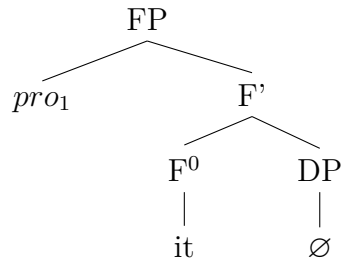
(271) Every farmer who owns some donkey pets it.

(272) $[[it_D]] = \lambda P.\lambda y. CF_5(\lambda x.P(x))(y)$

(273)



(274)



There are (at least) two potential implications of the indefinite-definite correspondence effects as well as other empirical trends presented above and

summarized below in section (4.4) for the relationship between antecedents and pronouns, in particular, from the perspective of providing a syntax-semantics mapping. This is because certain E-type anaphora constructions and interpretations appear to be aligned with certain indefinite antecedent syntax and semantics. First, the syntactic size of a pronoun/anaphor appears to be constrained by the syntactic size of its antecedent. Evidence for this is provided in section (4.4.3). This is because indefinites that may be analyzed as having less structure are aligned with pronouns that may be analyzed as having less structure in accounts such as those of Patel-Grosz and Grosz. This implication is described in section (4.3.2.1). Second, there is a natural consequence of said principle that we may infer on the assumption that indefinite antecedent syntax/semantics tends to give rise to certain anaphor/pronoun syntax/semantics. This implication of the syntax-semantics mapping described above is that the interpretation (i.e., the semantics) of a pronoun/anaphor appears to be constrained by the nature of its antecedent (in addition to its syntax, as described above).

4.3.2.1 Size of Pronoun/Anaphor Constrained by Size of Antecedent

In this section, I aim to describe one syntactic consequence of indefinite-definite correspondence effects described in this work. One potential implication of indefinite-definite correspondence effects as described in the above section is that the syntactic size of a pronoun/anaphor appears to be constrained by the syntactic size of its antecedent. This implication falls out if we assume that indefinite-definite correspondence effects arise because the structure of an antecedent is carried over into the structure of a pronoun; this is the case in the ellipsis based account adopted here, where the pronoun is literally a copy of its antecedent; note that this is the basic idea in but is not necessarily adopted in accounts such as (Elbourne 2005). In line with Patel-Grosz & Grosz (2017)'s approach to pronouns, less syntactic structure of an indefinite (in terms of number of functional projections present at LF) gives rise to less syntactic structure of a definite or pronoun anaphoric with it. In particular,

in [Patel-Grosz & Grosz \(2017\)](#)'s account, pronouns can differ in terms of number of syntactic projections that are present, and pronouns involve ellipsis of a constituent corresponding to an antecedent constituent.

Because of this, an inference we can draw is that pronouns with antecedents with less structure are expected to have less structure (although this is not an implication that Patel Grosz and Grosz themselves spell out). Here we may make a distinction between NP ellipsis as described in ([Elbourne 2005](#)) vs. DP ellipsis from DP vs. DeixDP (where DeixD is a projection for deixis phrase introduced in ([Patel-Grosz & Grosz 2017](#))) at LF respectively; this distinction in some cases corresponds to a weak vs. strong contrast in pronouns. Second, syntactic structural parallelism is tracked by differences in semantics. One inference that we might make based on empirical trends described above in this work is that indefinite form can bias toward different reference resolution because different indefinite forms tend to give rise to different definite or pronoun semantics.

- With morphologically weaker pronouns, a uniqueness-based determiner resolves reference based on unique possession of a property denoted by the elided NP.
- With morphologically stronger pronouns, a familiarity-based determiner resolves reference based on repetition of a choice function that is the head of the elided DP or from DeixDP.

Here, I propose a grammatical principle based on previous work in order to help explain indefinite-definite correspondence effects described above. This principle states that there is an additional projection in an anaphoric pronoun beyond what is present in the antecedent; this projection is required for anaphora resolution. This explanation is inspired by what authors such as [Lobeck \(1995\)](#) have claimed occurs with VP ellipsis as well as other forms of ellipsis; in particular, Lobeck's idea is that an elided phrase must be the complement of a functional head, such as D, C, or I, which ensures that there is an additional functional projection above the elided phrase. Note that this idea is also related to the idea of an E feature in the theory of [Merchant \(2001\)](#), which states

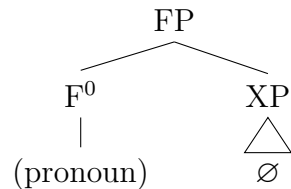
that a phrase XP is elided if and only if it is selected by a head that is [+E] (which for Lobeck would need to be functional). Taken together, Lobeck and Merchant’s ideas imply that VP anaphors always contain a functional head beyond what is present in the antecedent and that this head is [+E].

Here an additional projection corresponds to DeixD in the case of strong pronouns in which DP ellipsis is involved. In general, this idea can be implemented in Lobeck’s framework as illustrated in the following examples. A phrase XP is elided from a definite or pronoun with the structure [FP XP[]], where F is the head of a functional projection FP. An example of an antecedent is provided in example (275), and an example of a pronoun with ellipsis is provided in example

(275)



(276)

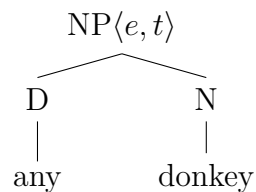


Here I propose to extend an account based on (Lobeck 1995) to the distinction between NP and DP ellipsis; the additional projection for an anaphor differs depending on the nature of its antecedent. We might call this additional projection “D_{det}” or “DeixD” for at least some instances of weak and strong pronouns respectively, adapting the theory of Patel-Grosz & Grosz (2017). Concretely, the proposal states that there are two competing pressures that are operative in the grammar and that apply to at least some languages. One pressure is to recover as much syntactic material as is both possible and is useful from an antecedent; for example, it may not be the case that *any* is recycled from an antecedent to a pronoun. Another pressure is to minimize the syntactic size of an anaphor/pronoun. The result of respecting these two pressures at

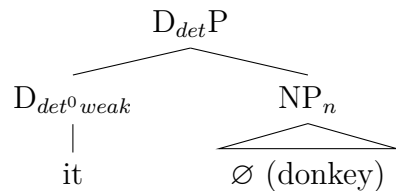
the same time is to use an anaphor/pronoun that is only one projection larger than its antecedent. In the ellipsis account that is proposed here, an antecedent of a size that respects these two pressures is copied.

I will illustrate how this idea works with trees below. In these trees, NPs and DPs are overt. Pronouns, which are treated along the lines of definite articles, are also overt. Surface forms include pronouns themselves but not NPs and DPs, which are elided. Meanings are computed as in the work of [Patel-Grosz & Grosz \(2017\)](#). In the examples presented below, we have NP ellipsis. In example (277) I provide a category label D for *any* but treat the entire phrase as an NP at LF on the assumption that only a D head that individuates such as ‘a/one’ or ‘two’ passes up its category label to the entire projection.

(277)

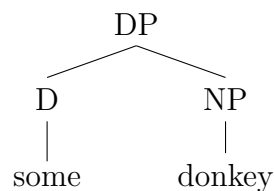


(278)

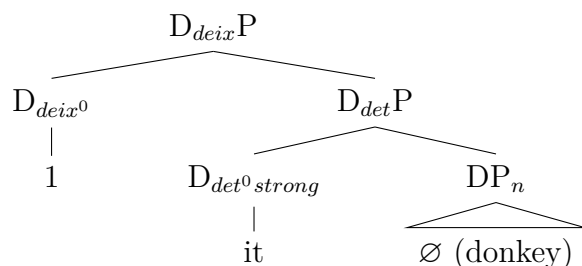


In the examples presented below, what we have is DP ellipsis. In the tree provided in example (280), the numeral 1 corresponds to a referential index. Note that *it* is not elided here; only the DP is.

(279)



(280)



A test case in which the principle of recycling an additional projection in the process of anaphora resolution as described above is with indefinite NPs with the determiner *any*; if *any* heads a DP, then we would expect that a pronoun anaphoric with an indefinite with *any* should contain an additional projection. However, this is not the case if as in the account proposed here, indefinites with *any* give rise to pronouns with uniqueness-based semantics, which we might analyze as DPs at LF. One way of addressing this issue is to state that *any* does not individuate and therefore does not pass up its label to the projection; it is treated similarly to a bare noun that denotes a property. That is, only individual denoting phrases are DPs.

Overt or covert realization of the head of an additional projection is parameterized across languages. This parameterization is needed because the correspondences between indefinite and pronoun form in donkey anaphora resolution described in section (3.5.2) are not absolute; for instance, the correspondence is relatively strong in Hungarian but is not present in Korean. We cannot examine English, which lacks overt contrasts in forms of pronoun. Note also that Chierchia (1998) and Boskovic (2008) argue that whether a covert determiner is present in certain nominals is parameterized across languages; whether overt determiners are present and when they are present is a matter of debate.

4.4 Summary of Empirical Trends Supporting the Above Analyses

In the following section, I will provide a summary of experimental and typological trends presented in previous chapters. A main objective of this section is to show why donkey anaphora interpretation appears to be largely determined by form of

antecedent indefinite, though form of pronoun may also have an effect on interpretation. I then explain how these trends can be used to argue in favor of the particular analyses presented in this chapter. First, I will introduce background on definites/pronouns relevant to the subsequent discussion. Next, I will describe effect of form of indefinite. Then, I will describe effect of definite/pronoun form and indefinite-definite/pronoun correspondence effects. Finally, I will describe some potential implications for the account developed here.

4.4.1 Effect of Indefinite Form

In this section I will describe how effect of indefinite form on donkey anaphora interpretation supports the analyses presented in this chapter. Narrow scope indefinites tend to give rise to universal readings, though they can generate existential readings with some regularity. On the other hand, wide scope indefinites are more aligned with existential readings (see data in sections (C.1) and (3.4)). In this section I will describe how effect of indefinite form on donkey anaphora interpretation supports the analyses presented in this chapter.

In the current section, I aim to show why certain interpretations of donkey anaphora (existential via domain narrowing and universal) would be aligned with narrow scope indefinites such as some instances of bare nouns and polarity indefinites. Results from an experiment on effect of English indefinite determiners on readings that follow this generalization are repeated below in Table (4.3). There were more universal readings with *any* than with *a* and more universal readings with *a* than with *some*.

Table 4.3: Mean Proportions of Universal Readings Across Indefinites for Experiments 1A and 1B

Indefinite/Tense	present (Exp. 1A)	past (Exp. 1B)	average
<i>any</i>	0.55	0.31	0.43
<i>a</i>	0.43	0.2	0.32
<i>some</i>	0.34	0.19	0.27
average	0.44	0.23	0.34

Examples from Hungarian that follow this generalization for universal readings are repeated below. Sentence (281) with a polarity indefinite displayed more universal readings than sentence (282) with an ‘a/one’ indefinite.

- (281) Akik meg vettek bármilyen könyvet, mutassák meg nekem
 who PRT buy-PAST-3PL any book-ACC show-IMP PRT me-DAT
pro.
 it.
 ‘Everyone who buys any book should show it to me.’
- (282) Akik meg vettek egy könyvet, mutassák meg nekem *pro.*
 who PRT buy-PAST-3PL a book-ACC show-IMP PRT me-DAT it.
 ‘Everyone who buys a book should show it to me.’

Bare nouns (bare nouns), in comparison with other indefinites (e.g., ‘a/one’ indefinites), also generated more existential readings derived via domain narrowing in terms of the paraphrase used to operationalize this way of deriving existential readings (see section (5.5.1) for details about these paraphrases) as well as more universal readings in terms of proportion of responses (see Chapter (3)). Examples from Arabic that follow this generalization for universal readings are repeated below. Example (318) with a bare noun was judged as exhibiting more bias toward universal readings, while example (319) with an ‘a/one’ indefinite was judged as being more biased toward existential readings derived via choice functions in terms of the paraphrase used to operationalize this way of deriving existential readings.

(283) Kl-u muzaria-t-i-n ta-mlek-u
 every-NOM farmer-3SG-FEM-GEN-INDEF 3SG-FEM-own-indicative
 hemar-a-n tu-dalel-uh-u
 donkey-ACC-INDEF 3SG-FEM-pet-it-INDIC
 ‘Every farmer who owns a donkey pets it.’

(284) Kl-u muzaria-t-i-n ta-mlek-u
 every-NOM farmer-3SG-FEM-GEN-INDEF 3SG-FEM-own-indicative
 hemar-a-n wahid-a-n tu-dalel-uh-u
 donkey-ACC-INDEF one-MASC-ACC-INDEF 3SG-FEM-pet-it-INDIC
 ‘Every farmer who owns a donkey pets it.’

These examples from Arabic also follow the above mentioned generalization concerning an existential via domain narrowing vs. a way of deriving existential readings via choice functions; a bare noun and overt clitic (*uh*) as shown in example (318) could have a way of deriving existential readings via domain narrowing. A bare noun and overt clitic could also usually have a way of deriving existential readings via choice functions (for two of three speakers, as described in Chapter (3)), while an overt clitic and ‘a/one’ indefinite as shown in example (319) could have both way of deriving existential readings.

In sum, bare nouns and polarity indefinites behaved similarly in that both displayed a tendency to give rise to more universal readings and a way of deriving existential readings via domain narrowing (in terms of the paraphrase used to operationalize this way of deriving existential readings) compared to ‘a/one’ indefinites.

The aforementioned findings and the fact that bare nouns have been analyzed using Restrict in (Chung & Ladusaw 2004) inform the question of universal readings should be analyzed; in particular, they suggest that an analysis using Restrict may be appropriate for universal readings because universal readings were more aligned with bare nouns. The theoretical reason for this claim is based on the analysis pursued below; in particular, Restrict provides a syntactic constituent (a relative clause modifier) that was hypothesized to give rise to more universal readings because it emphasizes situational uniqueness, which is associated with universal readings in the theory of (Elbourne 2005).

Additionally, given that bare nouns and polarity indefinites are more likely to be interpreted with narrow scope, their alignment with universal readings and existential readings derived via domain narrowing (in terms of the paraphrase used to operationalize this way of deriving existential readings) support the above analyses of these interpretations, on the assumption that such indefinites tend to give rise to pronouns with uniqueness-based semantics. This is because pronouns with uniqueness-based semantics are more readily analyzed using situational uniqueness and exclusion of situations from a domain via domain narrowing; they are not as readily analyzed using choice functions because choice functions. This is because choice functions do not necessarily encode familiarity. I propose choice functions implement familiarity-based resolution and are associated with existential readings.

Above, we saw that indefinites that take exceptional scope, such as indefinites with the determiner *some*, prefer existential readings. This effect was demonstrated with the results of experiments on English presented in section (2.1.3). See Table (4.3) above for a summary of these results. Examples from Hungarian that follow this generalization for universal readings are repeated below; sentence (285) with a polarity indefinite displayed more universal readings than example (286) with an ‘a/one’ indefinite (which can take wide scope).

(285) Akik meg vettek bármilyen könyvet, mutassák meg nekem
 who PRT buy-PAST-3PL any book-ACC show-IMP PRT me-DAT
pro.
 it.

‘Everyone who buys any book should show it to me.’

(286) Akik meg vettek egy könyvet, mutassák meg nekem *pro.*
 who PRT buy-PAST-3PL a book-ACC show-IMP PRT me-DAT it.

‘Everyone who buys a book should show it to me.’

We could explain the above mentioned empirical generalization if on the one hand narrow scope indefinites tend to give rise to either existential readings via domain narrowing or universal readings (with a preference for universal readings), and on the other hand, the alignment of wide scope indefinites with existential readings support

the above analysis of this interpretation using choice functions on the assumption that such indefinites are readily analyzed using choice functions.

4.4.2 Effect of Definite/Pronoun Form

In this section I will describe how effect of definite/pronoun form on donkey anaphora interpretation supports the analyses presented above. Results from an experiment on effect of form of definite DP in English on readings of donkey anaphora are repeated below. There were fewer universal readings with *the* NP than *the* NP + RelC. DPs of the form *the* NP and *that* NP did not differ. Proportions of universal readings were as presented in Table (4.4).

Table 4.4: Mean Proportions of Universal Readings Across Full Definite DPs and *it* for Experiments 2A and 2B

definite/Tense	present (Exp. 2A)	past (Exp. 2B)	average
<i>the</i> NP + RelC	0.58	0.35	0.47
<i>the</i> NP	0.49	0.31	0.4
<i>that</i> NP	0.55	0.35	0.45
<i>it</i>	0.43	0.2	0.32

Suppose that universal readings are associated with unique definites, based on accounts such as (Heim 1990) and (Elbourne 2005). Additionally, suppose that modified full definite DPs tends to be interpreted with uniqueness rather than familiarity-based resolution, similarly to null as opposed to overt pronouns, based on the results of experiments described in Chapter (2). We might make these inferences based on experimental results as summarized above in Table (4.4). A denotation of a modified definite DP is provided in (287); such a denotation may be derived if one assumes that a relation derived via Restrict as described in section (4.2.2) is taken as the argument of a definite article. That is, a particular sort of semantic object (a relation) denoted by a modified definite is recycled (i.e. occurs a second time). Furthermore, let

us assume that a relative clause modifier such as ‘that s/he owns’ emphasizes situational uniqueness. Although there is no guarantee that a relative clause modifier does in fact emphasize situational uniqueness, this assumption was part of the basis for hypotheses presented in Chapter (2), and these hypotheses received empirical support. If we adopt this assumption, it allows for a parsimonious explanation of the data.

Because of this, we obtain a pronoun with a uniqueness-based denotation that is equivalent to the denotation of a weak (uniqueness based) definite, and this biases toward universal readings. Given these assumptions, we may derive universal readings with such a uniqueness-based definite using the procedure described in section (4.2.2).

$$(287) \quad \llbracket \text{the donkey that } s/\text{he owns} \rrbracket = \llbracket \text{the}_{\text{weak}} \text{ donkey} \rrbracket = \text{the}_{\text{weak}}(s)(\lambda x.Dx) \\ = \text{the unique } x \text{ in } s \text{ such that } x \text{ is a donkey (resolution via uniqueness)}$$

Additionally, there was a slight tendency for null pronouns to generate more universal readings in comparison with overt pronouns. See section (3.3). If null pronouns are more likely to have uniqueness-based semantics than overt ones, then we could explain this trend by stating that uniqueness is involved in generating universal readings but not existential readings via choice functions. Examples from Armenian that follow this generalization are provided below. As for Western Armenian, Hossep Dolatian (p.c.) rated sentence acceptability using a 5-point Likert-type scale from “completely unacceptable” (1) to “completely acceptable” (5) and provided judgments about readings. A bare noun and null pronoun (together) in example (288) biased toward a universal reading, an ‘a/one’ indefinite and null pronoun as shown in example (289) biased toward an existential reading, a bare noun and overt demonstrative pronoun in (290) were degraded, and an ‘a/one’ indefinite and demonstrative pronoun as shown in example (291) biased toward an existential reading. Thus, there is slight positive evidence that null pronouns bias toward universal readings more than overt ones.

$$(288) \quad \text{Amen akaragaban vor} \quad \text{ef} \quad \text{uni, } \textit{pro} \text{ gə-foj-e.} \\ \text{every farmer} \quad \text{who donkey} \quad \text{has, } \textit{pro} \text{ PRES-pet-3SG.}$$

‘Every farmer who has donkey pets it.’

Acceptability rating: 5 on a 5-point scale

- (289) Amen akaragaban vor ef mə uni, *pro* gə-foj-e.
Every farmer who donkey INDF has, *pro* PRES-pet-3SG.

‘Every farmer who has a donkey pets it.’

Acceptability rating: 5 on a 5-point scale

- (290) Amen akaragaban vor ef uni, ador gə-foj-e.
Every farmer who donkey has, it/that_{medial} PRES-pet-3SG.

‘Every farmer who has a donkey pets it.’

Acceptability rating: 3 on a 5-point scale

- (291) Amen akaragaban vor ef mə uni, ador gə-foj-e.
Every farmer who donkey INDF has, it/that_{medial} PRES-pet-3SG.

‘Every farmer who has a donkey pets it.’

Acceptability rating: 5 on a 5-point scale

In sum, one could explain why indefinite form has an effect on readings that is paralleled in definite form if either a narrow scope indefinite or a modified full definite gives rise to a relation composed via Restrict, biasing toward unique resolution of the pronoun and in turn a universal reading rather than an existential reading derived via choice functions. In contrast, existential readings via choice functions are associated with wide scope indefinites and familiarity-based resolution of a pronoun. To summarize, effects of definite/pronoun on donkey anaphora interpretation described here provide support for the above analyses argued for in this work because weaker pronouns tend to have uniqueness-based semantics, and modified definites are proposed to emphasize situational uniqueness, which I propose is involved in deriving a universal reading through situational uniqueness and an existential reading via domain narrowing.

On the other hand, strong pronouns tend to have familiarity-based semantics, which I propose is involved in deriving an existential reading via choice functions. One possible explanation for an effect of definite/pronoun form on interpretation is that a weak vs. strong contrast for pronouns in a given language can in itself bias toward

different reference resolution. That is, if a weak/strong contrast exists in a language, weaker forms may prefer to be resolved uniquely. On the other hand, stronger forms may prefer to be resolved via familiarity. Uniqueness is associated with universal readings, and weaker pronouns are also. Familiarity is associated with existential readings, and stronger pronouns are also. These analyses are further described in section (4.3.2).

4.4.3 Indefinite-Definite Correspondence Effects

An additional finding that informs the current account is that wide scope indefinites are more aligned with pronouns that have more overt structure, while narrow scope indefinites are more aligned with pronouns that have less overt structure. That is, narrow scope indefinites prefer a morphologically weaker pronoun, while wide scope or individual denoting indefinites prefer a morphologically stronger pronoun. Such pronouns tend to have familiarity-based semantics; we might also analyze such pronouns with the use of choice functions to represent familiarity. This alignment is difficult to observe in languages such as English that lack an overt contrast in pronoun form, but it may be observed in some languages. While there may be a general alignment between indefinites and pronouns in some languages, it is not entirely clear that one can test every language and find such a correspondence.

Examples from Hungarian that follow the above mentioned generalization of indefinite-pronoun correspondence effect are repeated below. Relevant expressions (indefinites and definites or pronouns) are provided in bold. Null pronouns were more compatible with polarity indefinites as shown in examples (292, 293) (average rating: 3.5 from 3.0 and 4.0 respectively) than ‘a/one’ indefinites as shown in examples (294, 295) (2.9 from 3.9 and 1.9 respectively) but not bare nouns as shown in examples (296, 297) (4.0 from 4.0 and 4.0 respectively).

- (292) Akik vettek **bármilyen szamarat**, mutassák meg nekem *pro*.
 who buy-PAST-3PL any donkey-ACC show-IMP PRT me-DAT it.
 ‘Everyone who buys any donkey should show it to me.’

- (293) Akinek volt **bármilyen lova**, kölcsönadta *pro* a feleségének, hogy
 Who had any.FC horse, lent it the wife, to
 belovagolhasson a városba.
 ride the city.
 ‘Everyone who had any horse lent it to his wife to ride to the city.’
- (294) Akik vettek **egy szamarat**, mutassák meg nekem *pro*.
 who buy-PAST-3PL a donkey-ACC show-IMP PRT me-DAT it.
 ‘Everyone who buys a donkey should show it to me.’
- (295) Akinek volt **egy lova**, kölcsönadta *pro* a feleségének, hogy belovagolhasson
 Who had a horse, lent it the wife, to ride
 a városba.
 the city.
 ‘Everyone who had a horse lent it to his wife to ride to the city.’
- (296) Akik vettek szamarat, mutassák meg nekem *pro*.
 who buy-PAST-3PL **donkey-ACC** show-IMP PRT me-DAT **it**.
 ‘Everyone who buys a donkey should show it to me.’
- (297) Akinek volt **lova**, kölcsönadta *pro* a feleségének, hogy belovagolhasson a
 Who had horse, lent it the wife, to ride the
 városba.
 city.
 ‘Everyone who had a horse lent it to his wife to ride to the city.’

This interaction is summarized in (298).

- (298) Interaction Between Indefinite Form and Pronoun Form in Hungarian
 null: ‘a/one’ indefinite < bare noun \approx polarity indefinite
 demonstrative: ‘a/one’ indefinite = bare noun > polarity indefinite

Additionally, indefinite-definite correspondence effects provide further support for the above analyses in that they allow us to provide another explanation for why certain forms on indefinite have a particular effect on donkey anaphora interpretation; in particular, indefinite and definite/pronoun form may contribute to donkey anaphora interpretation as independent factors, but it is also possible that certain indefinite syntax/semantics gives rise to certain definite/pronoun syntax/semantics: narrow

scope indefinites as well as weak pronouns are more aligned with universal readings, while wide scope indefinites as well as strong pronouns are more aligned with existential readings derived via choice functions.

There was a general tendency for narrow scope indefinites to give rise to more universal readings, and experimental results for English agree with introspective judgments of speakers of a number of languages; Hungarian is a particularly good example. Though this tendency is far from absolute, it is stronger than the tendency for definites/pronouns. With current data, we cannot conclude that pronoun form by itself can bias toward either reading; instead, the hypothesis that antecedent indefinite form biases toward either reading (potentially through its effect on pronoun interpretation) is better supported. Stronger effects of indefinite and indefinite-definite correspondence effects, taken together, make it more plausible that effect of definite or pronoun form on interpretation arises indirectly as a result of effect of form of indefinite. These empirical trends have consequences for the analysis of E-type pronouns. In particular, they suggest that we should adopt a mixed approach the E-type anaphora with resolution via domain narrowing in the case of narrow scope indefinites and resolution via choice functions in the case of wide scope indefinites. Additionally, these empirical trends have consequences for the theory of anaphora resolution more generally. In particular, they suggest that we adopt a syntax-semantics mapping for indefinites and pronouns with a distinction between NP ellipsis in the case of narrow scope indefinites vs. DP ellipsis in the case of wide scope indefinites.

Some cross-linguistic implications and predictions of the empirical trends presented above include the following. Concretely, in any given language in which a contrast between NP-like and DP-like indefinites (or narrow vs. wide scope indefinites) as well as a relative contrast between weaker and stronger pronouns is present, we will be able to observe an alignment; NP-like indefinite antecedents will be more aligned with weaker pronouns, while DP-like indefinites will be more aligned with stronger pronouns. We should keep in mind that indefinite-definite correspondence effects as described in the above section are best conceptualized with respect to pronoun strength

in relative terms, as described in section (3.3.0.2). In particular, uniqueness tends to be associated with pronouns lower on the hierarchy, while familiarity tends to be associated with pronouns higher on the hierarchy. Syntactically simpler forms tend to be interpreted as unique, while syntactically more complex tend to be interpreted as familiar. Similarly, narrow scope indefinites tend to be more compatible with pronouns lower on the hierarchy, while wide scope indefinites tend to be more compatible with pronouns higher on the hierarchy. Some of these theoretical implications are discussed in section (4.3). In the next chapter, I will discuss open questions and issues that the account thus far developed in the previous chapters raises. I also discuss some other approaches and outstanding issues with the account.

Chapter 5

OPEN QUESTIONS, OTHER APPROACHES, AND OUTSTANDING ISSUES

In this chapter, I discuss open questions and issues that the account thus far developed in the previous chapters raises. I also discuss some alternative approaches and outstanding issues with the account thus far developed.

5.1 Comparison of Choice Functional and Other Approaches and Problems with a Choice Functional Approach

In the literature, one main motivation for employing choice functions was to deal with issues such as over-generation of possible interpretations afflicting a treatment of the behavior of indefinites employing existential quantification over individuals (rather than choice functions) and existential closure ([Schwarz 2011](#), [Charlow 2015](#)). I argue that there are also some advantages of a choice functional approach as in ([Matthewson 2008](#)) as applied to donkey anaphora.

First, it models the similarity of the meanings of one variety of existential reading as well as discourse anaphora (as all and only the same individual(s) are picked out by an antecedent and pronoun). Note, however, that Matthewsonian choice functions that include existential closure are not as naturally extended to discourse anaphora as are the free variable choice functions that are put forward in the analysis of ([Kratzer 1998](#)). Second, coindexation of functions avoids issues relating to characterizing how the anaphora is resolved (e.g., through a dynamic mechanism or via a D-type strategy). Finally, it models the connection between exceptional scope potential for an indefinite and its preference for an existential reading; this was shown in Chapter 4.

One of the main contributions of this work is to justify employing choice functions only with certain E-type constructions and interpretations, namely, one way of deriving existential readings, as well as discourse anaphora.¹ In particular, an advantage of a CF approach is that with it one could explain why antecedent indefinites with certain semantics (which one might analyze using choice functions) would give rise to certain parallel semantics of a pronoun or definite (which one could also analyze using choice functions). In particular, one could explain why CF indefinites give rise to more existential readings than property denoting indefinites. If a CF can only reselect (with a pronoun/definite) whatever an antecedent does, then we can explain why, as a natural consequence, a universal reading for donkey anaphora would be less available with certain indefinite and pronoun forms.

Other theories are not as readily able to make such a prediction. In particular, we can explain why a universal reading would be less available with DP-like indefinites (see section (3.4)) and with stronger pronouns (see section (3.3)). Another advantage of a choice functional approach in which we assume that there is salience associated with the use of a CF indefinite and pronoun is that it requires only a single cognitive value (of potential familiarity or salience) that may be used to explain both an antecedent's anaphoric potential and how a pronoun accesses it. Simply repeating a choice function is sufficient for both introducing and recovering a referent. We can thus give a similar semantic treatment of an indefinite and definite or pronoun within an anaphoric dependency.

Another advantage of a CF approach is that with the use of a CF, we don't need to specify in a formal way how coreference is established between the individuals that an antecedent and pronoun pick out. What is coindexed is functions rather than individuals *per se*. The CF approach is thus similar to approaches such as that of Heim (1982) that consider indefinites and definites or pronouns to be relatively on par because it analyzes indefinites and pronouns similarly using choice functions. It avoids

¹ L. Champollion, p.c., points out that an alternative analysis would be to use choice functions throughout and vary whether they can be Skolemized or not.

challenges inherent to other approaches, exemplified by D-type approaches such as (Elbourne 2005), that don't assume that indefinite and definite or pronoun are treated alike and thus must provide different semantic treatment of each. It also avoids the extension of the scope of existentials in such approaches as presented by (Groenendijk & Stokhof 1991); it is preferable to avoid employing an additional semantic mechanism if we do not need it. Crucially, a repeated CF is argued here to model non-maximal reference of pronouns, in opposition to the maximal reference (i.e. picking out all those individuals introduced by an antecedent) associated with uniqueness-based resolution.

The choice functional approach developed here, which is inspired by but distinct from dynamic approaches, differs from dynamic approaches in a number of respects. Dynamic approaches were developed largely before description and formalization of different semantics of definites and pronouns in such works as (Schwarz 2009) and (Patel-Grosz & Grosz 2017). Now that we know more about how to analyze definites and pronouns, a revision of the formulation of truth conditions may be justified.

One such revision is to use choice functions to represent the familiarity-based reference of definites and pronouns as well as the potential for familiarity-based reference of indefinites. An advantage of using a choice function rather than an existential quantifier to represent discourse anaphora is that dynamic extension of existential quantifiers as in (Groenendijk & Stokhof 1991) and text-level existential closure as in (Heim 1982) can be avoided. If we can avoid positing additional semantic mechanisms, then we have a simpler system of representation.

The use of familiarity-based reference resolution as an alternative to uniqueness based reference resolution is well established. (Patel-Grosz & Grosz 2017) extend Schwarz (2009)'s distinction of unique vs. anaphoric definites to pronouns.² Parallels have also been drawn between indefinite syntax and semantics and definite syntax and semantics (Jenks 2018). However, an analysis in which similar choice functional indefinite and definite semantics *per se* (as in (von Heusinger 2004)) is argued to

² While comparisons between non-unique definites and demonstratives have been made, I do not argue for or against such comparisons.

correlate with or be explained by particular indefinite and definite syntax and semantics appears to be unexplored. Such an analysis is pursued here. Lappin & Francez (1994) have also employed functions to analyze donkey anaphora; for universal donkey anaphora, they employ a function into a maximal *i*-sum; for existential donkey anaphora, they employ a choice function into a non-maximal *i*-sum. I do not assume an ontology that includes *i*-sums. Also, in my approach, a CF is used for only existential readings derived via choice functions of donkey anaphora, in correspondence with the syntax and semantics of an indefinite or pronoun.³

5.1.1 Addressing Problems with a Choice Functional Approach

A relatively new idea introduced in this work is that of employing a repeated choice function from the antecedent to the anaphora site. Both choice functions share an index, but one is a novel index, while the other is a familiar index. The first occurrence (for an antecedent) is non-anaphoric, while the second (for a definite or pronoun) is anaphoric. This idea is inspired by but distinct from the novelty condition proposed in (Heim 1982) in that in Heim’s work does not utilize choice functions. It is important that one way of deriving the existential reading is obtained with the use of a choice function as such in order to explain why wide scope indefinites (treated here with choice functions) would give rise to a distinct way of deriving existential readings (examined in more detail in section (5.5.1)).

Choice functional approaches have been criticized for a number of reasons. One criticism relates to the novelty condition. For example, Schwarz (2011) states: “Kratzer (1998) moreover suggests that her analysis of LD [long distance] *a certain* indefinites can be applied to all LD indefinites.¹⁰ Note that, just like Fodor and Sag’s (1982) analysis, this analysis is challenged by the fact, illustrated in Section 2, that LD

³ (Chierchia 1992) employs a family of choice functions to derive universal readings. Chierchia (1992)’s approach differs from the approach opposed proposed here, according to which a single function is employed to derive an existential reading. According to Chierchia (1992), a donkey sentence with an indefinite such as ‘a donkey’ makes salient a family of donkey-valued functions that map individuals such as farmers into a donkey they own. In my view, it wouldn’t matter if there were multiple functions, as long as each one selects the same individual according to the same criteria.

indefinites in questions do not always yield the expected pragmatic effect.” (p.892). One way of addressing such a worry is to state that in the case of discourse anaphora, any such “pragmatic effect” is not part of the semantics of any expression involved, e.g., epistemic specificity (having a known identity in mind). See (Farkas & Brasoveanu 2019) for distinctions among different sorts of specificity.

Another problem with a CF analysis is reviewed by Heim (2011): “Schwarz (2001, 2004) has shown that choice-function analyses do not solve the puzzle of wide-scope indefinites. Schwarz points out a problem of overgeneration which already afflicts the simpler version presented above and only gets worse in the skolemized version. This problem arises with indefinites in the scope of non-upward-monotone quantifiers. Consider (64a) with the potential LF in (64b).

(64) (a) No candidate submitted a paper he had written.

(b) \exists_{chf1} [no candidate₂ [t₂ submitted a_{chf1} paper he₂ had written]]

(64b) is equivalent to ‘no candidate submitted every paper he had written’, a reading clearly not attested for (64a).” One way of addressing said over-generation worry is to state that CF readings of *a* indefinites are blocked under determiners such as ‘no’; only property denoting readings are allowed. This would seem to be only a stipulation, unless we assume that *some* represents an individual denotation of *a*, while *any* represents a property denotation.⁴ We can see such a contrast between the following examples:

(299) No candidate submitted any paper he had written.

(300) ? No candidate submitted some paper he had written.

Thus, a CF analysis may not over-generate in this case, assuming a CF analysis can be applied only wherever an indefinite with *some* is allowed to occur; *a* indefinites are ambiguous between non-choice functional and choice functional denotation, following (Kratzer 1998).

⁴ Note that essentially the same point is made by Geurts (2000).

5.2 Second Quantifiers in Donkey Sentences

In this section, I introduce a theoretical option of second quantifiers in donkey sentences. Such a theoretical option might be employed in an account utilizing situations, similar to that of (Elbourne 2005) and is advocated for here. A single quantifier in donkey sentences is the standard assumption in the literature. This quantifier is denoted by the former determiner such as ‘every’. Let us consider the possibility of a second quantifier in relative clause donkey sentences (other than the main quantifier such as ‘every’). These quantifiers take two arguments: they quantify over a situation (which forms their restrictor) and have a nuclear scope. The second is either implicit (‘always’ is the default) or can be explicitly pronounced, e.g., in (301). The independence of these two quantifiers can be seen from the comparison of such examples as (301) and (302), in which the two are reversed. Another way of justifying the existence of a second quantifier is to observe that while universal force for donkey sentences is the default, this preference can be overridden with an explicit quantifier. See for example (303). Kurafuji (1998) judges sentences to lack this reading in English; however, I think it is present.

(301) Every farmer who owns a donkey usually pets it.

(302) Most farmers who own a donkey always pet it.

(303) Every student who read a paper usually/mostly/sometimes criticized it. (after (Kurafuji 1998))

A survey study described below also indicates that this may be the case. Thus, Kurafuji (1998)’s conclusion that donkey sentences in English cannot have a second quantifier, as is proposed there for Japanese, is somewhat premature. One way of justifying the existence of a second quantifier in donkey sentences is to consider the results of a survey on adverbs in relative clause donkey sentences presented below; an overt adverb can generate both proportional (existential and universal) and frequency readings. I conducted a survey of 11 native speakers of English using the sentences (304), (305), and (306) below. These sentences differ in the adverb present.

- (304) Every farmer who owns a donkey always pets it.
- (305) Every farmer who owns a donkey sometimes pets it.
- (306) Every farmer who owns a donkey usually pets it.

I aimed to determine whether a frequency interpretation concerning how often a given farmer pets donkey(s) s/he owns and/or a proportional interpretation concerning each farmer and the proportion of his/her donkeys that s/he pets. A number of speakers were consulted, some of whom were linguists and some of whom were not. To give a summary of the results, frequency interpretations are more prominent, but proportional interpretations are possible. A more detailed summary is as follows:

- All speakers stated that if either the frequency or proportional interpretation was present, the frequency interpretation was the first that came to mind.
- Almost all speakers could obtain a frequency interpretation with all three adverbs.
- Most speakers stated that there is only one donkey per farmer with all three adverbs. This implies that the question of whether there are proportional interpretations doesn't arise.
- Three speakers could obtain a proportional interpretation with all three adverbs.
- Two speakers could obtain a proportional interpretation only with 'usually' and not with 'sometimes' or 'always'.
- One speaker could obtain a proportional interpretation with 'sometimes' and 'usually' but not with 'always'.

The fact that there are proportional readings would seem to suggest that a second quantifier should be present somewhere in donkey sentences. Another factor to consider is the effect of tense on readings described in section (2.1.4). If a generic operator is in part responsible for what would appear to be universal readings, then it

is possible that such an operator could attach at a position where a second quantifier would otherwise. I remain agnostic as to the position at which such quantifiers attach in donkey sentences. Future research may elucidate this question.

A paraphrase of a donkey sentence with a second quantifier ‘most’ may thus be given as in (307). A possible structure for a donkey sentence that includes two quantifiers is provided in example (308). An advantage of such an analysis is that it allows us to provide the truth conditions of donkey sentences in a relatively straightforward way. These truth conditions include those of the universal reading and a way of deriving existential readings via domain narrowing. Another advantage is that the analysis allows us to account for generic readings by assuming that *Gen* may stand in for a second quantifier.

- (307) Every farmer who owns a donkey, usually, who owns a donkey/for most relevant donkeys, pets it (the donkey).

quantifier such as *Gen* is present, and this quantifier is responsible for the effect of tense/aspect on donkey anaphora interpretation.

5.3 Mixed Reading Sentences

Donkey sentences for which the most natural interpretation is universal with respect to one indefinite and existential with respect to another indefinite have been termed “mixed reading” sentences by [Brasoveanu \(2008\)](#). For example, the most natural interpretation of (311) is with a universal reading with respect to ‘a book’ and an existential reading with respect to ‘a credit card’.

(311) Every person who buys a book on amazon.com and has a credit card uses it to pay for it.

[Brasoveanu \(2008\)](#) argues that indefinites are underspecified and that choosing a different semantic value for each of the two indefinites is what generates mixed interpretations. Consider sentences such as (312) that seem to be most naturally interpreted as mixed as well but that have only one indefinite antecedent. ([Champollion et al. 2019](#)) (p.35) state: “On the most natural reading of this sentence, what is required for its truth is for every umbrella-owner to take one umbrella along when it is raining, and to leave all of his umbrellas at home when the sun is shining.”

(312) Every man who has an umbrella takes it along on rainy days but leaves it home on sunny days. (= (53), ([Champollion et al. 2019](#)), p.35)

If such interpretations are possible, then they would pose a challenge to an approach such as ([Brasoveanu 2008](#)) or the one developed here that assumes that an indefinite receives a single semantic value. One solution to this challenge is to assume that an indefinite receives a single semantic value; however, if the indefinite is underspecified, then it may be reinterpreted. Therefore, different pronouns may be interpreted with either semantic value and generate different interpretations (universal or existential). [Brasoveanu & Dotlacil \(2020\)](#) also point out: “Given that Chierchia (1995) agrees with the observation that examples like (73) and (74) [with mixed

readings] above involve a single pronoun, this approach is faced with the problem of deriving two kinds of semantic representations associated with just one instance of a pronoun” (p. 23). However, the problem of two semantic interpretations arises only if the pronoun can be interpreted exactly once. On the other hand, if the pronoun can be interpreted each time it establishes an anaphoric dependency with an indefinite (and so two times total in a sentence with two indefinite), then an approach reminiscent of (Chierchia 1995) may be upheld. Note that although it is difficult to determine the semantic value that a pronoun takes on (as a result of the semantic value of an antecedent indefinite being carried over into the pronoun), in English (as in English there is no overt realization of different semantics of pronouns), different semantic values may be observable in other languages that have an overt distinction between different forms of pronoun; it is left to future research to test whether these differences are in fact observed in other languages.

5.4 Other Approaches to E-Type Anaphora and Alternative Explanations of the Data

In this section I discuss other approaches to donkey and other E-type anaphora and compare them to the approach developed here, also pointing out alternative explanations of data in the thesis. In general, other approaches are lacking in one or more of the factors listed in (313). Accounting for these factors in conjunction is one of the main advantages of the proposed approach over other approaches.

- (313)
- Accounting for effects of former determiner, indefinite antecedent, and definite or pronoun in conjunction.
 - Cross-linguistic comparison
 - Experimental backing
 - Comparison of different categories of E-type anaphora

5.4.1 Neale (1990)'s Approach

Neale (1990) proposes that pronouns can be interpreted as either standard Russellian definite descriptions or as numberless ones (number-neutral). Numberless descriptions are used to yield typical (universal) reading of donkey sentences. A problem with Neale (1990)'s approach, pointed out in King & Lewis (2017), is that it over-generates. Numberless readings of donkey pronouns do not emerge in discourse anaphora, for example. The over-generation problem may be avoided by following (Elbourne 2005) and claiming that universal quantification over situations arises only in certain environments, such as donkey sentences. Singular definite pronouns do not have number-neutral readings; they may only appear to in such environments.

5.4.2 Brasoveanu (2008)'s Approach

The approach developed in this thesis is most similar to (Brasoveanu 2008) in terms of the crucial role that indefinite antecedent semantics plays in both approaches. (Brasoveanu 2008) relies on lexical underspecification of indefinites to generate existential vs. universal readings. However, the current approach differs from (Brasoveanu 2008). As pointed out by Champollion, Bumford & Henderson (2019), there is a potential worry about (Brasoveanu 2008), which is that the approach over-generates. The basic problem is that a donkey indefinite does not seem to display the same ambiguity outside of donkey contexts as in donkey contexts. This worry about Brasoveanu (2008)'s approach is reminiscent of the worry about Neale (1990)'s above. Brasoveanu (2008) guards against this worry by claiming that the ambiguity only arises with anaphora and when an indefinite is embedded in a quantificational context. This is a way of sidestepping the problem, but it is a stipulation. I argue that the problem should be sidestepped for a principled reason, namely that a property denotation of an indefinite in English (represented by *any*) is licensed by 'every' in its restrictor. This worry of over-generation can be avoided by assuming that a property denotation of an indefinite is not licensed in discourse anaphora (due the absence of a quantifier such as 'every' with an indefinite in its restrictor).

5.4.3 Champollion, Bumford & Henderson (2019)'s Approach

(Champollion, Bumford & Henderson 2019) is a formally sophisticated semantic and pragmatic approach to E-type anaphora. It considers the role of pragmatic reasoning in evaluation of donkey sentences' truth value. It also covers several readings of donkey sentences not considered here (including variations on the two canonical interpretations.) The main variable that determines interpretations in Champollion, Bumford & Henderson (2019)'s approach is question under discussion (QUD) (a pragmatic variable). Champollion, Bumford & Henderson (2019) rely on different interpretations of farmer determiners to generate divergent readings. It is thus not the choice of which FD is used in particular that leads to a different reading as in (Kanazawa 1994), though FD is recognized as a biasing variable. I think Champollion, Bumford & Henderson (2019)'s approach is correct and may be compatible with the current approach. However, it is important to recognize how there may be a default semantic interpretation of factors including FD and donkey indefinite based on their SS form that may bias toward different interpretations.

5.4.4 General Remarks

Other approaches to donkey anaphora rely on a single semantic variable (difference) (correlated with a difference in SS) and/or rely on factors not specific to donkey anaphora (e.g. meaning of lexical items and/or pragmatics). Other approaches also rely on using either farmer determiner (FD) or donkey indefinite and treat these as independent factors. I think that such approaches do not provide the most parsimonious and comprehensive explanation for the data because they do not include as full of an empirical investigation as was introduced in this work examining form of both indefinite antecedent and pronoun form and because the representations they include are very complex. The proposed explanation is a multi-factor model that takes into account the interaction of FD and indefinite in donkey sentences. This interaction is present because the semantic value of an indefinite in a donkey sentence depends on the FD that it is interpreted with. There are several approaches that trace

the existential/universal distinction to the donkey pronoun (Brasoveanu & Dotlacil 2020). While I agree that the pronoun may be one factor, empirical trends in the thesis including experimental results in Chapter 2 and typological trends in Chapter 3 indicate that indefinite has a stronger effect. Thus, we should include at least indefinite as a factor in the model and not necessarily pronoun as well.

5.5 Two Different Ways of Deriving Existential Readings

Aside from the universal interpretation of donkey anaphora, another interpretation, as paraphrased in (315), recognized by, e.g., Schubert & Pelletier (1989), is often called the “existential reading”. I will call the way of deriving existential readings associated with this paraphrase “via domain narrowing” because this way of deriving existential readings is derived in this work with the use of the semantic tool of domain narrowing from Krifka (1996). This paraphrase allows, but does not require, coreference between an antecedent indefinite and pronoun.⁵⁶⁷

(315) Every farmer who owns a donkey₁ is such that s/he pets at least one donkey_{1/2} that s/he owns.

⁵ Coreference is always required in a donkey sentence when “coreference” is defined in terms of identity of sense or property denoted by the indefinite; the indefinite antecedent and the pronoun must always have a meaning related to being a donkey. However, when coreference is defined in terms of identity of reference, an antecedent and pronoun in a donkey sentence need not be coreferential; the antecedent and pronoun need not pick out the same individual(s). By “coreferential” here I mean “pick out the same individuals” even if neither term is “referential” in the sense of having a known referent.

⁶ The question of whether donkey sentences require coreference between an antecedent indefinite and pronoun depends on what one takes indices to indicate. If indices indicate identity of sense or property, then an antecedent indefinite and pronoun must be coreferential, as each must pick out something that is a donkey. On the other hand, if indices indicate identity of reference or individual(s) (as is assumed here), then whether an antecedent indefinite and pronoun must be coreferential depends on the interpretation that one assumes a donkey sentence has.

⁷ Lack of required coreference appears to be more available with certain examples, such as (314) (based on (Schubert & Pelletier 1989)). Here the indices 1/2 indicate that a pronoun can pick out different individual(s) than its antecedent. One reason may be that the indefinite doesn’t “identify” an individual but rather a collection (of dimes) (of size one or more), and the pronoun merely draws from that collection.

(314) Every person who has a dime₁ puts it (= at least one dime_{1/2} [that s/he has]) in the parking meter.

While a donkey pronoun is often paraphrased with a modified indefinite, and this is called the “existential” reading, the possibility of non-coreference is not always noted. A sub-variety of the existential reading (which entails the way of deriving existential readings via domain narrowing) is one in which coreference is required. This is not a commonly observed interpretation. A good paraphrase seems to be obtained as shown in example (316) with a demonstrative phrase.⁸

(316) Every farmer who owns a donkey₁ is such that s/he pets that donkey₁ (and possibly others).

I call this other way of deriving the existential reading “via choice functions” because this way of deriving existential readings is derived in this work with the use of the semantic tool of choice functions from [Matthewson \(2008\)](#). I use the term “way of deriving readings” rather than “reading” because the two ways of deriving readings are not truth conditionally distinct.

Both this way of deriving readings and the way of deriving existential readings via domain narrowing are “existential” in the sense that they require the nuclear scope predicate to be true of at least one individual with certain properties. The two paraphrases are nearly identical in their truth conditions, but in the first paraphrase, a donkey is treated as more on par with an indefinite phrase since “at least one of the donkeys” is a paraphrase for a partitive existential quantifier.

It seems fair to say that little attention has been paid to the difference between these two interpretations, most likely because they do not differ in truth conditions. A research question is whether it is simply a matter of convenience in paraphrasing or there is some actual semantic difference. It is of interest to see if the difference between the two can be captured by an analysis because informants who have training in linguistics can detect a difference between them, as discussed in section (5.5.1) below. Furthermore, based on the judgments of informants, the two ways of deriving readings are aligned with different forms and semantics of indefinite and pronoun.

⁸ See [Abbott \(2002\)](#) who proposes a demonstrative paraphrase for various donkey pronouns.

5.5.1 Availability of Different Ways of Deriving Existential Readings With Different Indefinites

The focus of this section was on the following questions: is the difference between two ways of deriving existential readings detectable at all in other languages? If it is detectable, is either way of deriving existential readings more compatible with an NP-like antecedent or a DP-like antecedent or both? Consultants were graduate students who had some training in linguistics, and the crucial distinction with the two paraphrases was explained to them with specific scenarios. In my attempt to highlight the difference between the two paraphrases, I presented two scenarios that are minimally different in terms of whether the donkey that verifies some farmer as a donkey owner is or is not (guaranteed to be) identical to the donkey the farmer pets. As supporting material, consultants were presented with the relevant paraphrases with indices, which highlight the relevant difference, as shown in (317a) and (317b). In what follows, I present data from three languages, in which the consultants reported relatively clear judgments on the relevant distinction.

- (317) a. A. Every farmer who owns a donkey₁ pets that one₁ (and possibly others).
b. B. Every farmer who owns a donkey₁ pets a donkey_{1/2} that s/he owns (and possibly others).

5.5.1.1 Languages

5.5.1.1.1 Arabic

In Arabic, data from three speakers (Ahlam Alghamdi, Aidah Aljuran, and another linguist [via Aidah Aljuran], p.c.) was collected. Both paraphrases were available. As for a bare noun and overt clitic (*uh*) as shown in example (318), all speakers reported that this example was compatible with an indefinite-like paraphrase (317b), while only two speakers reported that this example was also compatible with the other paraphrase (317a). On the other hand, as for an overt clitic and ‘a/one’ indefinite as shown in example (319), all speakers reported that this example was compatible with either paraphrase.

- (318) Kl-u muzaria-t-i-n ta-mlek-u
 every-NOM farmer-3SG-FEM-GEN-INDEF 3SG-FEM-own-indicative
 hemar-a-n tu-dalel-uh-u
 donkey-ACC-INDEF 3SG-FEM-pet-it-INDIC
 ‘Every farmer who owns a donkey pets it.’
- (319) Kl-u muzaria-t-i-n ta-mlek-u
 every-NOM farmer-3SG-FEM-GEN-INDEF 3SG-FEM-own-indicative
 hemar-a-n wahid-a-n tu-dalel-uh-u
 donkey-ACC-INDEF one-MASC-ACC-INDEF 3SG-FEM-pet-it-INDIC
 ‘Every farmer who owns a donkey pets it.’

5.5.1.1.2 Armenian

Armenian has the clearest distinction of the three languages included in the survey. Based on the type of indefinite, one paraphrase is chosen. Bare nouns as shown in examples (320) and (322) were only compatible with an indefinite-like paraphrase (317b). In contrast, ‘a/one’ DPs as shown in examples (321) and (323) were only compatible with the other paraphrase (317a).

- (320) Amen akaragaban vor ef uni, *pro* gə-foj-e.
 every farmer who donkey has, *pro* PRES-pet-3SG.
 ‘Every farmer who has donkey pets it.’
 Acceptability rating: 5 on a 5-point scale
- (321) Amen akaragaban vor ef mə uni, *pro* gə-foj-e.
 Every farmer who donkey INDF has, *pro* PRES-pet-3SG.
 ‘Every farmer who has a donkey pets it.’
 Acceptability rating: 5 on a 5-point scale
- (322) Amen akaragaban vor ef uni, ador gə-foj-e.
 Every farmer who donkey has, it/*that_{medial}* PRES-pet-3SG.
 ‘Every farmer who has a donkey pets it.’
 Acceptability rating: 3 on a 5-point scale
- (323) Amen akaragaban vor ef mə uni, ador gə-foj-e.
 Every farmer who donkey INDF has, it/*that_{medial}* PRES-pet-3SG.

‘Every farmer who has a donkey pets it.’

Acceptability rating: 5 on a 5-point scale

5.5.1.1.3 Hungarian

All combinations of pronoun and indefinite form tested were only compatible with a paraphrase requiring coreference between antecedent and pronoun. In other words, the indefinite-like paraphrase is incompatible with a donkey sentence in Hungarian, regardless of the type of antecedent.

(324) Minden gazda, akinek van szamara, simogatja *pro*.
Every farmer, who has donkey, pets *pro*.
‘Every farmer who has a donkey pets it.’

(325) Minden gazda, akinek van egy szamara, simogatja *pro*.
Every farmer, who has a donkey, pets *pro*.
‘Every farmer, who has a donkey pets it.’

(326) Minden gazda, akinek van szamara, simogatja azt.
Every farmer, who has donkey, pets that.
‘Every farmer who has a donkey pets it.’

(327) Minden gazda, akinek van egy szamara, simogatja azt.
Every farmer, who has a donkey, pets that.
‘Every farmer who has a donkey pets it.’

5.5.1.2 Results

The overall results of this very preliminary survey may be summarized as follows. First, some but not all languages seem to allow an indefinite-like paraphrase. Second, if a language allows an indefinite-like paraphrase with DP-like indefinites, then it also allows an indefinite-like paraphrase with NP-like indefinites. In other words, we have so far not found a language in which an indefinite-like paraphrase is allowed for a DP-like antecedent but not for an NP-like antecedent. Conversely, the other, “coreferential” paraphrase cannot be imposed on an NP-like antecedent without its being imposed on a DP-like antecedent. These are the two preliminary implicational patterns.

5.5.1.3 Discussion

Here I discuss implications of the above survey for the form and derivation of truth conditions of a donkey sentence with an associated “indefinite-like” paraphrase. With the preliminary survey, we learned the following points. First, it seems that speakers can detect subtle differences within the existential interpretation, though it is also possible that the difference is not genuine and speakers are reporting on noise; more solid experimental evidence is welcome. The difference is based on whether there is a strict anaphoric relation between the indefinite antecedent in the restriction and the pronoun in the nuclear scope. Second, the indefinite-like paraphrase is not compatible with a DP-like indefinite antecedent. When this paraphrase is available, the antecedent is an NP-like antecedent. While the unavailability of the indefinite-like paraphrase is correctly predicted by the choice-function based analysis of a DP-like indefinite antecedent, the current proposal also makes the same prediction for an NP-like antecedent.

One interpretation of the empirical trend presented above is that with an “indefinite-like” paraphrase, we have something similar in meaning to noun incorporation in the restrictor of a donkey sentence.⁹ That is, we might paraphrase a donkey sentence as, for example, ‘every farmer who donkey-owns’ or ‘every donkey owning farmer’. Such an account would seem to pose a challenge for a standard uniqueness-based account in which a donkey pronoun is paraphrased as a definite description. This is because the restrictor does not guarantee the presence of a discourse referent that the pronoun can be anaphoric with, unlike with the case of an overtly existentially quantified antecedent. Note that this is similar to the case of noun incorporation, in which the presence of a discourse referent is also not guaranteed, and thus, we cannot pick out a situation in which there is a unique donkey. This problem may be overcome if we suppose that a relevant situation of donkey ownership can be introduced via a pragmatic mechanism such as presupposition accommodation,

⁹ As a matter of fact, noun incorporation was one of the main empirical phenomena motivating (Chung & Ladusaw 2004). See (Chung & Ladusaw 2004), p.4, and the previous chapter, for discussion

in which, for example, we pick some donkey or other that can verify ownership in a particular situation. What motivates this sort of pragmatic accommodation?

One explanation is that when the parser encounters an expression with semantics that it cannot interpret (namely a pronoun with uniqueness-based semantics), it resorts to reinterpretation. Since this is not necessary with a wide scope indefinite (which does not allow for noun incorporation), there is no reinterpretation with a wide scope indefinite; therefore, we don't typically see the possibility of lack of coreference between antecedent and pronoun with wide scope indefinites. Here is a first informal attempt to accommodate the use of a relation such as donkey-owning along with pragmatic accommodation. We may be able to characterize an existential reading derived via domain narrowing (in a similar vein as in the work of (Krifka 1996)) as follows. Note that this is presented as an alternative formulation that is intended to be compatible with the formulation in Chapter 4.

(328) For all x, s, s' such that, $s' \geq s$ and x is a farmer in s and x donkey-owns in s and there is y, y is a donkey in s' and x owns y in s' , there is $s'' \geq s'$ such that x pets the unique donkey in s' in s'' .

Here we have added something to the restriction in order for uniqueness of a definite to hold in the nuclear scope. Thus, we have a solution to the apparent conflict between providing truth conditions with a pronoun with uniqueness-based semantics and allowing for distinct individuals (donkeys) to be picked out by antecedent and pronoun; s' and s'' are different. This is what allows for a different donkey to be picked out by the antecedent and pronoun. The situation s'' is provided via pragmatic inference rather than being present in the truth conditions from the beginning.

There is a problem with these truth conditions as they stand, however. The following scenario would appear to be possible with this meaning: some donkey, D-a, is used to verify the proposition that x donkey owns in s , and there is yet another donkey, D-b, is in s' , and the donkey pronoun refers to this donkey. The problem is that $s' \geq$

s. D-a is in s , and D-b is in s' , but because $s' \geq s$, D-a is also in s' . This problem is caused by the nature of the containment relation \geq .

One potential way out of this problem is to introduce a relation for relevant individuals to the restriction of the quantifier. A widely held view is that in quantified sentences such as ‘a cat always lands on its feet’, there is an implicit restriction over relevant situations or events that lead up to a certain action taking place. See (Heim 1982) for details. I suggest that the same sort of implicit restriction may be applied in the antecedent of a donkey sentence such that we only consider relevant owning situations, as was advocated for in Chapter 4.

We also need the consequent to contain quantification over larger situations s'' that contain both s and s' . This use of larger situation s'' containing both s and s' allows us to avoid the problem described above because there is no containment relation between s and s' . A formula including these modifications is shown in example (329). Here $s+s'$ represents the combination of situation s and s' . Crucially, in this case, there is no relationship between s and s' such as containment.

(329) For all x , s , s' such that x donkey-owns in s and there is y , y is a donkey belonging to x in s' , $R(x)(y)$ for some salient relation R in s' , there is $s'' \geq s+s'$ such that x pets [the unique donkey in s'] in s''

People may use each donkey in s as an exemplar. However, there may also be a donkey in s' that could be the same or different than the donkey in s . Thus, which the donkey that is owned and the donkey that is petted may be the same or different. To summarize what was presented in the above chapter, first we compared the choice functional approach advocated for in this work with other approaches to donkey anaphora. Next, we examined an alternative analysis of donkey anaphora and some variations on donkey sentences. Third, we examined other approaches to E-type anaphora and some alternative explanations of the data in this work. Fourth, we examined a distinction between different varieties of existential reading.

Chapter 6

SUMMARY AND CONCLUSIONS

In this work, I have aimed to address several problems encountered in the analysis of E-type anaphora; see Chapter (1) for an overview. There are several related research questions that I have aimed to address. Answers to these questions in conjunction can inform each other. These research questions are listed below in (330).

- (330)
- First, how should different E-type constructions be analyzed?
 - Second, how should donkey anaphora be analyzed, in particular, in terms of the manner in which interpretations (readings) are generated?
 - Third, should an ambiguity approach to indefinites be adopted?
 - Fourth, how different choices of indefinites, of anaphoric elements, and of tense affect the preferred (universal vs existential) interpretations of donkey sentences.

While the research questions mentioned above are not new, there are also novel problems that empirical trends presented in this work may help address. In attempting to provide answers to the research questions mentioned above, I conclude that a mixed approach to E-type anaphora, similar to, e.g., (Chierchia 1995) or (Brasoveanu 2008), is best supported. The approach argued for may be called “mixed” for two reasons. First, donkey anaphora is resolved in different ways depending on interpretation (reading). Second, different categories of E-type anaphora receive different analyses. The approach adopted also incorporates an ambiguity-based approach to indefinites that is inspired by but distinct from (Fodor & Sag 1982) and that includes a choice functional approach inspired by (Matthewson 2008). I argue that this approach is distinct

from unified approaches to E-type anaphora (unique/D-type, e.g., (Elbourne 2005) and familiar/dynamic-like, e.g., (Groenendijk & Stokhof 1991)) and non-ambiguity approaches to indefinites in that it is based on new empirical evidence about the effect of indefinite form on readings of donkey anaphora. Empirical results support approaches such as (Brasoveanu 2008) in which interpretations arise via antecedent indefinite rather than via anaphoric definite or pronoun because the effect of form of indefinite on donkey anaphora interpretation was greater than the effect of form of definite or pronoun.

Several empirical trends were obtained using offline experimental methods (see Chapter (2)) and typological methods (see Chapter (3)). The following variables were manipulated: E-type anaphora construction, antecedent indefinite syntax and semantics, and definite or pronoun syntax and semantics. There are three main empirical trends for which this thesis provides support. First, indefinite antecedent syntax and semantics has an effect on donkey anaphora interpretation (readings). In particular, there are more universal readings with *any* than *a* and with *a* than with *some*, and there were more universal readings with polarity indefinites and bare nouns than with unmarked indefinites. Second, indefinite has a stronger effect than definite or pronoun on readings. In particular, form of full definite DP did not have much of an effect on readings, and neither did form of pronoun (weak vs. strong, e.g., null vs. overt). Third, there are indefinite and pronoun compatibility effects.

I will discuss how interpretation of these trends can be used to address the research questions mentioned in (330) in the following sections. I also discuss some problems that these trends raise and how they may be addressed. First, I describe some more established problems and the solutions that I propose for them. Second, I describe some new problems that the thesis raises.

6.1 How to Treat Different E-Type Anaphora Constructions

One of the main contributions of the thesis is to provide insight into how different E-type anaphora constructions should be analyzed based on empirical trends

that demonstrate a connection between the scope-taking possibilities of indefinites and different interpretations of donkey anaphora (except that the scope-taking possibilities have not been measured directly). This contribution is made in the form of analyses of E-type anaphora in Chapter (4). The analyses presented provide insight into an as yet unresolved research question: why there is an alignment between the scope-taking abilities of indefinites and maximal vs. non-maximal interpretations of donkey anaphora, as reviewed in (Charlow 2015). Indefinites with forms more aligned with narrow scope tend to give rise to interpretations that can be analyzed with narrow scope existential or universal quantifiers. Such indefinites are analyzed in this work using properties and not with the use of choice functions. The interpretations that fall under this heading are existential via domain narrowing and universal interpretations of donkey anaphora.

Indefinites with forms more aligned with the ability to take exceptional wide (quantificational and binding) scope tend to give rise to an interpretation of donkey anaphora that is not substantially different from discourse anaphora; I have termed this interpretation a way of deriving readings via choice functions. Such indefinites are analyzed in this work as individual denoting and with the use of choice functions. That such indefinites should give rise to an interpretation of donkey anaphora similar to discourse anaphora can be explained by the fact that discourse anaphora itself would appear to involve a sort of exceptional scope, namely, binding scope across matrix clauses (Charlow 2020). However, this work avoids analyzing such apparent exceptional scope as true scope but instead aims to analyze it using repeated choice functions.

A simple and novel solution to the problem of how to treat the reference resolution of pronouns anaphoric with choice functional indefinites is offered: the same choice function is repeated via a mechanism such as pragmatic recovery. This approach is inspired by the work of (Matthewson 2008) and Kratzer (1998). The implications of an analysis involving repetition of a choice function require further investigation. Another contribution of this work is to provide partly novel solutions to the source of

universal readings problem (see section (1.2.2)).

6.2 Differences Between the Current Approach and Other Approaches

In this section, I summarize some differences between the current approach for addressing challenges in the analysis of E-type anaphora (see section (1.2)) in comparison to other approaches (see section (1.3)). It is an open question whether existing approaches can account for the empirical generalizations presented in this thesis. The current approach traces the primary source of existential and universal readings in donkey sentences to the indefinite. Here I endorse a mixed approach based on effect of indefinite form that other approaches do not.

There is no unbound variable problem in the proposed approach (see section (1.2.1)) because indefinites are not treated as existential quantifiers. Instead, I propose to treat indefinites either as properties that are evaluated in the end as existential or universal quantifiers or using choice functions, which are pragmatically recovered. As a result, the problem of how to deal with the scope of existential quantifiers denoted by indefinite antecedents does not arise. Consequently, the current approach differs from dynamic approaches such as that of Groenendijk & Stokhof (1991) that employ extension of the scope of existential quantifiers. The current approach also differs from some D-type approaches, e.g., (Elbourne 2005), in that a treatment of discourse anaphora is provided. The syntactic problem of relative clause donkey sentences stating that an indefinite in a donkey sentence is not in a position c-commanding the pronoun is no longer an issue either; this is because indefinites in donkey sentences are not analyzed as existential quantifiers to begin with; instead, they are analyzed as either properties or with the use of choice functions. As a result, they are not expected to c-command a pronoun from out of a relative clause. The option of utilizing choice functions is distinct from dynamic approaches in that it offers a unified analysis of discourse anaphora and an interpretation of donkey anaphora that is similar to that of discourse anaphora.

I have justified explanations of how both existential and universal readings arise. These explanations address the existential vs. universal interpretation problem described in section (1.2.3) and a problem with D-type approaches of not giving an account of existential readings. Different analyses of existential vs. universal interpretations are justified by differences in indefinite semantics that correlate with differences in overt syntactic form (SS) of indefinite. These differences may be responsible for bringing about variations in definite or pronoun semantics as well. One way of accounting for this correspondence between indefinite and definite or pronoun form is to treat indefinites as properties and employ the operation of Restrict (Chung & Ladusaw 2004) along with the mechanism of domain narrowing (Krifka 1996), or choice functions. Which sort of analysis is adopted depends on the indefinite form in question (see Chapter (4)). Thus, either an indefinite based ambiguity approach or a definite or pronoun based ambiguity approach is justified.

The current approach differs from ambiguity-based approaches such as (Chierchia 1995) and (Brasoveanu 2008) in that the differences in readings that the current approach posits are based on a greater number of empirical trends, in particular, from both experimental and cross-linguistic research. Different mechanisms are posited for the existential and universal interpretations, arising from forms of expressions in natural language.

Another feature of the current approach is that it offers an explanation of indefinite and pronoun compatibility effects (as observed in Chapter 3, cases in which certain forms of indefinite are more compatible with certain forms of pronoun). A key claim made in the current approach is to explain such indefinite and definite or pronoun compatibility effects. It does so by stating that there are correlations between indefinite and definite or pronoun denotation. First, property denotation of an indefinite correlates with unique resolution of a definite or pronoun. Second, individual denotation of an indefinite correlates with familiarity-based resolution of a pronoun. The linkage between scope of indefinites and donkey sentence readings is explained by proposing a mechanism for how indefinites appear to take scope in the

LFs for donkey sentences. This proposal is described in Chapter (4).

The current approach introduces and provides an explanation for an interpretation of donkey anaphora, here termed a “way of deriving existential readings via choice functions”. In the current approach, the way of deriving readings via choice functions is accounted for as follows. A choice functional definite picks out all and only those individual(s) that its antecedent picks out. Thus, using a CF, we can explain why universal readings do not arise. The analysis of a way of deriving readings via choice functions may be naturally extended to discourse anaphora when choice functions are treated as free variables, in which a pronoun plays a similar role. Thus, the current approach differs from D-type approaches such as (Elbourne 2005) in that it can account for both existential readings and discourse anaphora.

The effect of farmer determiner on readings noted by, e.g., Kanazawa (1994), can be explained through indefinite form as follows. Farmer determiners such as ‘every’ license both property and individual denotations of indefinites, while those such as ‘some’ license individual denotation better. This may be observed in the pattern illustrated in examples (331) and (332).

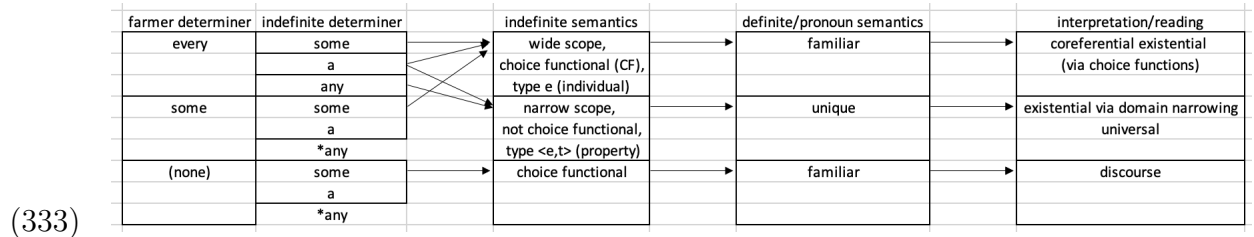
(331) Every farmer who owns a/some/any donkey pets it.

(332) Some farmer who owns a/some/#any donkey pets it.

Also, if indefinite syntax and/or semantics is carried over into a pronoun, then we have a natural explanation for why existential via domain narrowing and universal readings are blocked in discourse anaphora. Property denoting indefinites are not licensed in discourse anaphora. Thus, donkey pronouns are treated with the use of choice functions. If we assume that existential via domain narrowing and universal readings only arise through property denotation and not individual denotation, then they cannot arise when the donkey pronoun is treated using a choice function, which models individual denotation.

The interaction of the factors of FD, indefinite, and definite or pronoun in producing different interpretations of donkey and discourse anaphora is summarized in

(333). One feature of the current approach is that it can account for the interaction of said variables. On the other hand, most approaches to donkey anaphora and discourse anaphora account for only some of these variables and do not account for their interaction.



6.3 A Simple Dichotomy View of E-Type Anaphora

A view that I put forward as both a means of making sense of empirical trends and as a theoretically desirable goal is what could be termed a “simple dichotomy” (SD) view of E-type anaphora constructions and interpretations. The SD view states that E-type anaphora constructions and interpretations can be successfully classified on the basis of several characterizations listed below.

- maximality/non-maximality
- non-coindexation/coindexation
- unique/familiar
- exhaustive/non-exhaustive

An oft-cited problem is whether E-type pronouns should be paraphrased using non-minimal definite descriptions (DDs) (with modifying relative clause) (e.g. ‘the donkey that s/he owns’) or minimal (without modifying relative clause) definite descriptions (e.g. ‘the donkey’) (Elbourne 2005). Based in part on empirical trends, I argue that both are justified independent of E-type construction and number (singular/plural) of antecedent indefinite and pronoun/definite. Non-minimal DDs are more associated with uniqueness and maximality, while minimal DDs are more

associated with familiarity and non-maximality. The distinction between uniqueness and familiarity may in turn generate universal and existential interpretations of donkey anaphora respectively. As part of the SD view, I also adopt an extension of the distinction of unique vs. familiar reference resolution, namely that the distinction may in some cases correspond to a distinction between exhaustive vs. non-exhaustive reference resolution.

An issue raised by the trend of effect of indefinite on readings is what one might call the problem of “how indefinite has an effect on readings”. The question of how compatibility between indefinite and definite or pronoun arises is yet another problem. One could term this the problem of “indefinite and definite or pronoun correspondence”. The problem of “indefinite and definite or pronoun correspondence” may or may not be related to the problem of “how indefinite has an effect on readings”.

One answer to the problem of “how indefinite has an effect on readings” is that readings are mediated by definite or pronoun (with a more complicated model). That is, we have indefinite syntax/semantics being carried over into definite/pronoun in some way and thus have definite/pronoun ultimately having an effect on interpretation. This is a more accepted view. Another possible answer is that the indefinite itself is doing the work (i.e. we have a simpler model excluding definite or pronoun); this goes against the view that readings are mediated by definite or pronoun (with a more complicated model).

As discussed in section (4.3.2.1), one solution to address the problem of indefinite and definite or pronoun correspondence that is nearly ready made in the literature is to employ NP ellipsis, as in (Elbourne 2005), with an extension to DP ellipsis, and to combine this analysis with differences in pronoun structure, as in (Patel-Grosz & Grosz 2017). In this case, we can assume that antecedent structure has an effect on pronoun structure. A good feature of an NP/DP ellipsis solution is that it can also address the problem of how indefinite has an effect on readings. This is possible if we assume that readings are derived from definite or pronoun reference resolution, which is itself related to definite or pronoun structure; that is, in this case

we adopt a variant of the more complicated model mentioned above.

A mechanism to account for familiarity-based resolution is necessary. I adopt an extension of views in the literature, including those of [Matthewson \(2008\)](#) and [Kratzer \(1998\)](#), which I term a choice functional, pragmatic recovery (CFPR) view. One feature of the CFPR view is that it provides a solution to the problem of how indefinite has an effect on readings. Another feature of the CFPR view is that it offers insight into the problem of why discourse anaphora (exceptional binding scope) and exceptional quantificational scope are connected, in particular, why some indefinites but not others license both ([Charlow 2020](#)).

One interpretation of the experimental and typological data described in the thesis is that we should adopt a “predictive” view of E-type anaphora resolution. In particular, the empirical trends of greater effect of indefinite and than definite or pronoun form on donkey sentence interpretation might be taken to imply that the way an indefinite antecedent is interpreted affects the interpretation of an entire anaphoric dependency more than a definite or pronoun does; thus, prediction (due to indefinite) is a stronger factor in its interpretation than revision (due to definite or pronoun). Such a predictive view may be contrasted with a dynamic “update” (or non-predictive) view. For comparison of dynamic and static approaches, see, e.g., ([Charlow 2020](#)).

Finally, an additional view I put forward is what one could term a “way of deriving existential readings via choice functions” view. According to the this view, first, the way of deriving existential readings via choice functions (and not the way of deriving existential readings via domain narrowing) of donkey anaphora is the main way in which existential readings are derived. Second, the reading via choice functions of donkey anaphora is similar to discourse anaphora. One good feature of this view is that it offers a way of characterizing existential vs. universal readings of donkey anaphora that can be fit into the SD view. However, the question of whether existential via domain narrowing and wide scope aligned way of deriving readings can really be distinguished is in need of further empirical testing.

The current research focuses on experimental investigation of English and

non-experimental investigation of other languages. Future work may extend this research using experimental investigation of other languages.

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Appendix A

DATA SUPPORTING SIMILAR ANALYSES OF PAYCHECK AND BATHROOM ANAPHORA AND SOME INTERPRETATIONS OF DONKEY ANAPHORA

In this section I provide evidence in favor of similar analyses of paycheck and bathroom anaphora and some readings of donkey anaphora, as presented in chapter (4). In particular, evidence suggests that paycheck and bathroom anaphora are similar to the universal reading of donkey anaphora; an analysis of all three should take into account the fact that with all three, there is no necessary coreference between antecedent and pronoun. On the other hand, a different analysis of the existential reading is justified. Note however that the discussion of paycheck and bathroom anaphora here is somewhat peripheral because there is not much discussion of these constructions in the subsequent chapter; I introduce these results here more as interesting data points.

A.1 Bi (2018)'s Distinction of Donkey vs. Paycheck and Bathroom Anaphora

There is a cross-linguistic trend that provides evidence for a mixed approach to donkey anaphora. There is a complementary distribution of E-type pronouns in object position in Mandarin: paycheck and bathroom pronouns must be null, while donkey pronouns must be overt (Bi 2018). I asked whether this distribution has cross-linguistic validity. In particular, a research question I would like to address is presented in (334). Translations of “paycheck” sentences with an indefinite antecedent as seen in example (335) and with a definite possessive antecedent (‘his/her paycheck’), as is typical in the literature, were constructed. Similar trends were observed with both indefinite and definite antecedents. Data from languages in the sample are provided below.

- (334) Are null pronouns preferred over overt ones in paycheck and bathroom sentences as opposed to donkey sentences across languages?
- (335) A farmer who owns a donkey is wiser than a farmer who rents it.

A.2 Languages

Greek and Hungarian were excluded from the survey because paycheck sentences were judged unnatural with both null and overt pronouns (Mai Ha Vu, p.c.)

A.2.1 Armenian

A.2.1.1 Paycheck Pronouns

As for paycheck pronouns, in Armenian, with indefinite antecedents, a null pronoun and either a bare noun or an ‘a/one’ indefinite as shown in example (336) could have a paycheck reading. An overt pronoun as shown in example (337) could not, and it was only grammatical with an ‘a/one’ indefinite (Hossep Dolatian, p.c.).

- (336) Akarabagan mə vor eʃ (mə) uni aveli imastun e kan te
 Farmer INDF who donkey (INDF) has more wise is than
 akarabagan mə vor gə-varts̄-e.
 farmer INDF who PRES-rent-3SG.

‘A farmer who owns donkey(s) is wiser than a farmer who rents it.’

- (337) Akarabagan mə vor eʃ *(mə) uni aveli imastun e kan te
 Farmer INDF who donkey *(INDF) has more wise is than
 akarabagan mə vor ador gə-varts̄-e.
 farmer INDF who it/that_{medial} PRES-rent-3SG.

‘A farmer who owns a donkey is wiser than a farmer who rents it.’

In the case of paycheck sentences with definite antecedents, a null pronoun (338) could receive both paycheck and non-paycheck interpretations. On the other hand, one sort of overt pronoun *an* (339) could not receive a paycheck interpretation (Hossep Dolatian, p.c.).

- (338) mart-ə vor ir kork-ə kənets iran-e-n aveli
 man-DEF that.NOM his carpet-DEF bought.3SG Iran-ABL-DEF more
 harust e kan mart-ə vor kənets urkya-e-n
 rich is.3SG than man-DEF who bought.3SG *pro* turkey-ABL-DEF
 ‘The man who bought his carpet from Iran is more rich than the man who
 bought it from Turkey.’
- (339) mart-ə vor ir kork-ə kənets iran-e-n aveli
 man-DEF that.NOM his carpet-DEF bought.3SG iran-ABL-DEF more
 harust e kan mart-ə vor kənets an turkya-e-n
 rich is.3SG than man-DEF who bought.3SG it.3SG turkey-ABL-DEF
 ‘The man who bought his carpet from Iran is more rich than the man who
 bought it from Turkey.’

A.2.1.2 Bathroom Pronouns

Hyayr Khanjian (p.c.) rated sentence acceptability using a 5-point Likert-type scale. “Bathroom” sentences in Armenian with null pronouns as shown in examples (340, 341) were rated as more acceptable (4 on a 5-point scale, 5 on a 5-point scale), while parallel sentences with an overt pronoun as shown in examples (342, 343) were rated as less acceptable (3 on a 5-point scale, 2 on a 5-point scale). Thus, along with the paycheck data, there is positive evidence for the research question presented in (334).

- (340) gam ajs bantog-ə bedkaran ch-uni gam darorinag dey mən e.
 or this hotel-DEF bathroom NEG-has or unusual place INDF is.
 ‘Either this hotel doesn’t have a bathroom or it’s in a strange place.’

Acceptability rating: 4 on a 5-point scale

- (341) gam ajs bantog-ə bedkaran mə ch-uni gam darorinag dey mən e.
 or this hotel-DEF bathroom INDF NEG-has or unusual place INDF is.
 ‘Either this hotel doesn’t have a bathroom or it’s in a strange place.’

Acceptability rating: 5 on a 5-point scale

- (342) gam ajs bantog-ə bedkaran ch-uni gam adiga
 or this hotel-DEF bathroom NEG-has or that.distal.substantive
 darorinag dey mən e.
 unusual place INDF is.

‘Either this hotel doesn’t have a bathroom or it’s in a strange place.’

Acceptability rating: 3 on a 5-point scale

- (343) gam ajs bantog-ə bedkaran mə ch-uni gam adiga
or this hotel-DEF bathroom INDF NEG-has or that.distal.substantive
darorinag dey mən e.
unusual place INDF is.

‘Either this hotel doesn’t have a bathroom or it’s in a strange place.’

Acceptability rating: 2 on a 5-point scale

A.2.2 Japanese

Japanese allows for null pronouns in donkey anaphora (Kurafuji 1999) as in example (344).¹ Null pronouns can also be used in paycheck sentences such as (345) and bathroom sentences such as (346) (Kurafuji 1999). However, overt pronouns are less acceptable in these paycheck and bathroom sentences than in donkey sentences such as (344). Thus, there is partial positive evidence for the research question presented in (334).

- (344) [[Ronbun_i-o yon-da] dono gakusee]-mo sore_i-o/∅_i hihanshi-ta.
paper-Acc write-Past which student-∀ it-Acc criticize-Past
‘Every student that read a paper criticized it.’ (= (Kurafuji 1999), (4a), p.133)
- (345) John igai-no dare-mo-ga jibun-no kurejittokaadoj-o tsuma-ni
John except-Gen who-∀-Nom self-Gen credit.card-Acc wife-to
watashi-ta. John-wa ∅_i/??sore_i-o aijin-ni watashi-ta.
give-Past John-Top it-Acc mistress give-Past.
‘Everyone but John gave a credit card of his_i to his wife. John gave one of his_i to his mistress.’ (= (Kurafuji 1999), (8a), p.6)
- (346) Kono tatemono-ni toire_i-ga na-i ka, ∅_i/??sore_i-ga it-Nom
this building-in bathroom-Nom Neg-Pres or it-Nom funny
henna tokoro-ni a-ru ka-no dochiraka-dea-ru.
place-in exist-Pres or-Cop which-Q-Cop-Pres.
‘It is the case either that this building does not have a bathroom_i or that it_i is in a funny place.’ (= (Kurafuji 1999), (8b), p.7)

¹ This donkey anaphora is of the wh-headed relative clause variety.

A.2.3 Korean

A.2.3.1 Paycheck Pronouns

In Korean, with bare nouns, paycheck readings were available as can be seen in examples (347, 348), while non-paycheck readings (with antecedent and pronoun being coreferential) were marginal (Jinwoo Jo, p.c.). Paycheck readings were marginally available with a numeral and classifier phrase DP antecedent as can be seen in examples (349, 350) (Jinwoo Jo, p.c.).

- (347) Tangnakwi-lul soywuha-nun nongpwu-nun *pro* pilli-nun nongpwu-pota
donkey-Acc own-Rel farmer-Top *pro* rent-Rel farmer-than
hyenmyengha-ta.
be.wise-Decl.
'A farmer who owns a donkey is wiser than one who rents it.'
- (348) Tangnakwi-lul soywuha-nun nongpwu-nun kukes-ul pilli-nun nongpwu-pota
donkey-Acc own-Rel farmer-Top it-Acc rent-Rel farmer-than
hyenmyengha-ta.
be.wise-Decl.
'A farmer who owns a donkey is wiser than one who rents it.'
- (349) Tangnakwi-lul han mali soywuha-nun nongpwu-nun pilli-nun nongpwu-pota
donkey-Acc one CL own-Rel farmer-Top rent-Rel farmer-than
hyenmyengha-ta.
be.wise-Decl.
'A farmer who owns a donkey is wiser than one who rents it.'
- (350) Tangnakwi-lul han mali soywuha-nun nongpwu-nun kukes-ul pilli-nun
donkey-Acc one CL own-Rel farmer-Top it-ACC rent-Rel
nongpwu-pota hyenmyengha-ta.
farmer-than be.wise-Decl.
'A farmer who owns a donkey is wiser than one who rents it.'

Also, in Korean, in a paycheck sentence with a definite antecedent (351), a null pronoun was grammatical. In contrast, an overt pronoun would sound odd (Jinwoo Jo, p.c.).

- (351) Caki welkup-ul unhayng-ey ipkumha-nun salam-i (?kukel)
 self monthly.salary-Acc bank-Loc deposit-Rel person-Nom (?it.Acc)
 cwusik-ey thwucaha-nun salam-pota hyenmyengha-ta.
 stock-Loc invest-Rel person-than wise-Decl.
 ‘The person who deposits his/her paycheck to the bank is wiser than the person
 who invest it in stocks.’

A.2.3.2 Bathroom Pronouns

In Korean, in a bathroom sentence (352), a null pronoun was odd, but an overt pronoun was grammatical (Jinwoo Jo, p.c.). Thus, along with the paycheck data, there is positive evidence for the research question presented in (334).

- (352) yeki-ey-nun hwacangsil-i eps-kena (#kukes-i) engttwunghan kos-ey
 here-loc-top bathroom-nom not.exist-or (#it-nom) extraordinary place-loc
 iss-ta.
 exist-decl.
 ‘This place doesn’t have a bathroom or it is in a funny place.’

A.2.4 Mandarin

In Mandarin, a donkey pronoun as shown in example (353) must be overt, while a paycheck pronoun as shown in example (354) and a bathroom pronoun as shown in example (355) must be null (Bi 2018). This distribution is summarized in Table (A.1), taken from (Bi 2018). Thus, there is positive evidence for the research question presented in (334).

Table A.1: Distribution in Non-Subject Position

	<i>ta</i>	demonstrative	\emptyset	bare noun
book sentence (7)	✓	✓	✓	✓
paycheck sentence (10)	✗	✗	✓	✓
donkey-owner sentence (14)	✓	✓	✗	✗

- (353) mei-ge you lüzi_i de nongfu dou hui da ta_i/^{*}∅_i.
 every-cl have donkey de farmer all will beat ^{*}(it)
 ‘Every farmer who owns a donkey beats it.’ (= (Bi 2018), ex.(14))
- (354) chule Zhangsan, mei-ge-ren dou ba gongzikai gei-le qizi. Zhangsan
 except Zhangsan every-cl-person all ba paycheck give-perf wife. Zhangsan
 ∅_i/(ba ^{*}ta_i) gei-le qingfu.
 [it] give-perf mistress
 ‘Everyone except Zhangsan gave his paycheck to his wife. Zhangsan gave it to his mistress.’
- (355) zhe-dong lou yaome mei-you weishengjiani, yaome ∅_i/^{*}ta_i jiu zai
 this-cl building either not-have bathroom or it then in
 qiguaide difang
 weird place
 ‘It is the case either that this building does not have a bathroom or that it is in a funny place.’

A.2.5 Turkish

A.2.5.1 Paycheck Pronouns

In Turkish, with both bare noun and ‘a/one’ indefinites, null pronouns, as can be seen in examples (356, 357) were grammatical and could only receive a paycheck interpretation, while overt pronouns, as shown in examples (358, 359) were considered odd or ungrammatical (Dursun Altinok, p.c.).

- (356) eşeğ-i ol-an çiftçi kiralay-an-dan daha akıllı-dır
 donkey-ACC have-REL farmer rent-REL-COMP more smart-COP
 ‘A farmer who has a donkey is smarter than one who rents it.’
- (357) Bir eşeğ-i ol-an çiftçi kiralay-an-dan daha akıllı-dır
 One donkey-ACC have-REL farmer rent-REL-COMP more smart-COP
 ‘A farmer who has a donkey is smarter than one who rents it.’
- (358) *eşeğ-i ol-an çiftçi on kiralay-an-dan daha akıllı-dır
 donkey-ACC have-REL farmer it-NOM rent-REL-COMP more smart-COP
 ‘A farmer who has a donkey is smarter than one who rents it.’

- (359) *Bir eṣeğ-i ol-an çiftçi on kiralay-an-dan daha
 One donkey-ACC have-REL farmer it-NOM rent-REL-COMP more
 akıllı-dır
 smart-COP
 ‘A farmer who has a donkey is smarter than one who rents it.’

With a definite antecedent, in paycheck sentence (360), a null pronoun could receive a paycheck interpretation, while an overt pronoun was ungrammatical (Bilge Palaz, p.c.).

- (360) Maaş-ın-ı Ziraat Bankası-n-dan al-an kadın (*on-u) Halkbank-tan
 Salary-poss-acc Ziraat Bank-abl take-rel woman (*it-acc) Halkbank-abl
 al-an kadın-dan daha a kıllı-dır.
 take-rel woman-abl more smart-cop.3sg.prs
 ‘The woman who deposits her salary in Ziraat Bank is smarter than the woman who deposits it in Halkbank.’

A.2.5.2 Bathroom Pronouns

Also, in Turkish, in a bathroom sentence (361), a bathroom reading was available with a null pronoun but not with an overt pronoun (Dursun Altınok, p.c.) Thus, along with the paycheck data, there is positive evidence for the research question presented in (334).

- (361) Ya bu yerde banyo yok ya da o/*pro* garip bir yerde.
 Either this place-LOC bathroom not or it/*pro* strange a place-LOC
 ‘Either this place does not have a bathroom or it is in a strange place.’

A.3 Results

The overall results of this survey are summarized in Table (A.2) This table includes results with both indefinite paycheck antecedents (IPA) and definite paycheck antecedents (DPA). As can be seen in the table, there is positive evidence for a preference for null compared to overt pronouns in bathroom and paycheck anaphora, as opposed to donkey anaphora.

Table A.2: Preferences for Null vs. Overt Pronouns in Bathroom and Paycheck Anaphora

	evidence	evidence	source	forms tested
language	IPA	DPA		
Armenian	positive	positive	SB	null vs. overt (demonstrative)
Japanese	positive	N/A	(Kurafuji 1999)	null vs. overt
Korean	positive	positive	SB	null vs. overt
Mandarin	positive	N/A	(Bi 2018)	null vs. overt
Turkish	positive	positive	SB	null vs. overt

A.4 Discussion

There was a trend of a preference for null compared to overt pronouns in bathroom and paycheck anaphora as opposed to donkey anaphora. One explanation for this trend, along with the trend that weaker (e.g. null) pronouns sometimes give rise to more universal readings, described in section (3.3), is that donkey pronouns in sentences for which universal readings are preferred are more similar in structure to paycheck and bathroom pronouns compared to donkey pronouns in sentences with existential readings are preferred.

Appendix B

STIMULI USED IN EXPERIMENTS

B.1 Critical Experimental Items

In the following, I provide the contents of an experimental item file used in an MTurk experiment with present tense, *a* indefinites, and the pronoun *it*, as described in section (C.1). Other experimental item files were similar; however, they differed to reflect the fact that indefinite form, definite form, and tense/aspect were manipulated.

DonkeyIndefPres 101 UA

There were three different chefs. During the past week, chef number 1 baked one cake and moved it onto a table. Chef number 2 also baked one cake and moved it onto a table. Chef number 3 baked two cakes and moved only one of them onto a table.

True or False: Every chef who bakes a cake moves it onto a table.

DonkeyIndefPres 102 UA

There were three different workers. During the last workday, worker number 1 handled one box and taped it shut. Worker number 2 also handled one box and taped it shut. Worker number 3 handled two boxes and taped only one of them shut.

True or False: Every worker who handles a box tapes it shut.

DonkeyIndefPres 103 UA

There were three different people. Yesterday, person number 1 washed one shirt and folded it. Person number 2 also washed one shirt and folded it. Person number 3 washed two shirts and folded only one of them.

True or False: Every person who washes a shirt folds it.

DonkeyIndefPres 104 EA

There were three different patrons. On Friday night, patron number 1 carried one credit card and used it to pay their bill. Patron number 2 also carried one credit card and used it to pay their bill. Patron number 3 carried two credit cards and used only one of them to pay their bill.

True or False: Every patron who carries a credit card uses it to pay their bill.

DonkeyIndefPres 105 EA

There were three different actors. At the gala on Saturday, actor number 1 bought one outfit and wore it. Actor number 2 also bought one outfit and wore it. Actor number 3 bought two outfits and wore only one of them.

True or False: Every actor who buys an outfit wears it.

DonkeyIndefPres 106 EA

There were three different campers. Before a morning hike, camper number 1 packed one granola bar and ate it. Camper number 2 also packed one granola bar and ate it. Camper number 3 packed two granola bars and ate only one of them.

True or False: Every camper who packs a granola bar eats it.

DonkeyIndefPres 201 UA

There were three different queens. At the ceremony, queen number 1 accepted one chest and opened it. Queen number 2 also accepted one chest and opened it. Queen number 3 accepted two chests and opened only one of them.

True or False: Every queen who accepts a chest opens it.

DonkeyIndefPres 202 UA

There were three different kids. After the field trip, kid number 1 picked one flower and stuck it in a vase. Kid number 2 also picked one flower and stuck it in a vase. Kid number 3 picked two flowers and stuck only one of them in a vase.

True or False: Every kid who picks a flower sticks it in a vase.

DonkeyIndefPres 203 UA

There were three different players. During the tournament, player number 1 took one card and turned it face-up. Player number 2 also took one card and turned it face-up. Player number 3 took two cards and turned only one of them face-up.

True or False: Every player who takes a card turns it face-up.

DonkeyIndefPres 204 EA

There were three different pastors. On Sunday morning, pastor number 1 prepared one sermon and presented it at church. Pastor number 2 also prepared one sermon and presented it at church. Pastor number 3 prepared two sermons and presented only one of them at church.

True or False: Every pastor who prepares a sermon presents it at church.

DonkeyIndefPres 205 EA

There were three different hippos. For the past few hours, hippo number 1 passed one pond and entered it to lounge. Hippo number 2 also passed one pond and entered it to lounge. Hippo number 3 passed two ponds and entered only one of them to lounge.

True or False: Every hippo that passes a pond enters it to lounge.

DonkeyIndefPres 206 EA

There were three different magicians. At a casino at 8 o'clock, magician number 1 unpacked one costume and put it on for their show. Magician number 2 also unpacked

one costume and put it on for their show. Magician number 3 unpacked two costumes and put only one of them on for their show.

True or False: Every magician who unpacks a costume puts it on for their show.

DonkeyIndefPres 301 UA

There were three different guys. At the family reunion, guy number 1 took out one glass and filled it. Guy number 2 also took out one glass and filled it. Guy number 3 took out two glasses and filled only one of them.

True or False: Every guy who takes out a glass fills it.

DonkeyIndefPres 302 UA

There were three different cooks. Before the banquet, cook number 1 acquired one watermelon and lifted it onto a table. Cook number 2 also acquired one watermelon and lifted it onto a table. Cook number 3 acquired two watermelons and lifted only one of them onto a table.

True or False: Every cook who acquires a watermelon lifts it onto a table.

DonkeyIndefPres 303 UA

There were three different shoppers. In October, shopper number 1 bought one tomato and unloaded it into their fridge. Shopper number 2 also bought one tomato and unloaded it into their fridge. Shopper number 3 bought two tomatoes and unloaded only one of them into their fridge.

True or False: Every shopper who buys a tomato unloads it into their fridge.

DonkeyIndefPres 304 EA

There were three different couples. Last Wednesday from 9 to 10 p.m., couple number 1 investigated one dance hall and attended it. Couple number 2 also investigated one dance hall and attended it. Couple number 3 investigated two dance halls and attended only one of them.

True or False: Every couple who investigates a dance hall attends it.

DonkeyIndefPres 305 EA

There were three different employees. Before work on Thursday, employee number 1 considered one dress and zipped it up. Employee number 2 also considered one dress and zipped it up. Employee number 3 considered two dresses and zipped up only one of them.

True or False: Every employee who considers a dress zips it up.

DonkeyIndefPres 306 EA

There were three different professors. Last month, professor number 1 researched one breed of dog and chose it to be their family pet. Professor number 2 also researched one breed of dog and chose it to be their family pet. Professor number 3 researched two breeds of dog and chose only one of them to be their family pet.

True or False: Every professor who researches a breed of dog chooses it to be their family pet.

Appendix C

STATISTICAL MODEL CONSTRUCTION AND SELECTION, INCLUDING CODE FOR ANALYSES

C.1 Experiments on English Indefinite Determiners and *it*

In this section, I describe the model construction and selection procedure and provide the code in the R language for mixed effects models seen in section (2.1.3). Logistic mixed effects models were created using R (Team 2012) and the function “glmer” from the “lme4” library (Bates 2005). These models included fixed effects for the variables Indefinite and Tense and crossed random effects for the variables Subject and Item (Baayen, Davidson & Bates 2008). While including random slopes in a model is generally desirable (Harel & McAllister 2019), more complicated models with more random slopes reduce Type I error while also reducing power; it is therefore recommended that models include only as many random slopes as can be justified (Matuschek, Kliegl, Vasishth, Baayen & Bates 2017).

There are various approaches used for choosing the optimal model for a data set (Harel & McAllister 2019). I chose to use parsimonious models following the approach described in (Bates, Kliegl, Vasishth & Baayen 2015). Selection of these models involved starting with the maximal random effects structure that converged and simplifying the model by removing random slopes that did not significantly improve the model. Model convergence was assessed by attempting to construct a model in R; failure to converge was indicated with an error message when running an R script using the application RStudio. Models were compared in terms of fit for the data using the “anova” function in R. A full model with random slopes for both Subject and Item, a reduced model with random slopes for only Subject, and a minimal model without random slopes were constructed. In all three models, random intercepts for Subject

and Item were included. When all of these models failed to converge, a fourth model without random slopes and without a random intercept for Item was used. Random slopes for participants (subjects) are more important than random slopes for items (Rebecca Tollan, p.c.); thus, random slopes for Item were removed first to produce the reduced model. Models were evaluated to find significant effects using the “summary” command in R. Code for one of the mixed effects models mentioned in section (C.1) including random slopes for both Subject (WorkerId) and Item is shown in example (362).

```
(362) m1=glmer(Choice~(a_some+a_any)+(1+(a_some+a_any)|WorkerId)
          +(1+(a_some+a_any)|Item),data=data,family="binomial")
```

Appendix D
IRB/HUMAN SUBJECTS APPROVAL

The IRB at the University of Delaware has determined that the Mechanical Turk surveys used in the dissertation have Exempt status. The project submission number is [1357529-1], and the title is “Factors in the Interpretation of Anaphoric Dependencies”. All surveys began with a standard disclaimer, and all information was optionally given and kept anonymous.



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DATE: February 13, 2019

TO: Stefan Bartell
FROM: University of Delaware IRB

STUDY TITLE: [1357529-1] Factors in the Interpretation of Anaphoric Dependencies

SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF EXEMPT STATUS
DECISION DATE: February 13, 2019

REVIEW CATEGORY: Exemption category # (2)

Thank you for your submission of New Project materials for this research study. The University of Delaware IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will put a copy of this correspondence on file in our office. Please remember to notify us if you make any substantial changes to the project.

If you have any questions, please contact Renee Stewart at (302) 831-2137 or stewartr@udel.edu. Please include your study title and reference number in all correspondence with this office.

Appendix E

PILOT STUDY MEASURING READING TIMES OF DONKEY PRONOUNS

Pilot studies measuring self-paced reading times of donkey pronouns were conducted in order to put to test the hypothesis that reading times (RTs) for pronouns in donkey sentences and sentences as a whole would follow the trend presented in example (363). If indefinites with *some* instantiate a discourse referent in a discourse model or mental model, then it is possible that reading times for pronouns with indefinites with *some* will be higher because with such pronouns a search backward in memory or within a mental model is performed. On the other hand, if indefinites with *any* do not instantiate an individual in a mental model, then it is possible that no search backward will be performed with pronouns with indefinites with *any*. Thus, reading times with *any* will be lower. Reading times with *a* are expected to fall midway between the two if *a* is ambiguous between *some* and *any*.

(363) *some* > *a* > *any*

The sentences tested were almost identical to the sentences that were used in the experiments described in section (C.1). However, sentences were constructed with additional words at the end so that they did not end with the word *it*. Sentences did not end with *it* in order to avoid sentence wrap-up effects as described by (Just & Carpenter 1980). Also, sentences did not begin with ‘True or False:’. An example sentence is provided in example (364). Sentences were presented in a random order using PsychoPy (Peirce 2007).

(364) Every camper who packs a granola bar eats it hungrily.

In one pilot study, indefinite form was manipulated. There were six experimental items (two each with *some*, *a*, and *any*) and 12 filler items. Filler items used the same sentences as the fillers in the experiments described in section (C.1) but excluded ‘True or False: ’. There were eight native speakers of English. Participants read donkey sentences word by word and pressed the spacebar key on a computer in order to advance to each subsequent word. Critical regions in sentences include the pronoun *it*, the noun that is part of the indefinite antecedent, and the last word of the sentence. These regions are critical for the following reasons. They can tell us what the reading time for the pronoun is, and this reading time may offer clues as to how reference of the pronoun is resolved on the assumption that different reading times may be associated with different forms of reference resolution or a difference between search or lack thereof when subjects read the pronoun in question.

Additionally, the reading time for a noun that is part of an antecedent phrase is critical because it allows us to measure reading of a pronoun relative to its antecedent. Results are presented in Table (E.1). Mean RTs are listed in seconds (not milliseconds) for the pronoun *it*, as well as the last noun (N) in the indefinite NP/DP, the difference between *it* and the last noun in the NP/DP, the mean RT across all words in the sentences, and the difference between *it* and all words in a given sentence. The measure of difference in reading time between the pronoun *it* and all words in a given sentence was included in order to control for the possibility that some sentences as a whole might be read faster than others due to, e.g., pragmatic, lexical, or world knowledge factors.

Table E.1: Average Reading Times in Seconds for Donkey Indefinites and Pronouns
(with Fillers)

indefinite	<i>it</i>	N	<i>it</i> - N	sentence	<i>it</i> - sentence
<i>some</i>	0.63	0.58	0.05	0.56	0.07
<i>a</i>	0.47	0.49	-0.02	0.53	-0.06
<i>any</i>	0.51	0.71	-0.21	0.58	-0.08

In line with the hypothesis presented in (363), RTs for the pronoun *it* with *some* were higher than RTs with *a* and *any* (i.e. reading times were slower). The pronoun *it* with *some* did not differ much in RT relative to an indefinite noun compared to *a* and *any*; however, *it* displayed a higher RT relative to the mean RT across all words in sentences. Also in line with hypothesis (363), RTs for *it* with *any* were lower relative to indefinite noun. The above results provide tentative evidence for the claim that different indefinites give rise to different forms of anaphora resolution possibly associated with different operations in memory. In particular, narrow scope indefinite antecedents such as *any donkey* may give rise to D-type or uniqueness-based resolution and creation of an item in working memory. This creation of an item in working memory incurs less processing cost associated with anaphora resolution and gives rise to lower RT of a pronoun. In contrast, wide scope indefinites such as *some donkey* may give rise to familiarity-based resolution and retrieval of an item from working memory. This retrieval incurs higher processing cost, as indicated by higher reading time.¹

These results provide insight into addressing an apparent discrepancy between the results of two recent studies. Moulton & Han (2018) found a difference between what would appear to be non-c-commanded but semantically bound QP antecedents

¹ There are some complications with drawing the above inferences. Alternative explanations for why *some* indefinites might lead to slower processing may include deciding between different interpretations in terms of scope. Note as well that the above studies are only pilot studies with participants that have training in linguistics. Furthermore, counterbalanced lists must be added before any firm conclusions are drawn.

such as ‘each boy’ and referential DP antecedents such as ‘the boy’ using a GMME paradigm. They found a GMME for referential DPs only and thus argued for a difference in processing between the two, with only referential DPs being accessible to a pronoun outside a c-command domain.

Kush & Eik (2019), following up on (Moulton & Han 2018), examined anaphora with indefinite antecedents in donkey position (in the restrictor of a DP) in Norwegian using DPs headed by *the* and ‘every’. They also employed a GMME paradigm. They found a “comparable” GMME for both. In contrast to Moulton & Han (2018), Kush & Eik (2019) did not find a difference between what would appear to be non-c-commanded but semantically bound antecedent indefinites (e.g. ‘a daughter’) in the restrictor of DPs headed by determiners such as ‘every’ in comparison to definite DPs; they state that their results argue against Moulton & Han (2018)’s analysis. Kush & Eik (2019) state: “Our findings disconfirm [(Moulton & Han 2018)]’s broad prediction that non-referential phrases that do not c-command a pronoun are uniformly inaccessible to retrieval.” (p.8).

Moulton & Han (2018) and Kush & Eik (2019) did not employ the same contrast in antecedents, and this may have contributed to the difference in results. One possibility that can reconcile the results of the two studies is that not all indefinite antecedents are processed alike: narrow scope indefinites are processed similarly to QPs, while wide scope indefinites are processed similarly to referential antecedents. This idea is schematized in Table (E.2).

Table E.2: Alignment of Categories of Non-Indefinite and Indefinite DPs

non-indefinites	QPs	referential
indefinites	narrow scope	wide scope

If indefinites in Kush & Eik (2019)’s experiments were processed as wide scope

(like *some* indefinites) more than narrow scope (like *any* indefinites), then this picture could help explain the divergence findings of (Moulton & Han 2018) and (Kush & Eik 2019). One reason that indefinites in Kush & Eik (2019)’s experiments might have been processed as wide scope is that in Kush & Eik (2019)’s experiments, “Antecedent NPs were human-denoting NPs (e.g. *ei datter* ‘a daughter’ [...]).” (Kush & Eik 2019) (p.4). Such NPs might be more easily interpretable as either specific or unique relative to what the embedding DP denotes because a human-denoting DPs might be more likely to be interpreted as individuals rather than objects.

To return to a fundamental question about the nature of E-type anaphora, namely whether it is neither a bound variable nor referential (i.e. it is a third category), one possibility that suggests itself based on the above alignment is that E-type anaphora that is resolved via familiarity is not substantially different from anaphora with referential DP; referential DPs are accessed during anaphora resolution in a similar way (e.g., by searching backward in memory for a discourse referent that has been incorporated into a discourse model or mental model in the sense of Johnson-Laird (2010)). On the other hand, E-type anaphora that is resolved via uniqueness or a D-type strategy may be either similar to bound variable anaphora or may be similar to neither bound variable anaphora nor referential anaphora. That is, E-type anaphora may be a third category, as traditionally conceived. Further research is required to help decide between these analytical options.