12-13-2013

Logic and Grammar in Child Language: How Children Acquire the Semantics of Polarity Sensitivity

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University of Connecticut, 2013

This dissertation examines the acquisition of a phenomenon that lies at the interface of logic and grammar. Polarity-sensitive items (PSIs), including negative polarity items (NPIs) such as English *any*, are often characterized by their restricted distribution, and analyzed in terms of their *licensing condition* (compare *John doesn't have any books*, where *any* is licensed by negation, with the unlicensed **John has any books*). *Any* moreover oscillates between NPI uses and so-called 'free choice' uses (*John may choose any book*). While a small handful of previous acquisition studies on English *any* have targeted children's knowledge of the licensing condition, no previous study has systematically investigated children's knowledge of the complex underlying semantics of PSIs like *any*, let alone the question of how children are to reconcile the dual nature of *any*. The series of studies in this dissertation presents novel evidence from experiments and corpora demonstrating that children have incredibly sophisticated semantic knowledge of *any*, which includes the ability to generate subdomain alternatives, to (pre-)exhaustify these alternatives, to perform *domain widening*, and to compute so-called free choice inferences. Yet samples of parental spontaneous production reveal very little evidence that could inform the learner as to how to carry out the semantic operations required for adult-like interpretation of *any*. I propose that the solution to this learning problem lies in innately constraining the hypothesis space of PSI types. Such a restricted hypothesis space is available to us in the form of a generative typology put forth in Chierchia (2013), an analysis that derives the possible classes of PSIs on the basis of free variation along two dimensions: the kind of alternatives that the target PSI activates, and the mode of exhaustification that factors the alternatives into meaning. On the assumption that these two dimensions are innately specified, only a finite set of PSI types can be generated; I discuss how the learner might use *any*'s unique distributional properties in the input to map the string *any* to the target PSI within the typology of restricted options.

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How Children Acquire the Semantics of Polarity Sensitivity

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M.A., University of Connecticut, 2012

A Dissertation

Submitted in Partial Fulfillment of the

Requirements for the Degree of Doctor of Philosophy

at the

University of Connecticut

2013

APPROVAL PAGE

Doctor of Philosophy Dissertation

Logic and Grammar in Child Language:

How Children Acquire the Semantics of Polarity Sensitivity

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ACKNOWLEDGEMENTS

It has been nine years since I accidentally stumbled upon the wondrous world of linguistics. It is impossible to acknowledge here all the people who have, in that time, contributed to my training, education, and development as a linguist. It is my hope that **any**body and everybody who is owed thanks knows the depth of my gratitude.

Chronologically, the first person I should thank is Yves Roberge at the University of Toronto. I had never heard of Linguistics prior to his course. Yet by the end of that year (my second at U of T), I had switched my program of study to include a Major in (French) Linguistics, and by the following year was working on an Honors Thesis with Yves and applying to graduate programs in Linguistics. I am grateful to Yves, along with my other "first instructors" in linguistics (Cristina Cuervo, Elizabeth Cowper, Alana Johns, Yoonjung Kang, Diane Massam, Ana Teresa Pérez-Leroux, Mihaela Pirvulescu, and Jeffrey Steele) for tempting me into the field of linguistics, encouraging me and providing me with countless research opportunities to explore my interests. Finally, it was also at the University of Toronto that I met some of the loveliest linguists **ever** (whom I now run into at conferences these days): Christina Bjorndahl, Ailis Cournane, Ewan Dunbar, Meagan Louie, and Michelle St-Amour. Thank you to *all* of the Toronto linguists I had the pleasure of interacting with – you set the stage for what was to come, you set the bar high, and you will always feel like home to me.

In 2008, I started my PhD program at the University of Connecticut, and met my doctoral advisor for the first time. I can't thank Diane Lillo-Martin enough for all that she's done for me over the past five years. She kept me on track, provided a soundboard for my ideas, and always sent back insightful and constructive feedback (often without much turnaround time) – no matter how busy she was. And how**ever** crazy (I know) her schedule was, I never once felt like I was getting less than her full attention. For all my inability to stay put in one place for very long, or to focus on a single project for very long – she provided just the right kind of guidance, care, and support that I needed from an advisor, and for that I am incredibly grateful.

I would also like to thank the other members of my dissertation committee. Thank you to William Snyder for his support and encouragement, for always being willing to meet, and for providing excellent feedback and thought-provoking questions. Thank you to Jon Gajewski, who, frankly, has been enabling my addiction to negative polarity since the very beginning of my program. I came to UConn having never taken a semantics course – and have not been able to get away from semantics since that first year introduction.

Besides the faculty on my dissertation committee, I have also had the opportunity to work with some incredibly dedicated and talented linguists during my time at UConn, those who taught me, those who met with me, those I TAed for, those who provided feedback on my work in one form or another, and those who were simply a pleasure to be around (non-mutually-exclusive categories): Jonathan Bobaljik, Željko Bošković, Andrea Calabrese, Marie Coppola, Harry van der Hulst, Magdalena Kaufmann, Stefan Kaufmann, Susi Wurmbrand, and for regrettably less time, Jon Sprouse, Kathryn Davidson and Scott AnderBois. Yael Sharvit also deserves a nod here for overseeing my second generals paper, and more importantly, for telling me not to be afraid of semantics. Thanks to all for shaping me as a linguist.

For their support and good company through many a late night, I'd like to thank Jungmin Kang, who pulled double duty as Thrice-Roommate and Thousand-Times-Shopping Partner (in Mischief), and Zheng Shen, a superlative friend who contrary to popular opinion does not own the best albums by U2.

To **any** officemates, classmates, visitors, and friends at UConn with whom I've **ever** shared a drink, a meal, a dessert, a movie, a ride, an apartment, a joke, a song – thank you. These moments made my time in Storrs infinitely more colourful than it would have been without you. In alphabetical order, thank you to: Ana

Bastos-Gee, Safet Beriša, Karina Bertolino, Johnny Cheng, Jean Crawford, Marcin Dadan, Miloje Despić, Natasha Fitzgibbons, Mary Goodrich, Corina Goodwin, Zhanna Glushan, Gísli Harðarson, Ryosuke Hattori, Simona Herdan, Chris I-Ta Hsieh, Helen Koulidobrova, Pei-Jung Kuo, Renato Lacerda, Yu-Riu Liu, Troy Messick, Irina Monich, Beata Moskal, Emma Nguyen, Toshiko Oda, Koichi Ohtaki, Jayeon Park, Vanessa Petroj, Roberto Petrosino, Nina Radkevich, José Riqueros, Jelena Runić, Yuta Sakamoto, Tsuyoshi Sawada, Nilufer Şener, Serkan Şener, Yoshiyuki Shibata, Koji Shimamura, Peter Smith, Adrian Stegovec, Masahiko Takahashi, Kensuke Takita, Aida Talić, Abigail Thornton, Neda Todorović, Alexandre Vaxman, Julio Villa-García, Ting Xu, Jing Yang, YongSuk Yoo, and Cynthia Zocca. Thanks also to UConn alum Duk-Ho An, whose initial encouragement prompted my application to UConn.

I spent Spring 2012 in the Department of Linguistics at the University of Maryland, and I am grateful to Jeff Lidz for making the at-the-time fanciful idea of a visiting semester at Maryland a reality. The UMD department provided one of the most intellectually stimulating and productive environments I've **ever** worked in, and my dissertation owes a great deal to the time I spent there. Thanks to all the faculty and graduate students with whom I interacted for making it ridiculously difficult to leave once the semester was up. Special thanks to Sol Lago for showing me, among other things thankfully, how to beat a carpet with a broom.

In the critical last year leading up to the dissertation, I worked closely with Jacopo Romoli, whom I first met in New England, but whom I ultimately got to know in a short period of time in Sydney, Australia. Always quick with a joke, encouragement, and contagious enthusiasm for our joint projects – I am immensely grateful for the mentorship and continuing collaborations. Here's hoping for many more Australian flat whites, Irish beers, and French wines in our academic future.

I am also indebted to the folks at Macquarie University Centre for Cognition and its Disorders (CCD) for making me feel at home for four amazing months in early 2013, in particular: Stephen Crain, Rozz Thornton, Peng Zhou, Vincenzo Moscati, Graciela Tesan, Cory Bill, Mike Iverson, Kelly Rombough, and Aijun Huang. My time at the CCD, filled with discussions about the acquisition of semantics, was regrettably much too short, and I relish the thought of one day returning.

The research in this dissertation would not have been possible without the various labs and daycares that graciously opened their doors to me (and the families who participated in my studies): UConn Child Labs, Mansfield Discovery Depot, Discovery Learning Zone, Mt. Hope Montessori, UMD Language Acquisition Lab, UMD Center for Young Children, and the Macquarie CCD Acquisition Lab. The research herein also benefited greatly from support from the Social Sciences and Humanities Research Council of Canada.

I am indebted to my family for their unconditional love and support. My parents always told me to "Go study!", said it was the only thing I had to be good at – and they ought to have been more careful what they wished for, because now they can't understand why I want nothing more than to go to school and learn for the rest of my life. They may not understand what it is I do, but they are damned supportive, and for that I cannot be thankful enough. Being away from my baby sisters Amanda and Amy was probably the hardest part of moving to Storrs, CT for five-some years, but their love and support drove me to work doubly hard to make that time worth something.

And finally, to my partner and best friend, Alex, with whom I appear to be engaged in a never-ending competition to individually conquer the corners of the earth in the quest for **ever** higher education. The idea that I could thank him sufficiently for all that he does, in a single paragraph, is downright absurd. So I will simply look forward – as we have always done. Thanks for being my best friend in Toronto, and Waterloo, and Connecticut, and Maryland, and Sydney, Australia, and maybe Europe for the next little while. At some point, we will have to unpack the suitcases and settle down. Until then, here's to wher**ever** the next chapter and spin of the globe may take us. We could go **any**where...

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Chapter 1

Introduction

1. Background

One of the central undertakings of cognitive science is to understand how we acquire knowledge. Language acquisition in particular has been the focus of heated debate, generating a massive amount of research and theorization over the past half century. For all of the productive research that has been carried out, and all the progress that we have made in characterizing the child language development process, we are still struggling with the so-called *logical problem of language acquisition* (cf. Chomsky, 1965, 1975). How do children, in response to a finite set of input data from the environment, generalize to a complete set of grammatical representations that for all intents and purposes mirrors that of their caregivers?

For all of the progress that researchers have made toward answering the learnability questions for specific pockets of linguistic phenomena (e.g., constraints on pronominal interpretation, quantifier scope relations, argument structure, question formation, etc.), there remains contentious back-and-forth between the so-called nativist generative approach, which explains a great deal of children's success by appealing to innate acquisition mechanisms and linguistic knowledge, and domain-general approaches to language learning that posit acquisition on the basis of sensitivity to statistical regularities in the input. Of course these labels are overly general, and there are indeed pockets of research that attempt to bridge the gap by more rigorously investigating the interaction of the input data with the hypotheses that children purportedly must

entertain (cf. for example Yang, 2004 and Pinker, 1979); such attempts also more recently include targeted investigations of *how* a learner uses the linguistic input to arrive at the correct generalizations (cf. Lidz and Gagliardi, to appear; Gagliardi, 2012; Viau & Lidz, 2011; Omaki, 2010; Pearl & Lidz, 2009). Wherever this recent trend will take us, it is clear that for the moment the 'nature vs. nurture' debate is far from settled. In fact, in recent years, the debate has intensified, partly due to discoveries that children can in fact learn certain linguistic properties from statistical regularities in the input (cf. Saffran, Aslin, & Newport, 1996).

Against this background, I want to tackle two general issues in this dissertation. First, many of the developments in the field, including a recent shift to consider more and more seriously the possibility of language acquisition without innate abstract principles, have generally played out in the domain of syntax; I believe we are missing an important part of the picture by (relatively) neglecting the semantic component of the grammar.[1] Second, I will use the acquisition of a semantic phenomenon to address the so-called *Poverty of the Stimulus* (Chomsky, 1965, 1975). I will attempt to show that when we examine the semantic component of the grammar the way that we have the syntactic component, we find compelling evidence for a poverty of the stimulus argument. Yet there is a subtle tension here: whatever degree of impoverishment we want to ascribe to the input, the plain fact of the matter is that the input *cannot* be insufficiently rich, for the normally developing child inevitably acquires the target grammar. This tension between an input that at first glance may appear insufficiently rich, and the ultimate success that the child learner achieves, is in very broad terms what I will address in this dissertation.

---

[1] Going beyond the word level, i.e. lexical development, semantics/pragmatics is generally understudied within generative acquisition work. Notable exceptions include in-depth examinations of: quantifier scope interactions (cf. Gualmini, 2004; Lidz & Musolino, 2002; Miller & Schmitt, 2004; Musolino 1998; Musolino & Lidz, 2002, 2003, 2006), logical operators (disjunction, negation, conjunction, conditionals) (cf. Crain & Thornton, 2006 for a nice overview), scalar implicatures (cf. among many others, Chierchia et al., 2001; Gualmini et al., 2001; Guasti et al., 2005; Pouscoulous et al., 2007; Papafragou & Musolino, 2003), presupposition (Legendre, 2011; Yatsushiro, 2008a,b), and children's development of Theory of Mind (cf. Tager-Flusberg et al., 1997; Wimmer & Perner, 1983; Perner, 1988; Fodor, 1992; de Villiers, 2007). While these few topics have been the subject of intense study, it is generally the case that what researchers have relied on to argue for or against innate language-specific knowledge is evidence from syntax and syntactic development. While there are studies that target semantic phenomena, these have generally focused more on whether children are adult-like, than on how children can acquire the relevant phenomena. Perhaps it is because meaning is generally conceived of as much more transparent than underlying syntactic structure, and so one tends to take it for granted that children can and will learn 'all the right meanings' on the basis of evidence in the input.

2. Outline of the Study

The semantic phenomenon I will investigate is the semantics of so-called negative polarity items (NPIs). What most of the literature on negative polarity has focused on is the observation that NPIs like English *any* need to be "licensed" (compare (1) and (2)). One prominent account of NPI licensing is the Fauconnier/ Ladusaw hypothesis, according to which NPIs are licensed when they appear in the scope of a downward-entailing operator, i.e. an operator that licenses subset inferences.

(1) Alexandre did not attend any lectures.

(2) *Alexandre attended any lectures.

But adult-like knowledge of *any* entails knowing much more than its restricted distribution; in particular it entails a fair amount of sophisticated semantic knowledge (i.e. the key semantic mechanisms that underlie *any*'s restricted distribution). This dissertation will present a series of experimental and corpus studies meant to probe for this semantic knowledge; moreover these studies will all constitute steps towards a discussion of the learning problem that polarity sensitive items (PSIs) like *any* pose to the child learner.

Chapter 2 will start the ball rolling by presenting the object of study, namely the PSI *any*, and how this item is represented in the adult grammar. I'll present some prominent accounts of the NPI *any* from the theoretical literature, as well as the ingredients we'll need to investigate children's knowledge of NPI *any*. The key is to clearly define the adult grammar, as we take it to be the target of acquisition for the child learner. With this goal in mind, Chapter 2 will also present an experiment designed to tap into adults' intuitions concerning a particular property of *any*, namely that of domain widening. This experiment will investigate adults' sensitivity to the nature of *any*'s semantic alternatives, how these alternatives are factored into meaning, i.e. exhaustified, and how *any*'s domain of quantification contrasts with more restricted ones of plain indefinites like *a* and bare plurals.

Once we have a proper characterization of the adult grammar with respect to *any*, we'll move on to a discussion of the child data. Chapter 3 will begin by reviewing previous acquisition studies of 3-, 4-, and 5-year-olds' knowledge of *any*. In particular, I will argue that these studies overlooked the semantics of *any*,

and thus their claims of target performance cannot be equated with a claim that 4-year-olds have (complete) target knowledge of *any*. To rectify this, I will present an experiment that demonstrates that most (though not all) 4-year-olds have very sophisticated semantic knowledge that allows them to interpret *any* in an adult-like manner: they are able to identify the nature of *any*'s alternatives, generating them from the context; they are able to perform an exhaustification operation over these alternatives; moreover, they are sensitive to contrastive focus and can contrast *any*'s domain of quantification with more restricted domains available in the context.

In Chapter 4, I continue in the same vein by presenting novel experimental evidence that 4-year-olds are also adult-like in their comprehension of *any* on its so-called "free choice" instantiation (3); children can compute "free choice inferences" like that in (3), interpreting *any* in modal contexts in an adult-like way:

(3) You may write your paper on <u>any</u> topic.

→ You may write your paper on topic A, and you may write your paper on topic B, and you may write your paper on topic C, ...

In Chapter 5, I present the learning problem that the child learner faces: on the one hand, we will by that point have accumulated a great deal of evidence that children are target-like both in their production and comprehension of *any*. On the other hand, I will present an analysis of parental speech samples that reveal very little to no direct evidence for the semantic mechanisms and operations that would be required for children to display such target-like performance on our experiments. To solve this learning problem, I look to Chierchia's (2013) theory-driven typology of the kinds of PSIs that we can expect to find within and across languages. According to Chierchia, PSIs can differ along two dimensions: the kinds of alternatives that they activate, and the modes of exhaustification that use up those alternatives (and factor them into the meaning of the sentence). I argue that these two dimensions must be innately specified, such that the child only has to consider a restricted space of possible PSI categories; more specifically, these two dimensions and their respective range of parametric variation will only generate a restricted set of possible categories. The child's task is to use the unique distribution of *any* in the input (for which there is indeed observable

evidence) to map *any* to the target PSI within the typology of restricted options. The dissertation will close with discussion of some open questions, as well as some predictions of the proposed account.

Chapter 2

NPI *any* in the Adult Grammar

1. Introduction

In this chapter, we will begin our study in earnest by establishing the target grammar to be acquired by the child; after all, only once we have established an adequate characterization of the target structures can we begin to fully investigate the learning task that faces the child learner.

A great deal of literature has focused on the restricted distribution of the negative polarity item (NPI) *any*, attempting to derive appropriate licensing conditions that can capture its restricted distribution. Section 2 of this chapter will review some previous approaches to *any*, including a recent compositional implementation of *any*'s semantics. Section 3 will present an experiment designed to resolve some controversy surrounding *any*'s semantic contribution.

2. Theories of Negative Polarity Item *any*

Much of the literature on NPIs has focused on the fact that NPIs like *any* have a restricted distribution: they must be 'licensed' where they appear. While I will briefly describe that restricted distribution in this section, highlighting one prominent line of proposals concerning *any*'s licensing condition, the focus of this dissertation is on *any*'s semantics. The key semantic property of *any* that I will focus on, i.e. *domain*

widening, can, at least descriptively, be discussed independently of the particular view of licensing that one chooses to adopt; this is because any account of licensing must contend with the domain widening facts. In this chapter, I will present one particular approach to licensing that successfully ties licensing to the domain widening semantics of *any*. But the child data that we will subsequently discuss will not hinge on a particular account of NPI licensing, and any learnability story will ultimately have to contend with how children acquire the semantics of *any*, regardless of the particular account of NPI licensing adopted.

2.1 NPI Licensing

Any is licensed in the scope of negation in (1), but is ill-formed in the affirmative declarative sentence in (2).

(1) Alexandre did not attend any lectures.

(2) *Alexandre attended any lectures.

Given this pattern of behaviour, *any* is a so-called NPI; its distribution appears restricted to "negative" environments, and it is almost always acceptable under negation. The set of licensing environments for *any* extends well beyond negation however, as seen in (3)-(8).

(3) Nobody has any idea where Mathieu and Sophie have gone.

(4) Every Bluth Company investor who has any sense will sell their stock.

(5) If anybody wants office space, there is a free room down the hall.

(6) I regret giving Sasha any of my money.

(7) Did anybody survive the zombie apocalypse?

(8) I wonder whether Ron has any eggs.

A great deal of the extensive literature on NPI licensing has therefore been devoted to characterizing those environments which do appear to license NPIs like *any* (see among others, Fauconnier, 1975, 1979; Ladusaw, 1979; Linebarger, 1987; Heim, 1984; Horn, 1989; Kadmon & Landman, 1993; Krifka, 1995;

Giannakidou, 1998). One very productive line of research is built upon the Fauconnier-Ladusaw hypothesis, according to which NPIs are licensed by downward-entailing (DE) operators such as negation (Ladusaw, 1979, a.o.). A DE operator is one which has the logical property of validating set-to-subset inferences (9). According to the Fauconnier-Ladusaw proposal (10), NPIs are licensed in the scope of such DE expressions.

(9) A function of type $<\sigma,\tau>$ is downward entailing iff for all x,y of type σ such that $x \Rightarrow y$: $f(y) \Rightarrow f(x)$.

(10) An NPI is only grammatical if it is in the scope of an α such that [[α]] is downward-entailing.

(von Fintel, 1999:100)

While the affirmative (11a) entails (11b), the addition of negation, a DE operator, reverses the direction of entailment such that truth is preserved when moving from the superset (12a) to the subset (12b).

(11)a. Alexandre is a father

b. ⇒ Alexandre is a man

(12)a. Alexandre is not a man

b. ⇒ Alexandre is not a father

The negative quantifier *no NP* is DE (13) and licenses *any* (14), while the existential quantifier *some NP* is not DE (15) and fails to license *any* (16).

(13) No students read novels ⇒ No students read fantasy novels

(14) No students saw <u>any</u> movies over the weekend

(15) Some students read novels ⇏ Some students read fantasy novels

(16) *Some students saw <u>any</u> movies over the weekend

Other examples of licensing environments include the restrictor of universal quantifiers, antecedents of conditionals, the scope of adversative predicates such as *regret* and *sorry*, the scope of *only,* superlatives, and matrix and embedded polar questions.

A number of *any*'s licensing environments have been shown not to be strictly DE, and thus have been cited as counterevidence to the DE hypothesis (cf. Linebarger, 1987 for extensive discussion of noted counterexamples). (17) for example shows that *only* is not strictly DE, despite licensing *any* (18).

(17)a. Only Ethan read a book

b. $\not\Rightarrow$ Only Ethan read a linguistics book

(18) Only Ethan has <u>any</u> linguistics training

von Fintel (1999) argues that the presuppositional content of the expressions involved interferes with the evaluation of the relevant DE inferences. (17b) for example, presupposes that *Ethan read a linguistics book*, and failure to satisfy this presupposition interferes with our evaluation of the entailment relation in (17). von Fintel proposes the modified notion of downward entailment in (19), according to which DEness is evaluated on the assumption that all the conventional implicatures and presuppositions of the premises and conclusion are satisfied:

(19) Strawson downward entailment

A function of type $<\sigma,\tau>$ is Strawson-DE iff for all x,y of type σ such that $x \Rightarrow y$ and f(x) is defined: $f(y) \Rightarrow f(x)$.

(von Fintel, 1999:104)

By adding the definedness condition in (19), von Fintel eliminates the problem of having to judge truth values in contexts containing unsatisfied presuppositions. Indeed we see that once we add the premise that the conclusion's presupposition in (17) is satisfied, i.e. that it is true that *Ethan read a linguistics book* (in addition to the presupposition that *a linguistics book is a book*), the entailment goes through without issue:

(20) A linguistics book is a book

Ethan read a linguistics book

Only Ethan read a book

∴ Only Ethan read a linguistics book

While debates over adequate licensing conditions are far from definitively settled, von Fintel's (Strawson-)DE account appears to be sufficient for the purposes of capturing the restricted distribution of the English NPI *any*, and thus we will adopt it here in our discussion of children's acquisition of negative polarity.[1] Any differences among alternative accounts of licensing will not play a substantive role in the discussion (nor will I aim to use the child data to tease apart alternative accounts of licensing). In the coming chapters, I will separate children's acquisition of the licensing condition, i.e. of *any*'s restricted distribution, from their acquisition of *any*'s semantic contribution, i.e. its meaning. Insofar as these are discussed separately, any adequate account of NPI licensing in the adult grammar will suffice for the discussion.

[1] Rather than modify the relevant notion of DEness, alternative licensing accounts instead attribute licensing to properties other than DEness. Giannakidou (1998, 2011) for example, attributes licensing to the property of non-veridicality, defined for propositional operators as follows:

(i) A propositional operator *F* is veridical iff *Fp* entails or presupposes that *p* is true in some individual's model M(x); *p* is true in M(x), if M(x)⊂*p*.
(ii) If (i) is not the case, *F* is nonveridical.

(Giannakidou, 2011:1676)

As we obtain more diverse data sets from cross-linguistic investigations of NPIs, it may become apparent that different approaches fare better with different languages. In Mandarin Chinese for example, non-interrogative uses of the wh-indefinite *shenme* 'what' are claimed to be subject to a 'weaker' licensing condition than *any*, namely non-veridicality (Lin, Weerman, & Zeijlstra, 2013; cf. also Liao, 2011). I leave the issue of cross-linguistic variation aside until Chapter 5, where we discuss how the cross-linguistic picture bears on the learnability of polarity sensitivity. There however, focusing on the semantics of negative polarity, I will adopt an exhuastification-based framework posited to capture cross-linguistic variation in the polarity sensitivity system; thus I will not go any further into non-veridicality here.

2.2 The Semantics of *any*

2.2.1 Domain Widening

Kadmon and Landman's (1993) paper was a hallmark attempt to explain *why* NPIs ought to be sensitive to a logical notion such as downward entailment. According to Kadmon and Landman's influential thesis, we can derive the restricted distribution of *any* by looking at a quirk of its quantificational properties: *any* widens previously restricted domains of quantification along contextually given dimensions, giving rise to an apparently reduced tolerance of exceptions. Consider the following example:

(21) *[Conversation in a department store]*

A: Do you have a camera? / Do you have cameras?

B: No.

A: Nothing too fancy, even a disposable camera will do.

B: I don't have ANY cameras.

Imagine that the initial domain of quantification starting with A's query is set to cameras of a decent grade that one might look to purchase in a department store, e.g., one that by contextually determined technological standards, includes only digital cameras of a decent grade, and excludes one-time-use disposable cameras. The observation is that B's final assertion (containing *any*) quantifies over a wider domain that has in fact been expanded to include even basic disposable cameras, which were initially treated as exceptions to the domain. That is, B's final assertion "widens" the domain of quantification such that disposable cameras no longer count as exceptions to the claim that B does not have cameras.[2] This latter

[2] Notice that B could also reply with: *In that case, yes, I have some*. This suggests that the initially restricted domain did not include disposable cameras (hence B's initial negative response), but was subsequently expanded to include disposable cameras (hence B's changing his response to *yes*).

point exemplifies Kadmon and Landman's observation that *any* is somehow less tolerant of exceptions to the domain.[3]

The typical cases of "widening" provided in the literature involve this kind of contrast between the wider domain of *any* and a more restricted initial domain of quantification. *Any*, however, can be uttered out of the blue, and in such contexts, the domain of quantification can be set any which way (Chierchia, 2013). In (22) for example, the customer can issue his initial query using *any* rather than the plain indefinite *a*; in such a case, the initial domain could still exclude disposable cameras (i.e. it might still be restricted to digital cameras of a decent grade that one might expect to buy in a department store); the dialogue could continue as it did in (21), with the final use of *any* still quantifying over a wider domain.

(22) *[Conversation in a department store]*

A: Do you have <u>any</u> cameras?

B: No.

A: Nothing too fancy, even a disposable camera will do.

B: I don't have <u>ANY</u> cameras.

B': Oh, in that case, yes, I have some.

According to Kadmon and Landman's analysis, the key to licensing *any* is the following: widening must yield a stronger assertion. That is, the statement on the "widened" interpretation (i.e. after domain widening) must entail the statement on the narrower interpretation. *Any* is licensed under negation because negatively quantifying over a larger domain yields a stronger assertion than the same assertion quantifying over a

[3] Of course it is A's preceding utterance that first introduces disposable cameras to the domain of discourse; the point however is that while *any* can quantify over the wider domain (which now includes disposable cameras), a regular plain indefinite like *a* cannot (Chierchia, 2013):

(i) A: Do you have a camera?
B: No.
A: Nothing too fancy, even a disposable camera will do.
B: #I don't have <u>A</u> camera!

narrower domain. Notice the contrast between the direction of entailment in the affirmative, upward-entailing (UE) (23) and that in the negative, DE (24):

(23)a. I saw a student [D: in the UConn linguistics lounge]

b. I saw a student [D': in the UConn linguistics building]

c. I saw a student [D'': on the UConn campus]

(24)a. I didn't see a student [D'': on the UConn campus]

b. I didn't see a student [D': in the UConn linguistics building]

c. I didn't see a student [D: in the UConn linguistics lounge] (where D⊂D'⊂D'')

The direction of entailment in (23) goes from (23a) through to (23c); the strongest assertion one can make, given these three alternatives, is the one quantifying over the narrowest domain. If *I saw a student* where the set of contextually relevant students are those in the linguistics lounge, then it is also true that *I saw a student* in the linguistics building, and likewise it is true that *I saw a student* where the set of students I have in mind are those on campus. But negation reverses the direction of entailment in (24) such that the strongest assertion of the three alternatives is the one that quantifies over the largest domain, i.e. it entails the other two alternatives. If I did not see any students on campus, then it follows that I did not see any students in the linguistics building or in the linguistics lounge.

Thus under Kadmon and Landman's story, *any* widens the domain of quantification, and is licensed under negation (and other DE operators) because it is precisely in these environments that widening results in a stronger assertion. Kadmon and Landman rooted these properties in the lexical semantics of *any* and did not develop a compositional analysis of its behaviour.[4]

[4] Lee and Horn (1994) also converge on this characterization of 'widening', but induce the widening effect through the use of an underlying *even*. It is this silent *even* that is responsible for triggering expansion of the set to include unlikely and atypical exemplars. Under this account, NPI *any* denotes a low endpoint on a scale of quantities, and under negation triggers a meaning akin to 'not even a single X' or 'not even the least bit of X'.

Krifka (1995), building on similar intuitions regarding the strengthening effect of *any*, links domain widening to quantity implicatures. He assumes that NPIs introduce alternatives, and moreover that these alternatives induce an ordering relation of semantic specificity, with the NPI denoting the most specific element of these alternatives. *Anything* yields the assertive content of *thing*, but because of its alternatives, further triggers an implicature that the assertion containing *any* is the strongest of the alternatives.[5] In positive environments, negating semantically stronger alternatives yields a contradiction, while in scale-reversing/DE environments, the assertion and the implicature are consistent. In more recent work building on the earlier insights behind Kadmon and Landman's and Krifka's proposals, Chierchia (2006, 2013) provides a compositional implementation of *any*'s semantics.[6] Under this analysis, *any* is truth-conditionally equivalent to plain indefinites (like *some* or *a*) (25), but activates a set of alternatives corresponding to the indefinite associated with more restricted domains of quantification available in the context, i.e. its subdomain alternatives (26):

(25) $\|\text{any}\| = \|\text{some}\| = \lambda P \lambda Q \exists x \in D[P_w(x) \& Q_w(x)]$

(26) $\|\text{any}\|^{\text{D-ALT}} = \|\text{some}\|^{\text{D-ALT}} = \{\text{some}_{D'}: D' \subseteq D\}$

(Chierchia, 2006; 2013)

Crucially, active alternatives must be factored into meaning. This is carried out through the use of exhaustification operators. In the case of NPIs like *any*, subdomain alternatives are exhaustified via a covert *only*-like operator (27).[7] Exhaustification via O eliminates any alternatives that are not entailed by the assertion, yielding the consequence that the assertion is stronger than all of the activated alternatives.

---

[5] In a similar vein, Lahiri (1998) proposes that the lexical meaning of *any* includes a component similar to the focus particle *even*.

[6] Chierchia's account of *any* is part of a larger proposal that attempts to reconcile different polarity-sensitive elements (NPIs, free choice items, negative concord items, etc.) within a recursive compositional system of scalar implicatures. We will focus here on his implementation of *any* as an NPI, and turn to free choice *any* in Chapter 4.

[7] Covert O and *only* differ in that O asserts rather than presupposes the truth of its prejacent. This difference will not bear on the present discussion.

(27) $O_c(p) = p \,\&\, \forall q \in C\, [q \rightarrow p \subseteq_C q]$, where C=ALT

(Chierchia, 2006; 2013)

In Chierchia's analysis, *any* bears a [+D(omain)] feature which must be checked by an exhaustifying operator that bears the same feature (i.e. O_{DA}, which operates over domain alternatives). Obligatory exhaustification is thusly encoded in the syntax. Semantically, *any* can only occur in DE environments because these are the environments that satisfy the requirements of the exhaustification operator; in a non-DE environment, exhaustification will yield a logical contradiction. Take the sentence in (28a), which corresponds to the literal meaning in (28b). The alternatives that *any* activates correspond to all the possible ways of dividing up the domain D into smaller subdomains (e.g., smaller subdomains of novels in D, let's say *fantasy novels*, *sci-fi novels*, and *romance novels*), represented schematically in (28c). (28a) essentially amounts to saying that John has one or more novels in D (i.e. one or more fantasy, sci-fi, or romance novels) (28d). The problem arises when we attempt to exhaustify the alternatives (28e). Negating the stronger alternatives amounts to saying that John doesn't have any of the specific kinds of novels, which is in contradiction to the assertion that he does have one or more of these novels (28f).[8]

(28)a. *John has any novels

b. $\exists x \in D[\text{novel}_w(x) \wedge \text{have}_w(j,x)]$

c. {f,s,r}

{f,s} {s,r} {f,r}

{f} {s} {r}

d. $[\text{novel}_w(f) \wedge \text{has}_w(j,f)] \vee [\text{novel}_w(s) \wedge \text{has}_w(j,s)] \vee [\text{novel}_w(r) \wedge \text{has}_w(j,r)]$

e. $O_{DA}([\exists x \in D[\text{novel}_w(x) \wedge \text{have}_w(j,x)])$

[8] Generalizing, in any UE environment, none of the alternatives will be entailed by the assertion and will have to be eliminated, yielding a logical contradiction. While the [+D] feature on *any* can still be checked by the O operator, i.e. satisfying the syntactic requirement, exhaustification will fail to yield a consistent semantics, i.e. failing to satisfy the semantic requirement of NPI licensing. It is the latter that makes *any* ungrammatical in UE environments.

f. $[\text{novel}_w(f) \wedge \text{has}_w(j,f)] \vee [\text{novel}_w(s) \wedge \text{has}_w(j,s)] \vee [\text{novel}_w(r) \wedge \text{has}_w(j,r)]$

$\wedge \neg([\text{novel}_w(f) \wedge \text{has}_w(j,f)]) \wedge \neg([\text{novel}_w(s) \wedge \text{has}_w(j,s)]) \wedge \neg([\text{novel}_w(r) \wedge \text{has}_w(j,r)])$

(adapted from Chierchia, 2013:166, Ex. 45)

Exhaustification is consistent however, in a DE environment (29a,b). Again, the set of subdomain alternatives correspond to the more restricted domains of quantification in the context, yielding the assertion in (29c). In this case, as in any DE environment, the relevant alternatives are all entailed, so exhaustification does not yield a logical contradiction (29d). If John doesn't have any novels, it follows that he doesn't have any specific kinds of novels. In other words, (29a) has the effect of a plain negative existential statement.

(29)a. John doesn't have any novels

b. $\neg\exists x \in D[\text{novel}_w(x) \wedge \text{have}_w(j,x)]$

c. $\neg([\text{novel}_w(a) \wedge \text{have}_w(j,a)] \vee [\text{novel}_w(b) \wedge \text{have}_w(j,b)] \vee [\text{novel}_w(c) \wedge \text{have}_w(j,c)])$

d. $O_{DA}(\neg\exists x \in D[\text{novel}_w(x) \wedge \text{have}_w(j,x)])$

$= \neg\exists x \in D[\text{novel}_w(x) \wedge \text{have}_w(j,x)]$

(adapted from Chierchia, 2013:166, Ex. 47)

To summarize then, *any* is lexically specified to trigger obligatory exhaustification of its subdomain alternatives. This exhaustification succeeds in DE environments but fails in non-DE environments.

2.2.2 Problems

Despite the fairly strong intuitions behind the domain widening thesis, some have objected that domain widening can't be central to *any*, because it does not arise as systematically as claimed. The objection is that when we go beyond the clean minimal pair examples in the literature (e.g., *I don't have a potato* vs. *I don't have ANY potatoes*), judgments are not as clearcut as expected. As Arregui (2008) points out, plain

indefinites may not always restrict even when there is a salient restriction in the context (30), and *any* may not always widen as expected (31).

(30) A friend approaches you at a barbecue with a plate of veggie burgers he has recently finished cooking. They are burnt.

Your friend: Do you want veggie burgers?

You: No thanks, I don't want veggie burgers.

(Arregui, 2008:48, Ex. 9)

(31) You: Do you know French writers or singers?

Me: I don't know any writers, but I know singers. (=I don't know any French writers)

(Arregui, 2008:51, Ex. 17)

In (30), the bare plural *veggie burgers* in the second utterance seems not to be restricted to the salient set of burnt veggie burgers; in (31), uttering *any* does not seem to expand the domain of writers beyond French ones.[9]

In her objections, Arregui rightly argues that her data reveal a disconcerting lack of categorical difference between regular indefinites and *any* indefinites. She suggests that we need more systematically collected data that speak to the predicted differences between plain indefinites and *any*. Under the Kadmon and Landman-/Krifka-/Chierchia branch of accounts, and given the objections raised by Arregui, what we can safely say is that *any* has the *potential* to quantify over "larger" domains than plain indefinites; that is, *any* can but need not always quantify over wider domains. So when we refer to the 'domain widening' property of *any*, what we really mean to refer to is a *potential for domain widening*. Moreover, the problem seems to be that a satisfying explanation of why *any* is licensed in DE environments, even one that links its

[9] In a somewhat similar vein of objections, see also Duffley and Larrivée (2010) for an argument that the scalar endpoint meaning of *any*, i.e. the *even the least/even a single* meaning apparent in the typical examples of domain widening, is not a part of *any*'s core meaning. Rather, these authors argue that the scalar meaning arises as a product of the interaction of the NPI with contextual factors.

restricted distribution to its semantics, does not on its own appear to be sufficient to systematically capture when domain widening does and does not occur.

It is difficult to systematically compare "potential" domain sizes without controlling for what sets of individuals count as relevant in a particular context. This is where careful semantic/pragmatic experimentation that can systematically control for relevant subdomain alternatives can fill a critical gap. What is required is a way to systematically evoke categorically different responses to *any* compared to plain indefinites. Yet there has been relatively little psycholinguistic study investigating domain widening with *any*. One problem is that it is not a trivial task to get exactly at domain widening and not some possibly confounding phenomenon (such as the scope of *any* relative to licensers within the relevant sentences).

In the next section, I describe a study that was designed to meet the need for systematically elicited judgments about domain widening. The experiment was devised to measure the relative degree to which participants could restrict the domain of quantification for different indefinites, namely *any*, *a*, and bare plurals. What we wanted to know was whether, when provided with clearly defined subdomain alternatives in the context, adults would interpret *any* as quantifying over larger domains than plain indefinites.

3. Experiment 1: Evidence for Domain Widening

3.1 Method

3.1.1 Subjects

We tested 145 adult native speakers of English (99 females, 46 males). All participants were undergraduate linguistics/psychology students at the University of Connecticut or the University of Maryland. Participants were paid $10 or received course credit for participating. All were native English speakers according to the information filled out on the consent forms.

3.1.2 Procedure

We tested adults' interpretations of negatively quantified sentences containing different indefinites using the Truth Value Judgment Task (TVJT) methodology (Crain & Thornton, 1998, 2000). The task was carried out by a single experimenter using a laptop computer. Stories were told (by the experimenter) using cartoon pictures and animations created and displayed in PowerPoint. Pre-recorded video clips of a puppet created the pretense that the puppet was participating in the task live via webcam. Participants were told that the puppet was not very good at paying attention to stories, and were given a scorecard to fill out, with the goal of helping the puppet to learn how to pay better attention. At the end of each story, the puppet was asked a question about the story. The participant's task was to determine whether the puppet's statement was 'right', in which case s/he was instructed to put a stamp under the 'smiley face' column of the scorecard. If the puppet was 'wrong', the participant was instructed to put a stamp under the 'sad face' column of the report card. We also elicited follow-up justifications from subjects to ascertain their reasons for providing *yes* or *no* responses. All subjects were tested individually. Sessions were videorecorded for subsequent coding and analysis.

One of the reasons for using this child-friendly (TVJT) method was that we wanted to be able to eventually replicate the experiment with young children. Subjects were told of this in advance of starting the experiment so that they were not thrown off by the puppet ruse or use of the scorecard.

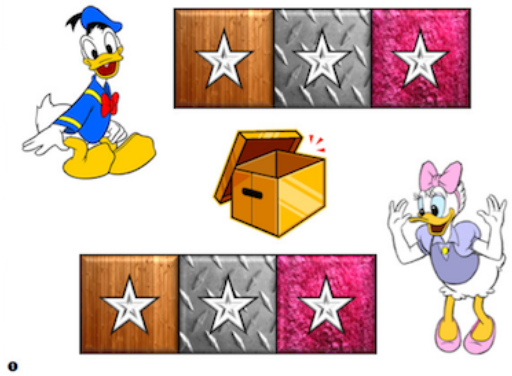
3.1.3 Materials

We designed experimental situations that made negatively quantified statements felicitous. The context clearly provided different possible (sub)domains of quantification. On the critical test trials, the context would also make one of these possible subdomains highly salient; importantly, the relevant subdomain was not the largest of the possible domain alternatives but rather a restricted subdomain. Depending on whether subjects accepted the negatively quantified test sentence, we could infer whether they were associating the relevant indefinite with the more restricted subdomain, or whether it had to quantify over a larger domain alternative. Acceptances or rejections of the puppet's statements, along with appropriate follow-up

justifications, were taken as a measure of subjects' ability to restrict the domain of quantification to just the salient subdomain.

Each subject received two training items, followed by four test and four control items, which were randomized and counterbalanced. The four test trials varied in the dimension along which widening could be expected (colour, pattern, size, and texture). An example test story is provided in Fig. 1.

Fig. 1. Experiment 1: Example test story



(Slide 1/8)

"This story is about Donald and Daisy. They're doing some puzzles. See, they have to put a wooden star here, a metal star here, and a fuzzy star here.
Oh no! The puzzle box is empty! Where all the pieces?"

(Slide 2/8)

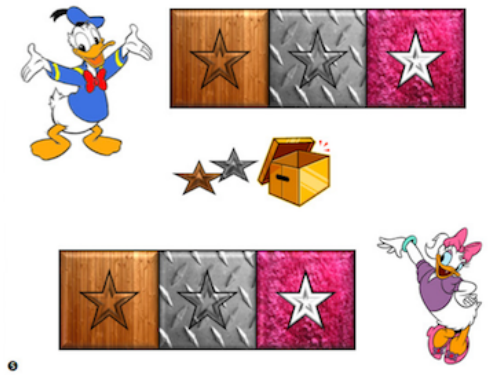
"Silly Goofy! He's taken all the puzzle pieces and hidden them all over the attic! If Donald and Daisy want to finish their puzzles, they're going to have to find some stars!"

(Slide 3/8)

"Can you find all the wooden stars? Can you find all the metal stars? What about the fuzzy stars? They're all the way up on the clock! Good job. Let's see if Donald and Daisy can find them."

(Slide 4/8)

"Donald and Daisy find all the wooden stars and all the metal stars!"

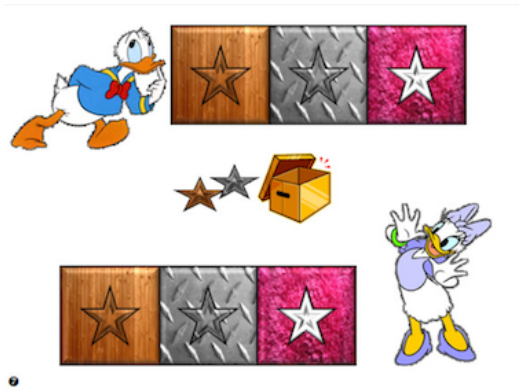


(Slide 5/8)

"They can fit their wooden stars and their metal stars perfectly! What they each need to finish their puzzle is a fuzzy star."

(Slide 6/8)

"But Goofy did a really good job hiding the fuzzy stars up on the clock. Donald and Daisy look and look but they can't find the fuzzy stars!"



Slide (7/8)

"So they can't finish their puzzles. Let's ask Froggy why."

(Slide 8/8)

"EXP: Hey Froggy, why can't Donald and Daisy finish their puzzles?

(i)	'Hmm... Donald and Daisy both can't find any stars!'	(*ANY* condition)
(ii)	'Hmm... Donald and Daisy both can't find a star!'	(*A* condition)
(iii)	'Hmm... Donald and Daisy both can't find stars!'	(*BARE PLURAL* condition)"

In this test story, the domain of quantification consists of a set of nine stars which vary along the contextually determined dimension of texture, i.e. there are three wooden stars, three metal stars, and three fuzzy stars. The largest domain of quantification in this context is the one containing all nine stars. Possible subdomain alternatives in this context include: {wooden stars}, {wooden stars, metal stars}, {metal stars, fuzzy stars}, {fuzzy stars}, etc. In the story, Mickey and Minnie have to find the stars in order to finish a puzzle; at a critical juncture of the story, it is established that though they have been successful in finding the wooden stars and the metal stars, they cannot finish their puzzles because they cannot find the fuzzy stars. Thus what is at issue revolves around just one particular subdomain alternative (e.g., the fuzzy stars). At this point, a puppet appears on the screen to answer a question about the story: *Why can't they finish their puzzles?* with a negatively quantified sentence containing one of the indefinites: "Mickey and Minnie both can't find any stars!"/"Mickey and Minnie both can't find a star!"/"Mickey and Minnie both can't find stars!" The participant's task was to decide if the puppet's statement was correct (*Did he say the right thing?*). If participants restricted the domain of the relevant indefinite to a smaller subdomain alternative (i.e. the fuzzy stars), they were expected to accept the statement; if the indefinite had to quantify over a larger domain, they were expected to reject the statement.

The primary comparison of interest is that between *any* and plain indefinites, as *any* is argued to quantify more widely. Claims that *any* widens the domain rely on it doing so *in contrast to* plain indefinites like *a* or *some*. First, we chose to compare *any* to *a* for the following reason: we chose to use negative test sentences, as negation is the most frequent licenser of *any*. The test sentences were then designed to be identical across conditions save for the indefinite: since *some* resists the scope of negation, and *any* is only good in the scope of negation, we chose to use *a*, which allows a narrow scope reading. But the use of *a* gives rise to a potential scope confound: a wide-scope, specific reading of *a* above negation yields the same

response as a narrow scope reading of *a* with a restricted domain of quantification. Bare plurals on the other hand, resist wide scope (Carlson, 1977), and thus provide a control for the scope confound.[10,11]

The critical test sentences from the four test trials, along with the final slides that subjects saw when hearing the test sentence, are provided in Table 1.

---

[10] For example, the following examples from Carlson (1977) show that the wide scope reading which is available with *a* in (i) is unavailable with the bare plural in (ii).

(i) Minnie wishes to talk with a young psychiatrist
  (a) (∃sg x) (young psychiatrist(x) & Minnie wishes Minnie talk with x)
  (b) Minnie wishes (∃sg x) (young psychiatrist(x) & Minnie talk with x)
(ii) Minnie wishes to talk with young psychiatrists
  (a) #(∃pl x) (young psychiatrist(x) & Minnie wishes Minnie talk with x)
  (b) Minnie wishes (∃pl x) (young psychiatrist(x) & Minnie talk with x)

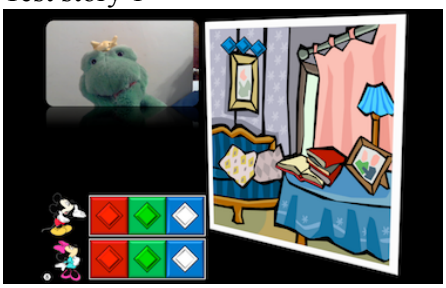
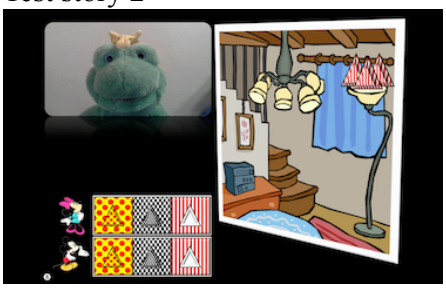
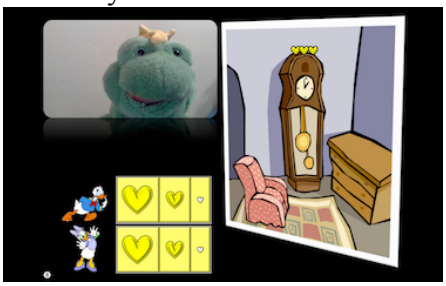
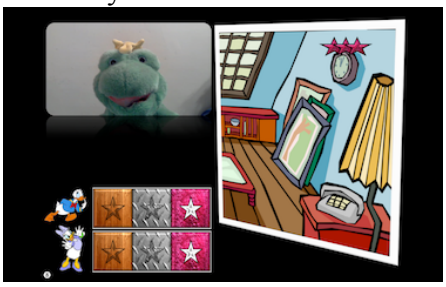
(Carlson, 1977:417)

Carlson goes on to show that the unavailability of the wide scope reading cannot lie in the plurality marker, since other plurally quantified NPs (*many*/*all*/*twelve*/*a few*/*most psychiatrists*) exhibit a similar scope ambiguity as that displayed in (i). Similar contrasts can be observed in the following examples:

(iii) (a) Max believes a Commie to have robbed Macy's.
  (b) Max believes Commies to have robbed Macy's.
(iv) (a) A drunk is likely to win the annual potato-sack race.
  (b) Drunks are likely to win the annual potato-sack race.
(v) (a) Max is seeking a unicorn.
  (b) Max is seeking unicorns.
(vi) (a) Gerald must talk to a congressman before noon today.
  (b) Gerald must talk to congressmen before noon today.

(Carlson, 1977:418)

[11] Initial piloting involved stories that had only one character completing a single puzzle; piloting with the addition of a bare plural condition revealed that the bare plural sentences were much more felicitous when there was more than one character searching for (multiple) puzzle pieces. Thus for consistency, and because it did not affect the felicity of the other two conditions, we had two characters searching for multiple copies of the three puzzle pieces across all three conditions. The floated *both* was then added based on pilot feedback suggesting that it made the use of the conjoined NP subject more natural.

Table 1. Experiment 1: Puppet's statements on (4) test stories for (3) test conditions			
	ANY condition	*A* condition	*BARE PLURAL* condition
Test story 1 	'Mickey and Minnie both can't find any diamonds'	'Mickey and Minnie both can't find a diamond'	'Mickey and Minnie both can't find diamonds'
Test story 2 	'Mickey and Minnie both can't find any triangles'	'Mickey and Minnie both can't find a triangle'	'Mickey and Minnie both can't find triangles'
Test story 3 	'Donald and Daisy both can't find any hearts'	'Donald and Daisy both can't find a heart'	'Donald and Daisy both can't find hearts'
Test story 4 	'Donald and Daisy both can't find any stars'	'Donald and Daisy both can't find a star'	'Donald and Daisy both can't find stars'

The researcher who played the role of the puppet in the pre-recorded videos was instructed to say the sentences as naturally as possible, with neutral intonation, and in particular without stressing the indefinite. Having the critical test sentences presented via video files ensured consistency in stimuli across subjects.

In addition to the four test stories, each participant also saw four control trials. Two of the four control trials had test sentences containing negation without any indefinites, and the other two control trials involved sentences containing the relevant indefinite without negation (i.e. *some* in the *ANY* condition, *a* in the *A* condition, and the bare plural in the *BARE PLURAL* condition). These control items allowed us to ensure that subjects were on task, and would later allow us to control for children's knowledge of the relevant indefinites and negation separately from each other. The control items were also presented dynamically: if a subject provided a *yes* response to a given test story, the following control item would have as its target a *no* response, and vice versa. This allowed us to balance the number of *yes* and *no* responses. Any subjects who did not correctly answer at least 3 of the 4 control trials were excluded from data analysis. The puppet's statements on the negation control stories are provided in Table 2, and the indefinite controls in Table 3.

Table 2. Experiment 1: Puppet's statements on (2) negation control stories

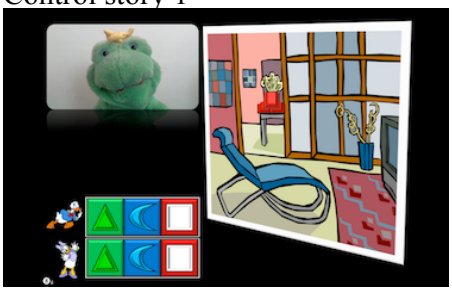
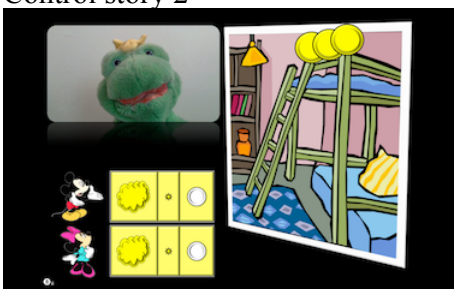
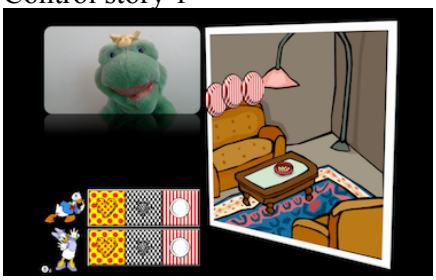
Control story 1 	'Mickey and Minnie both didn't find the squares' (target: *yes*) 'Mickey and Minnie both didn't find the moons' (target: *no*)
Control story 2 	'Mickey and Minnie both didn't find the circles' (target: *yes*) 'Mickey and Minnie both didn't find the suns' (target: *no*)

Table 3. Experiment 1: Puppet's statements on (2) indefinite control stories			
	ANY condition	*A* condition	*BARE PLURAL* condition
Control story 1 	'Mickey and Minnie both found some suns' (target: *yes*) 'Mickey and Minnie both found some circles' (target: *no*)	'Mickey and Minnie both found a sun' (target: *yes*) 'Mickey and Minnie both found a circle' (target: *no*)	'Mickey and Minnie both found suns' (target: *yes*) 'Mickey and Minnie both found circles' (target: *no*)
Control story 2 	'Mickey and Minnie both found some squares' (target: *yes*) 'Mickey and Minnie both found some clouds' (target: *no*)	'Mickey and Minnie both found a square' (target: *yes*) 'Mickey and Minnie both found a cloud' (target: *no*)	'Mickey and Minnie both found squares' (target: *yes*) 'Mickey and Minnie both found clouds' (target: *no*)

72 adult participants were randomly assigned to one of the three test conditions. We treated indefinite type as a between-subject factor to avoid contaminating effects on subsequent trials. If a participant happened to interpret an indefinite as associated with a more restricted domain of quantification for example, we wanted to ensure that this domain restriction would not influence how they interpreted subsequent sentences containing other indefinites. Thus subjects only heard one kind of indefinite across the four test trials.

In addition to the three test conditions described above, we also had three control conditions. The test stories in these control conditions were parallel to those in the test conditions except that the three puzzle shapes in each case did not vary along the relevant dimensions (colour, pattern, size, or texture); rather they were of three completely different shapes, thus eliminating potential widening of the domain as a factor. This allowed us to control for subjects' ability to simply interpret the literal, truth conditional meaning of negatively quantified existential statements. The target truth values of these control sentences were the opposite of the target values in the test conditions, i.e. where we expected *yes*-responses on the plain indefinite test conditions, we expected *no*-responses on the plain indefinite control conditions, and where we

expected *no*-responses on the *any* test condition, we expected *yes*-responses on the *any* control condition. Examples of the test stories from the control conditions are provided in Tables 4 and 5. In these conditions as well, subjects received two training items, followed by four test and four control items, which were randomized and counterbalanced. The control items were the same as those in the test conditions (two negation controls and two indefinite controls), and were also dynamically presented to balance the total number of *yes* and *no* responses. In all, 73 adult subjects were randomly assigned to one of the three control conditions.

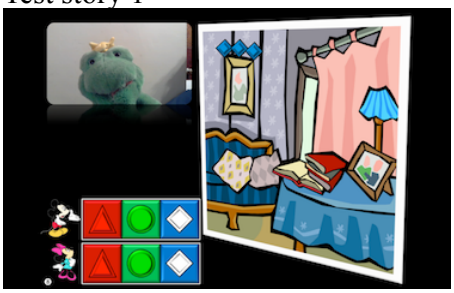
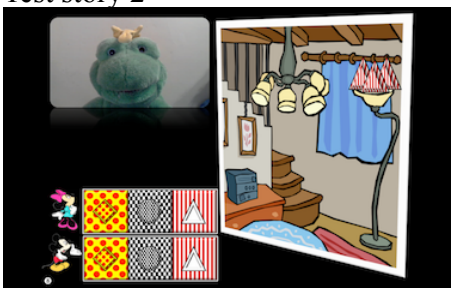
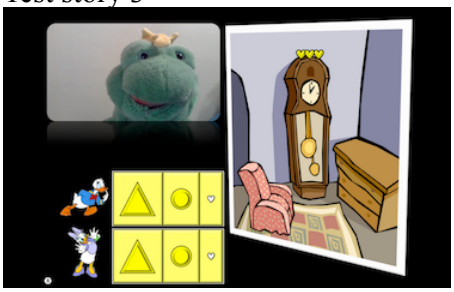
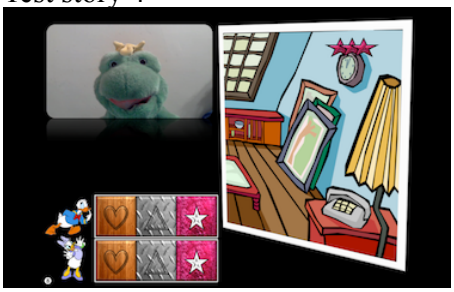
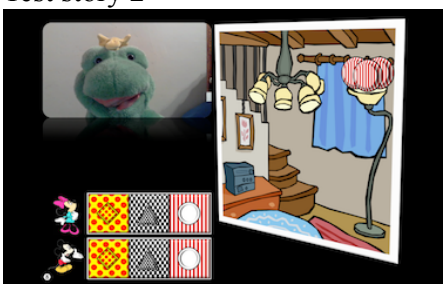
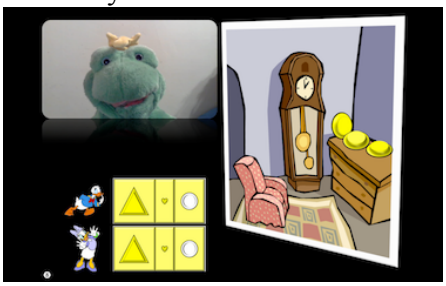
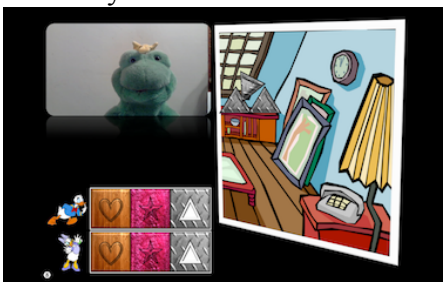
Table 4. Experiment 1: Puppet's statements on (4) test stories for *ANY* control condition	
Test story 1 	'Mickey and Minnie both can't find any diamonds' (target: *yes*)
Test story 2 	'Mickey and Minnie both can't find any triangles' (target: *yes*)
Test story 3 	'Donald and Daisy both can't find any hearts' (target: *yes*)
Test story 4 	'Donald and Daisy both can't find any stars' (target: *yes*)

Table 5. Experiment 1: Puppet's statements on (4) test stories for *A* and *BARE PLURAL* control conditions

	A condition	*BARE PLURAL* condition
Test story 1 	'Mickey and Minnie both can't find a diamond' (target: *no*)	'Mickey and Minnie both can't find diamonds' (target: *no*)
Test story 2 	'Mickey and Minnie both can't find a triangle' (target: *no*)	'Mickey and Minnie both can't find triangles' (target: *no*)
Test story 3 	'Donald and Daisy both can't find a heart' (target: *no*)	'Donald and Daisy both can't find hearts' (target: *no*)
Test story 4 	'Donald and Daisy both can't find a star' (target: *no*)	'Donald and Daisy both can't find stars' (target: *no*)

3.2 Results

The dependent measure in the following analyses was the proportion of *yes*-responses to the puppet's statements, taken to indicate domain restriction to a salient subdomain.

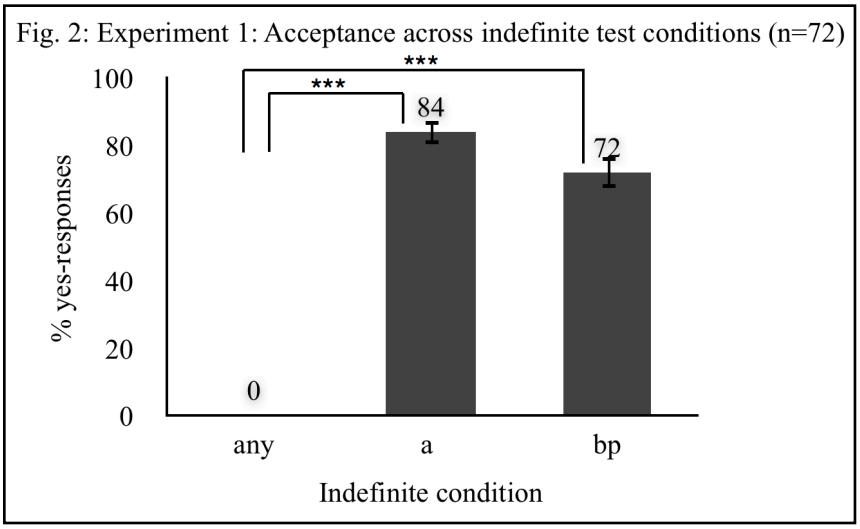
3.2.1 Control Conditions

All subjects in the three control conditions gave correct answers to the test trials 100% of the time. There was no effect of condition ($F(2,70)=0.959$, $p=.388$). Subjects were also at ceiling on the control items in the three control conditions; no subjects were excluded from data analysis.

3.2.2 Test Conditions

Subjects performed at ceiling on the control items in the three test conditions; no subjects were excluded from analysis. Subjects performed as expected on the test trials (Fig. 9). A one-way ANOVA revealed a significant main effect of indefinite type ($F(2,69)=54.8$, $p<.001$). Adults rejected the puppet's statement in the *any* condition 100% of the time, but generally accepted the plain indefinite statements (84% *yes* in the *A* condition; 72% *yes* in the *BARE PLURAL* condition). Adults were significantly more accepting in the *A* and *BARE PLURAL* conditions than in the *ANY* condition (Tukey HSD; both $p<.001$), but did not differ significantly in their acceptance of *a*- and bare plural statements ($p=.34$).

Fig. 2: Experiment 1: Acceptance across indefinite test conditions (n=72)



Follow-up justifications from the participants also allowed us to ascertain their reasons for accepting or rejecting the statements. Justifications for accepting the plain indefinite statements made reference to the relevant restricted subdomain alternative (e.g., *Yes, they can't find the blue diamonds*). In contrast, justifications for rejecting *any*-statements made reference to the other two subdomain alternatives, suggesting these could not count as exceptions to the domain of quantification (e.g., *No, they found the red and green diamonds - they just can't find the blue diamonds*).

3.3 Discussion

Our main finding from Experiment 1 was that when provided with contextually salient subdomain alternatives, adult speakers of English systematically interpreted *any* as quantifying over larger domains than the plain indefinites *a* and bare plurals. Follow-up justifications suggested that *any*-statements were rejected for quantifying more widely than was appropriate given the context. Thus we now have systematic evidence of categorical differences between *any* and plain indefinites in terms of the relevant size of domain of quantification. Our results thus provide empirical support for the domain widening thesis, according to which *any* is distinct from plain indefinites in its preference for "wider" domains. The adult findings here will provide a baseline for our discussion in Chapter 3 of a parallel experiment conducted with 4- and 5-year-old children. Before we move on to the child experiments however, our findings above raise some questions, which I address in turn below.

3.3.1 The Role of Contrastive Focus

Given the nature of the test stories, and with 100% rejection in the *any*-condition, a natural conclusion seems to be that among a set of domain alternatives, *any* must quantify over the largest. As soon as we've introduced a possible subdomain alternative, we cannot exclude it. Importantly, the stories that led up to the critical test sentences in the three test conditions were identical - the only thing that differed was the indefinite used in the test sentence. Thus we see that with plain indefinites, we can harmlessly exclude subdomain alternatives that may no longer be relevant or salient by the end of the story; but these same

alternatives cannot be excluded when *any* is uttered. Thus all of the alternatives that have been introduced in the story must be exhaustified. On Chierchia's analysis, exhaustification of these alternatives is obligatory, being triggered by a focal feature on *any*. But what forces the set of alternatives to be the largest one available? In other words, what is the source of *any*'s preference for the widest domain?

Consider again the example in (32). A plain indefinite like *a* can be used out of the blue as in (32-A1), and the subsequent use of *any*, particularly when stressed, yields the familiar "widening" effect (such that even the most basic disposable cameras are no longer exceptions to the domain). Recall that *any* can also be uttered out of the blue, in which case its domain can also be restricted to exclude disposable cameras, as in (33-A1). As we saw however, ending the dialogue with the plain indefinite *a*, even with stress, fails to induce widening (33-B2).

(32) A1: Do you have a camera?
B1: No.
A2: Nothing too fancy, even a disposable camera will do.
B2: I don't have ANY cameras.

(33) A1: Do you have any cameras?
B1: No.
A2: Nothing too fancy, even a disposable camera will do.
B2: #I don't have A camera.

Two questions immediately arise. First, what is behind the widening that succeeds in (32-B2) but fails in (33-B2)? Second, why does *any* widen the domain in (32-B2) but not in (33-A1)? In other words, we have now returned to our initial question of when precisely domain widening does and does not arise.

For Chierchia, the answer lies in the nature of contrastive focus on the relevant indefinites. The successful widening in (32-B2) arises from contrastively focusing *any*; since the focal alternatives of stressed *any* are its domain alternatives, the discourse in (32) satisfies conditions on contrastive focus by providing an appropriate antecedent (Rooth, 1992); in other words, the domain of *any* in (32-B2) is

contrasted with the more restricted domain of *a* in (32-A1). Focal stress on *a* fails to widen the domain in (33-B2) because the focal alternatives of plain indefinites are not domain alternatives, but rather functions of the same type (*I don't have <u>two</u> cameras, I don't have <u>every</u> camera*, etc.).

Thus in the absence of contrastive focus, *any* should behave like a plain indefinite in terms of its domain restriction; but where conditions on contrastive focus are satisfied, we expect domain widening to succeed. In light of this, let us reconsider our experimental findings. We saw that our adult subjects consistently interpreted *any* as quantifying over the widest possible domain. Yet our test sentences were presented without stress on *any*; all of the test sentences were pre-recorded with neutral intonation. Thus the finding of domain widening in the absence of stress on *any* provides experimental evidence that stress is not required to derive domain widening.[12]

One might question however whether the condition on contrastive focus was satisfied, even without the stress on *any*. Recall that the test sentences were not explicitly contrasted with an immediately preceding plain indefinite statement. Given the design of our stories however, there are (at least) two ways in which the contrastive focus condition might have been satisfied. Participants could have explicitly contrasted the *any*-statement with the negative statement that precedes the prompt by a few lines in the story:

(34) EXP: *Mickey and Minnie look and look, but <u>they can't find the blue diamonds</u>. So they can't finish their puzzles. Let's ask Froggy why. Hey Froggy, why can't Mickey and Minnie finish their puzzles?*

FROGGY: *Hmm... <u>Mickey and Minnie both can't find any diamonds</u>.*

If subjects could recall the story and retrieve the previous negatively quantified statement, which explicitly mentioned the salient subdomain of blue diamonds, then it would appear conditions are met for contrasting the wider domain of the *any*-sentence with the more restricted domain of the previous negative statement, thereby yielding the widening effect.

[12] This is consistent with Kadmon and Landman's and Chierchia's claims.

Alternatively, participants might have contrasted the *any*-statement with their preconceived answer to the experimenter's question to the puppet. Since the question was posed explicitly (*Why can't they finish their puzzles?*), subjects might have come up with what they thought to be the most appropriate (and informative) answer, i.e. *Because they can't find the blue diamonds*. In this case, again, it would appear conditions are met for contrasting the *any*-statement with an alternative, thereby yielding the widening effect. Our findings do not allow us to decide what contrasts (if any) the subjects were performing before rejecting the *any*-statements. They do reveal however that domain widening can take place even in the absence of an explicit contrast between an *any*-statement and an immediately preceding antecedent. It appears that the presence of salient subdomain alternatives in the context is sufficient to yield widening, i.e. through implicit contrast between the domain alternatives.

3.3.2 Plain Indefinites

While adults were significantly more accepting of both kinds of plain indefinite statements than of *any*-statements, one might question why the acceptance rates in the plain indefinites were not higher than they were. In other words, why did the participants, who rejected *any*-statements 100% of the time, not accept plain indefinite statements 100% of the time? A second question arises from comparing the *A* and *BARE PLURAL* conditions. These did not differ significantly in acceptance rates (p=.34), but the trend was towards greater acceptance in the *A* condition than in the *BARE PLURAL* condition. Why should this be the case? I consider these two questions in turn below.

Although adults generally accepted the plain indefinite statements, several of them equivocated and reasoned about the relative informativeness of the plain indefinite statements. While adults did not hesitate to reject the *any*-statements, they were often slower to accept the plain indefinite statements. When asked after the experiment whether they had had difficulty with any of the test sentences, a number of adults in the plain indefinite conditions noted that the puppet could have been more specific by including the relevant property of the puzzle pieces (i.e. that the diamonds were blue, or that the triangles were striped, etc.). On the one hand, this might be a task effect. Although adults can and ultimately do accept the plain indefinite

statements, they might initially resist a restricted interpretation because they are in an experimental situation in which a puppet is essentially being tested for whether he can provide the "right" kind of information; in particular, the subjects were being asked to fill out a scorecard for the puppet. It could very well be that what is perfectly acceptable in a spontaneous dialogue is insufficient on such a metalinguistic judgment task. On the other hand, although there is a clear preference for accepting the plain indefinite statements on the restricted interpretation, there is nothing ungrammatical about the plain indefinite statements on the widened interpretation. With plain indefinites, participants are free to set the domain of quantification however they please; thus the 16% rejection rate in the *A* condition and the 28% rejection rate in the *BARE PLURAL* condition might very well arise from licit interpretations of plain indefinites being associated with a relatively wider domain of quantification available in the context. What is crucial for us is the absolute rejection of *any*-statements in the same contexts, compared to the relatively high rates of acceptance in the plain indefinite conditions.

Next, consider the difference between the two plain indefinite conditions. One possible reason that adults trended towards being more accepting of *a*-statements might lie in the possibility of the wide scope, specific reading of the indefinite. The reason for including the bare plural condition was to control for this scope confound, since bare plurals resist wide scope. While we can be reassured that the two conditions did not differ significantly, it was indeed crucial to include the *BARE PLURAL* condition in our experiment, as we cannot rule out that some of the acceptance in the *A* condition was due not to domain restriction but to wide scope of the indefinite above negation.

Another possible explanation for the trend towards greater acceptance in the *A* condition lies in the nature of bare plurals, which are ambiguous between an existential reading (i.e. on the event reading of the predicate) and a universal reading (i.e. on the characteristic reading of the predicate), as shown in the following examples from Carlson (1977):

(35) Dinosaurs ate kelp.

(36) Maxwell ate kelp.

(37) Lots of conductors ate kelp.

(38) The old fireman ate kelp.

(39) A few scientists ate kelp.

The intended target reading of the bare plurals in our test sentences was the existential, event reading. But one possible reason the bare plural statements were accepted 72% rather than 100% of the time might be that some subjects were accessing a characteristic or generic interpretation of the bare plural statement. For example, some subjects might have interpreted *Mickey and Minnie both can't find diamonds* as *Mickey and Minnie are both incapable of finding diamonds*, which is clearly false in the given scenario.

On this note, one might think that the use of the present tense in the test sentences could have biased participants towards the generic interpretation. Contrast the version used (40) with a version of the prompt and test sentences in the past tense (41):

(40) EXP: Why can't Mickey and Minnie finish their puzzles?

PUPPET: Hmm... Mickey and Minnie both can't find {any/a/∅} diamond(s).

(41) EXP: Why couldn't Mickey and Minnie finish their puzzles?

PUPPET: Hmm... Mickey and Minnie both couldn't find {any/a/∅} diamond(s).

To rule out an effect of tense, we ran the three test conditions with the prompt and test sentences in the past tense with a new group of 45 adult subjects (15 per condition), and found virtually no change in the responses (Table 6). T-tests revealed no significant differences between rates of acceptance on the present tense condition and past tense condition for all three indefinite conditions.

Table 6. *Yes*-responses across tense conditions		
Indefinite condition	% *yes*-responses	
	Present tense (original data set)	Past tense
any	0	0
a	84	87
bare plural	72	70

Thus if some proportion of adults were accessing a generic or characteristic interpretation of the bare plural sentence, it cannot be due to the use of the present tense.[13]

Whatever the source of the non-categorical acceptance of the plain indefinite statements however, what is crucial for us is that adults were significantly more accepting in the plain indefinite conditions than in the *ANY* condition.

4. Summary

The experiment described in this chapter provides novel empirical evidence for the domain widening thesis. We see that once we carefully control for the possible subdomain alternatives that *any* can trigger, adults do indeed consistently interpret *any* as quantifying over wider domains than plain indefinites. In particular, our findings suggest that *any* must quantify over the widest domain available in the context; once a possible

[13] Although we've ruled out an effect of the present tense, a separate issue worth investigating is the role of the modal *can* in allowing the more restricted reading of the plain indefinites. In the same contexts as those presented in our test conditions, switching from *can* to *do* appears to make it more difficult to accept the plain indefinite statements (compare (i) and (ii)). This apparent contrast between (i) and (ii) does not appear to have any clear explanation within the theories of domain widening discussed so far.

(i) EXP: Why couldn't Mickey and Minnie finish their puzzles?
(a) PUPPET: Hmm... Mickey and Minnie both couldn't find a diamond.
(b) PUPPET: Hmm... Mickey and Minnie both couldn't find diamonds.
(ii) EXP: Why didn't Mickey and Minnie finish their puzzles?
(a) PUPPET: Hmm... Mickey and Minnie both didn't find a diamond.
(b) PUPPET: Hmm... Mickey and Minnie both didn't find diamonds.

subdomain alternative has been introduced, it cannot count as an exception to the domain, thus resulting in *any*'s observed reduced tolerance of exceptions (Kadmon & Landman, 1993). In contrast, there is no such restriction on the interpretation of plain indefinites, which are free to restrict to salient subdomains.

Now that we have clear baseline measures of how adults interpret *any* and plain indefinites (and their associated domains of quantification), we are in a position to evaluate whether young children are sensitive to the domain widening property of *any*.

Chapter 3

Children's Knowledge of NPI *any*

1. Introduction

Chapter 2 served to establish the nature of *any* in the adult grammar, and in particular examined its property of *domain widening*. This chapter takes up the question of whether young children acquiring English can demonstrate adult-like knowledge of the properties of *any*. As such, this chapter has three main goals. We will begin in Section 2 by providing as explicit as possible a description of the target of acquisition, that is, the NPI *any* along with its relevant syntactic, semantic, and pragmatic properties. Identifying these target properties will crucially set the stage for our subsequent discussion (in Section 3) of children's knowledge of these properties, and for our later discussion (in Chapter 5) of how children could acquire knowledge of these properties.

In Section 3, we will examine various measures of children's knowledge of *any*. First, I provide evidence of apparent target-like behaviour from an analysis of the spontaneous speech transcripts of 40 children acquiring American and British English. The data demonstrate that children (as young as 2;02) who produce *any* spontaneously and productively, have target-like knowledge of the licensing condition on *any*. I then review previously gathered evidence from elicited production (O'Leary & Crain, 1994) and comprehension experiments (Thornton, 1995; Xiang et al., 2006) suggesting that children as young as 3;06 (by comprehension measures) and 4;04 (by elicited production measures) exhibit target-like production and comprehension

of *any* in the scope of negation. While the spontaneous and experimental data appear to converge however, I will then argue that neither the experimental studies nor the spontaneous production data allow us to conclude that the children have target knowledge of all of *any*'s quantificational properties; in particular I argue that the previous studies do not justify any conclusions about children's knowledge of *any*'s potential for domain widening.

In Section 4, I address the missing piece of evidence regarding children's knowledge of *any*. I present the results of a truth value judgment task conducted with 4- and 5-year-old English-speaking children, which suggest that many, but not all, children in this age group interpret *any* as quantifying over wider domains than plain indefinites. After some discussion of the results, we will close the chapter with a summary of what we have learned about children's knowledge of NPI *any*.

2. The Target of Acquisition

In this section, I lay out the key properties of *any* that I take to form part of the target of acquisition. NPIs like *any* involve an amalgamation of syntactic, semantic, and pragmatic properties, and I will, for ease of exposition, try to be as explicit as possible in identifying these different target properties of *any*.

Let us begin with the syntax. First, *any* usually surfaces as an indefinite determiner; this entails a certain syntactic distribution. As shown in (1) and (2), *any* can take a noun phrase (NP) complement, which can be elided. As shown in (3) and (4), *any* can also occur within an NP as part of a complex indefinite. Finally, as (5) and (6) show, *any* can also be used as a modifier of the comparative adverb *more*.

(1) I don't have <u>any</u> milk.

(2) I don't have <u>any</u>.

(3) John didn't see <u>anyone</u>.

(4) Mary didn't write <u>anything</u>.

(5) I don't have <u>any</u> more milk.

(6) Don't do that <u>any</u>more.

In addition to the syntactic distribution of *any*, the child must figure out the structural licensing condition on *any*, that is, the particular structural dependency relation that holds between *any* and its licensing operator. *Any* must be c-commanded by its licensing operator, as shown by the contrast between (7) and (8).[1] Moreover, the dependency relation between *any* and its licenser is not clausebounded, as shown in (9).[2]

(7) The student doesn't have any homework.

(8) *Any student doesn't have homework.

(9) John didn't say that Mary would write anything.

Consider now what *any* contributes to the truth-conditional meaning of a sentence in which it appears. Let us assume that the child has knowledge of general rules of semantic composition which will be among those used to compute truth conditions of sentences containing *any*. What the child must learn specifically about *any* is its existential quantificational force, for its NPI status goes hand in hand with its interpretation as an existential within the scope of negation. Finally, in order to properly license *any*, the child must have knowledge of the logical property that is shared by the set of possible licensers.

As we saw in Chapter 2, many contemporary accounts of NPI licensing are predicated on some version of the Fauconnier/Ladusaw proposal, according to which NPIs are licensed in the scope of downward-entailing (DE) operators, i.e. operators that license subset inferences (10).

(10) Alexandre is not a man

⇒ Alexandre is not a father

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[1] I assume the following definition of c-command: a node A dominates a node B if and only if the lowest branching node that dominates A also dominates B, and A and B do not dominate each other.

[2] The particularities of the structural licensing condition vary in systematic ways across languages, so the child must learn the English-specific version for *any*. Korean, for example, allows subject NPIs, and does exhibit a clausemate restriction on licensing (unless the NPI is the subject of a state predicate) (cf. Lee, 1993).

Under the DE account of licensing, the target of acquisition thus includes knowledge of the logical property of DEness, such that licensing can be generalized beyond any single operator. Note that unless the learner could generalize to the set of DE operators, she would have to learn each individual licenser on a case-by-case basis. In Chapter 5, we will examine the kinds of evidence that children receive for licensing by DE operators. For the moment, it is worth pointing out a line of research arguing that DEness is innate rather than learned from the input. Gualmini and Crain (2002) argue that data indicating relevant entailment relations are unlikely to be available in sufficient quantity; instead, they propose, entailment relations displayed by certain DE quantifier determiners follow from their meaning, and given a restricted hypothesis space, children only have to entertain a small number of the logically possible hypotheses about determiner meanings.[3] Crain and Thornton (2006) provide further discussion motivating the innate specification of downward entailment as part of Universal Grammar, discussing the universality of key properties of DE expressions as well as a substantial body of experimental evidence showing that 4-year-olds are sensitive to the

[3] According to Gualmini and Crain, children are adult-like in classifying linguistic expressions as either being DE or not DE, but they are not necessarily fully adult-like in classifying NPIs. This is in part because what constitutes an NPI can differ cross-linguistically, whereas natural languages do not differ in their classifications of DE vs. non-DE expressions.

properties of DE operators.[4] While we will eventually examine the input for evidence of DE licensers, we will largely adopt these previous claims that DEness is innate.[5]

Consider now the semantics of *any*. As we saw in Chapter 2, *any* triggers obligatory exhaustification of subdomain alternatives. This means the child must come to have knowledge of the following: (i) the nature of *any*'s alternatives, i.e. that they are subdomain alternatives; (ii) the fact that these alternatives must obligatorily be exhaustified; (iii) how to carry out this exhaustification operation through the use of a covert exhaustification operator. Moreover, as we saw in Experiment 1, given a set of contextually defined domain alternatives, *any* generally quantifies over the widest possible domain, and is consistently interpreted as quantifying over wider domains than plain indefinites such as *a* or bare plurals. Thus the child must come to know that *any* is a (potential) *domain widener*, and in fact that it widens the domain in cases of contrastive focus. This will also entail sensitivity to and knowledge of contrastive focus.

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[4] One of the properties of DE expressions is that they give rise to so-called 'conjunctive entailments' of disjunction (Chierchia, 2004), as shown in (i)-(iii).

(i) The runner did not receive a medal or a cash prize
⇒ The runner did not receive a medal **and** the runner did not receive a cash prize

(ii) Every runner who received a medal or a cash prize did an interview
⇒ Every runner who received a medal did an interview **and** every runner who received a crash prize did an interview

(iii) If the runner received a medal or a cash prize, he was obliged to give an interview
⇒ If the runner received a medal, he was obliged to give an interview **and** if the runner received a cash prize, he was obliged to give an interview

A number of experimental studies have shown that 4- to 5-year-olds are sensitive to these conjunctive entailments (Chierchia et al., 2001; Gualmini et al., 2001; Gualmini & Crain, 2002; Crain et al., 2002; Gualmini & Crain, 2004); for example, children compute the conjunctive entailment in the restrictor but not the scope of the universal quantifier *every*, suggesting they know the restrictor is DE but the scope is not. As Crain and Thornton discuss, the challenge of learning this distinction between the restrictor and the scope on the basis of positive evidence is particularly acute, given the distinction doesn't involve the distribution of lexical material.

[5] Since the focus of our investigation will be on the semantic/quantificational properties of *any*, I will generally refer to the existing literature on the acquisition and learnability of DEness without taking a particular stance on how it is acquired.

Given the target set of knowledge just enumerated, let us now turn to various measures of children's knowledge of NPI *any*, the goal of all of which is to determine whether (and when) children are target-like with respect to *any*.

3. Measures of Children's Knowledge of NPI *any*

3.1 Corpus Study 1: Children's Spontaneous Production of NPI *any*

Certain experimental methods such as the Truth Value Judgment Task (TVJT) (Crain & McKee, 1985; Crain & Thornton, 1998) are notoriously difficult to conduct with children younger than 3;00 and are typically only successful with children who are older than 3;06. But looking at how children younger than 3;06 behave with respect to NPI licensing can show us whether children's earliest hypotheses are different from those of older children (and of adults). To accomplish this, we can look to spontaneous speech transcripts, a prime source of evidence regarding younger children's knowledge of NPI licensing. I present here data from an analysis of the spontaneous speech transcripts of 40 children acquiring American and British English as a first language. In determining whether children are target-like in their knowledge of *any* from the point at which they begin to produce it spontaneously and productively, I discuss two aspects of the children's spontaneous production data: (i) quantitatively, I discuss their rates of licensed vs. unlicensed *any*, which provide an indication of, among other things, whether the children are target-like in their knowledge of the licensing conditions on *any*; (ii) qualitatively, I examine the environments in which *any* appears, and in particular, the diversity of licensers, which can tell us whether children genuinely have productive knowledge of *any* (and its licensing condition). The data come from 18 American children, covering the age range 0;11,04-5;02,12, and 22 British children aged 1;08,22-4;11,20. These spontaneous corpora are available on the CHILDES database (MacWhinney, 2000), and are listed in Tables 1 and 2.

Using the *kwal* and *combo* programs available on CLAN, the corpus analysis program associated with the CHILDES database, we can find all child utterances containing *any*, and check for utterances containing negation and other potential NPI licensers, discounting imitations, repetitions, routine utterances, unclear utterances (symbolized in the transcripts with "xxx" or "yyy"), and single-word utterances (or utterances

consisting solely of *any*+NP). Charting out the development of NPI *any* over the entirety of the transcripts for each child, we can take note of the proportion of licensed and unlicensed *any*, as well as the operators that license *any*.

Table 1. American English: Corpora under study

CORPUS	CHILD	AGE RANGE	NO. OF TRANSCRIPTS	NO. OF UTTERANCES
Bloom	Peter	1;09,07 – 3;01,21	20	23,000
Brown	Adam	2;03,04 – 5;02,12	55	45,371
	Sarah	2;03,05 – 5;01,06	139	31,195
	Eve	1;06,00 – 2;03,00	20	10,856
Demetras	Trevor	2;00,27 – 3;11,27	28	6,568
Kuczaj	Abe	2;04,24 – 5;00,11	210	22,684
Providence	Alex	1;11,16 – 3;03,21	56	31,423
	Ethan	0;11,04 – 2;11,01	50	21,898
	Lily	1;01,02 – 4;00,02	80	39,852
	Naima	0;11,28 – 3;10,10	83	43,542
	Violet	1;02,00 – 3;11,24	54	17,274
	William	1;04,10 – 3;04,15	44	21,220
Sachs	Naomi	1;02,29 – 4;09,03	93	15,542
Suppes	Nina	1;11,16 – 3;03,21	56	31,423
Weist	Emily	2;06,06 – 4;05,19	23	7,264
	Emma	2;07,08 – 4;08,04	28	6,669
	Mat	2;03,10 – 5;00,05	56	10,157
	Roman	2;02,20 – 4;07,20	42	11,064
		TOTAL	1,137	397,002

Table 2. British English: Corpora under study				
CORPUS	CHILD	AGE RANGE	NO. OF TRANSCRIPTS	NO. OF UTTERANCES
Belfast	Barbara	2;04,09 – 4;01,18	14	2503
	Conor	3;08,14 – 4;06,05	14	3045
	Courtney	3;04,00 – 4;00,11	7	2021
	David	2;00,03 – 4;02,03	14	2472
	Johnny	3;06,00 – 4;04,01	7	1678
	Michelle	2;04,28 – 4;04,19	14	3075
	Rachel	2;05,25 – 2;09,16	8	1184
	Stuart	3;05,12 – 4;05,04	11	3369
Lara	Lara	1;09,13 – 3;03,25	120	47,876
Manchester	Anne	1;10,07 – 2;09,10	68	19,866
	Aran	1;11,12 – 2;10,28	66	17,111
	Becky	2;00,07 – 2;11,15	68	23,300
	Carl	1;08,22 – 2;08,15	65	24,857
	Dominic	1;10,25 – 2;10,16	68	21,097
	Gail	1;11,27 – 2;11,12	68	16,947
	Joel	1;11,01 – 2;10,11	68	17,862
	John	1;11,15 – 2;10,24	64	13,303
	Liz	1;11,09 – 2;10,18	68	16,545
	Nicole	2;00,25 – 3;00,10	68	16,937
	Ruth	1;11,15 – 2;11,21	66	20,295
	Warren	1;10,06 – 2;09,20	67	16,587
Thomas	Thomas	2;00,12 – 4;11,20	379	198,647
		TOTAL	1,392	490,577

NPI *any* is not a particularly high-frequency construction. To avoid distortion due to low denominators (i.e. low numbers of total NPI *any*), in analyzing the error rates, I focus here on the results for the 26 children who produced a minimum of 15 instances of NPI *any* over the entirety of their transcripts.

The main finding was that both the American and British groups of children made very few NPI licensing errors; moreover, these errors were interspersed among adult-like usage of the NPI. Of the 1724 total instances of NPI *any* across the 26 children, 41 were categorized as errors (to be described further below). This represents an error rate of only 2.38%.[6,7,8] Thus the children appeared to be quite target-like in their knowledge of the licensing condition on *any*; they were able to limit the distribution of *any* to appropriately licensed environments. (11) is an example of licensed *any* from Abe's speech (Kuczaj corpus).

(11) Abe (Kuczaj corpus), Transcript 133 (age 3;09,12), Lines 461, 469

*CHI: can you find <u>any</u> scissors ?

*FAT: I'll look I don't think paper wings are a good idea (.) Abe .

*CHI: come on I can't find <u>anything</u> else .

Before moving on, it's worth considering the nature of the 2.38% error rate. Taking first the total number of apparently unlicensed NPI *any* (i.e. instances of NPI *any* where a licenser seemed to be missing), I classified the environments of these apparently unlicensed *any* into four categories: (i) plausibly negative (declarative), (ii) plausibly positive (declarative), (iii) plausibly interrogative, and (iv) indeterminate. The plausibly negative cases were instances where the child clearly intended a negative meaning, but simply omitted sentential negation. The plausibly positive cases involved positive environments in which the child used *any* but essen-

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[6] This is strikingly low, particularly if we wish to consider 5% as an arbitrary baseline error rate (to accommodate speech and transcription errors).

[7] I have chosen to collapse the American and British data here. The American and British children did not differ significantly from each other in their mean error rates ($t(24)=-0.95$, $p=0.35$).

[8] It is worth mentioning here van der Wal's (1996) corpus study of Dutch-speaking children's spontaneous production of NPIs, in which van der Wal reported error rates up to 14%. Her error rates however encompassed all non-adult-like utterances, including both commission and omission errors. As I detail below, I further classified potential licensing errors into different categories, e.g., commission vs. omission errors.

tially intended *some* (these constitute the true commission errors). The plausibly interrogative cases involved sentences which would be classified as grammatical if they were questions; these would initially be counted as apparent errors because of the lack of a question mark in the transcription. It was sometimes possible however to determine the interrogative status of an utterance, using the surrounding context.[9] Finally, the fourth category was for occurrences of *any* that might or might not have been grammatical; the surrounding context of these utterances was simply not sufficient to yield a confident judgment. To be conservative, the error rate was based on the sum of the plausibly positive and the indeterminate cases. Some examples of cases involving omission of negation and cases of true commission errors follow:

(12) *Omission of Negation*

Sarah (Brown corpus), Transcript 33 (age 2;10,11), Line 410

*MOT: that's to make orange juice (.) squeeze the oranges for orange juice for babies .

*CHI: me ?

*MOT: yeah .

*CHI: I want <u>any</u> .

%com: negative meaning

*MOT: you don't want any !

%par: laughs

*CHI: no .

*CHI: xxx baby .

%alt: I not baby .

[9] CLAN allows us to specify a number of preceding and following lines that surround the utterance containing the search string. In determining how to classify the apparent errors into the four categories, I examined the transcripts and looked at as much of the preceding and following discourse context as was relevant to the utterance at hand.

(13)a. *True Commission Errors*[10]

Ruth (Manchester corpus), Transcript 23b (age 2;07,10), Line 809

*MOT: there you go .

*CHI: want anymore, Mummy .

*MOT: I think there only is three darling .

*MOT: I don't think there's anymore .

b. Liz (Manchester corpus), Transcript 15b (age 2;04,03), Line 1018

*CHI: there's giraffe .

*MOT: yes that's the giraffe .

*CHI: and get any more .

*CHI: get any more .

*MOT: I think there's only one giraffe love .

The numbers of apparent errors, true commission errors, and error rates for the 26 children are given in Table 3.

[10] The two examples I have given of commission errors show quite clearly that *any* is being used in a positive environment. Note that there are dialects of English where positive *anymore* has a meaning similar to *nowadays* or *these days* (see Haycock, 2000 and references therein for a characterization of the phenomenon and its geographical distribution). As far as I can tell, there is no evidence suggesting that any of the children spoke such a dialect, although two of Ruth's four errors did involve *anymore* in a positive environment. In any event, if the children who produced *anymore* in positive environments were actually speakers of the positive-*anymore* dialect, these instances ought to count as grammatical (or rather be excluded as instances of a different lexical item), further reducing the number of commission errors. To be conservative, I assumed that none of the children spoke such a dialect, and therefore counted all positive instances of NPI *any* as ungrammatical.

Table 3. Qualitative error analysis
(— = Plausibly negative; + = Plausibly positive; Q = Plausibly interrogative; Ind. = Indeterminate)

Corpus	Child	Apparent errors / Total NPI *any*	—	+	Q	Ind.	True commission errors	Error rate (%)
Bloom (US)	Peter	4 / 75	2	1	0	1	2 / 75	2.67
Brown (US)	Adam	4 / 53	0	2	0	2	4 / 53	7.55
	Sarah	8 / 53	4	0	0	4	4 / 53	7.55
Demetras (US)	Trevor	1 / 18	1	0	0	0	0 / 18	0.00
Kuczaj (US)	Abe	6 / 288	4	0	1	1	1 / 288	0.35
Providence (US)	Lily	2 / 32	1	0	1	0	0 / 32	0.00
	Naima	0 / 59	0	0	0	0	0 / 59	0.00
Sachs (US)	Naomi	1 / 24	0	0	0	1	1 / 24	4.17
Suppes (US)	Nina	3 / 53	1	0	1	1	1 / 53	1.89
Weist (US)	Emily	4 / 37	3	0	0	1	1 / 37	2.70
	Emma	2 / 29	2	0	0	0	0 / 29	0.00
	Mat	0 / 55	0	0	0	0	0 / 55	0.00
	Roman	3 / 48	2	0	0	1	1 / 48	2.08
Belfast (UK)	Conor	0 / 19	0	0	0	0	0 / 19	0.00
	Michelle	0 / 23	0	0	0	0	0 / 23	0.00
	Stuart	0 / 21	0	0	0	0	0 / 21	0.00
Lara (UK)	Lara	1 / 172	1	0	0	0	0 / 172	0.00
Manchester (UK)	Anne	0 / 18	0	0	0	0	0 / 18	0.00
	Aran	0 / 25	0	0	0	0	0 / 25	0.00
	Carl	2 / 16	2	0	0	0	0 / 16	0.00
	Dominic	6 / 20	1	5	0	0	6 / 20	30.00
	Gail	1 / 23	0	0	0	1	1 / 23	4.35
	Joel	1 / 18	0	1	0	0	1 / 18	5.56
	Nicole	1 / 26	0	1	0	0	1 / 26	3.85
	Ruth	7 / 43	1	4	0	2	6 / 43	13.95
Thomas (UK)	Thomas	18 / 476	2	7	5	4	11 / 476	2.31

Errors of commission were interspersed among adult-like usage of the NPI; no child appeared to exhibit a developmental stage characterized by lack of the licensing condition.[11]

Let us now briefly switch gears to a more qualitative examination of the data and consider the kinds of licensers observed in the children's spontaneous production. In attempting to determine whether children have target-like knowledge of the DE licensing condition on *any*, one might wish to verify that the children have not simply memorized *any* as forming a lexicalized chunk with sentential negation. One way to do this is to consider other classes of potential licensers. In particular, two other classes of operators (distinguished by their logical properties) have been identified as NPI licensers. According to Zwarts (1998) for example, there are at least three classes of NPIs, licensed accordingly by three classes of licensers that differ in their "negative strength", i.e. by the number of De Morgan's laws that they validate. While DE operators satisfy the De Morgan's laws in (14i-ii), anti-additive operators satisfy (14i-iii), and anti-morphic operators satisfy (14i-iv):

(14) (i) $f(x)\ f(y) \rightarrow f(x \wedge y)$

(ii) $f(x \vee y) \rightarrow f(x) \wedge f(y)$ Downward-entailing operators (*license weak NPIs*)

(iii) $f(x) \wedge f(y) \rightarrow f(x \vee y)$ Anti-additive operators (*license strong NPIs*)

(iv) $f(x \wedge y) \rightarrow f(x) \vee f(y)$ Anti-morphic operators (*license superstrong NPIs*)

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[11] The reader may notice that Dominic's production (Manchester corpus) exhibited a particularly high error rate (30%). It is worth pointing out that 5 of his 6 errors appear to arise from the same discourse context, within a single transcript. It is difficult to argue that Dominic went through a stage of unlicensed *any* when the bulk of his errors are isolatable to one discourse:

(i) *Transcript 21a* (age 2;05,22)

CHI: Gordon [0has] got any [/] any passengers on .	(line 673)
*CHI: he's got any [/] any [/] any +...	(line 700)
CHI: Gordon [0has] got any [/] any .	(line 764)
CHI: Gordon [0has] got any [/] any passengers .	(line 822)
*CHI: Toby got any [/] any passengers on .	(line 1005)

The next instance of *any* was produced seven days later (i.e. two transcripts later); from that instance through to the end of the transcripts, all instances of *any* were appropriately licensed. Prior to the utterances in (i), Dominic produced three instances of *any*, two of which were licensed.

Some examples from each of the three classes of NPI licensers follow:

(15)a. Anti-morphic, anti-additive, and downward-entailing: sentential negation *not*

b. Anti-additive and downward-entailing: *no, nothing, never, no one, nowhere, without, before, nobody…*

c. Downward-entailing: *less than n, not every, hardly, rarely, only, at most, few, not many…*

Anti-additive operators are also DE, and anti-morphic operators are also anti-additive and DE. For our purposes, we won't need to go any further into the details of Zwarts' account, because *any* is considered a weak NPI. This means that it minimally requires a DE licenser, a condition that is satisfied by all three classes of potential NPI licensers. I point out the classes of licensers here to demonstrate the diversity of operators that can license *any*; for us, diversity in the children's production can provide an indication of whether children genuinely have productive knowledge of *any*.[12] Let us consider as an example the data for Abe (Kuczaj corpus), who produced a sizeable sample of *any*. Abe produced a total of 228 instances of NPI *any* in declarative environments, 217 of which involved licensing by sentential negation. Other licensers included negative

[12] Given that the licensers stand in a subset-superset relation (anti-morphic operators are also anti-additive and DE, while anti-additive operators are also DE but not anti-morphic), one question that might arise is whether children resort to a conservative widening strategy, according to which they would start off with the conservative hypothesis that only anti-morphic operators (i.e. sentential negation in English) license *any*; they would then widen the set of licensers to include anti-additive and DE operators on the basis of positive evidence. One way to test whether children follow such a widening strategy is to determine whether there is a significant chronological gap between the onset of licensing by anti-morphic operators and the onset of licensing by non-anti-morphic operators. Only three of the 40 children examined here produced more than a couple isolates of non-anti-morphic licensers, and for these three children (Abe, Mat, and Thomas) we did not find a significant chronological gap between the onset of anti-morphic and non-anti-morphic licensing (by Binomial Test). On the basis of such data, I argued in Tieu (2010) that English-speaking children appear not to resort to a conservative widening strategy in the acquisition of NPI licensing. See Lin, Weerman, and Zeijlstra (2013) however, for arguments of conservative widening in languages such as Mandarin Chinese. Also relevant is van der Wal (1996), who postulated a hypothesis of conservative widening in Dutch children's acquisition of NPIs. van der Wal found that children went through a progression of stages, first producing NPIs only with *niet* 'not', then producing illicit forms of licensing by anaphoric, deictic, and contextual negation, followed by non-adult-like NPIs in affirmative constructions. van der Ziel however ultimately tied this progression to children's development of negative expressions, rather than a widening of the set of possible licensers for NPIs.

quantifiers, *never* (which is anti-additive in addition to being DE), *without* (also anti-additive and DE), *if*-conditionals, *in case*-conditionals, and comparatives. The distribution of licensers in Abe's production of *any* is shown in Table 4.

Table 4. Abe: Distribution of licensers in declaratives

TOTAL NPI *ANY* IN DECLARATIVES	LICENSERS						
	NEG	*NO-*	*NEVER*	*WITHOUT*	CONDITIONAL *IF*	*IN CASE*	*COMPARATIVE -ER*
228	217 (95.18%)	2 (0.88%)	2 (0.88%)	2 (0.88%)	3 (1.32%)	1 (0.44%)	1 (0.44%)

In other words, 95.18% of Abe's production of *any* involved licensing by sentential negation, while 4.82% involved licensing by (six different) non-anti-morphic licensers. Note that the low proportion of licensing by an operator other than sentential negation cannot be taken as evidence that Abe did not have productive knowledge of licensing by various DE operators. In fact, the large proportion of licensing by sentential negation was also observed in the parental speech. Abe's father was an active conversational partner in 209 of the 210 transcripts in the corpus, producing a total of 87 NPI *any* in declaratives, 81 of which involved licensing by sentential negation. That is, 93.10% of his uses of *any* involved licensing by sentential negation, and roughly 6.90% involved licensing by (three different) non-anti-morphic licensers. The precise distribution of licensers is given below:

Table 5. Abe's father: Distribution of licensers in declaratives

TOTAL NPI *ANY* IN DECLARATIVES	LICENSERS			
	NEGATION	CONDITIONAL *IF*	*DOUBT*	*FORGET*
87	81 (93.10%)	4 (4.60%)	1 (1.15%)	1 (1.15%)

The pervasiveness of licensing by sentential negation is thus reflected in both the parent's speech and the child's speech. Qualitatively, it appears that Abe was indeed adult-like in his knowledge that licit licensers of

any included operators other than sentential negation. In other words, he was able to generalize to the class of DE operators as NPI licensers.

To summarize this section, the children under study demonstrated a target-like distribution of *any* in their spontaneous production. That is, wherever the children produced *any* spontaneously, they produced it (at least superficially) in a target-like manner. Moreover, some children were able to use *any* with DE operators beyond sentential negation, i.e. with operators that are not merely DE. The surface distribution of *any* thus suggests productive knowledge that *any* must occur in the scope of a DE operator.

3.2 Elicited Production (O'Leary & Crain, 1994)

Conclusions from the single reported elicited production study of *any* converge with the conclusions that can be drawn from the spontaneous production data: children know how to restrict *any* to the scope of licensers in their production. The experimental evidence comes from O'Leary and Crain's (1994) study (reported in Gualmini, 2004), which used an elicited production paradigm to elicit DE and non-DE environments from 11 children (4;04-5;04). In the condition shown in (15), the authors found that children never produced *any* outside the scope of negation, i.e. in a positive declarative, even when *any* appeared in the prompt. In contrast, children had no problem producing *any* when it could appear in the scope of negation, as in (16).

(15)a. *Situation:* Some dogs were hungry, and every dog eventually ate some food.

b. *Test sentence:* Only one dog got any food.

c. *Experimenter prompt:* What really happened?

d. *Children's responses:* No, every dog got <u>some</u> food! / *No, every dog got <u>any</u> food!

(16)a. *Situation:* Some dogs are hungry; only one dog decides not to eat.

b. *Test sentence:* Every dog got some food.

c. *Experimenter prompt:* What really happened?

d. *Children's responses:* No, this dog did not get <u>any</u> food! / No, this dog did not get <u>some</u> food!

(Gualmini, 2004:960)

In sum, children can restrict *any* to the scope of a licenser in both spontaneous and elicited production.

3.3 Comprehension in Questions (Thornton, 1995)

Other experimental evidence of children's target-like knowledge of *any* comes from studies of children's comprehension of *any*, using versions of the TVJT. Thornton (1995) showed that children as young as 3;06 have knowledge of entailment relations. She tested children's comprehension of questions containing NPI *any* and negation such as the following:

(17)a. Did <u>any</u> of the turtles not buy an apple?

b. Didn't <u>any</u> of the turtles buy an apple?

Thornton conducted the test with 10 children (3;06-4;11) and found that these children had no problem interpreting *any* with respect to negation, pointing to the turtle that hadn't bought an apple 93% of the time in response to (17a), and to the turtle(s) that had bought an apple 85% of the time in response to (17b). Such findings suggest that by 3;06, children can correctly interpret *any* as an existential in questions and under negation.

3.4 Comprehension in Declaratives (Xiang, Conroy, Lidz, & Zukowski, 2006)

Using a TVJT design, Xiang et al. (2006) provided evidence that children between the ages of 4;05-5;05 correctly interpret *any* as taking narrow scope with respect to negation. These authors compared children's comprehension of negative declaratives containing *a*, *some*, and *any*. While all three are interpreted as existential indefinites, the three differ in their possible scope interpretations (relative to negation). Xiang et al. set out to test whether young children understand the scope properties of these indefinites. They designed contexts that biased towards wide scope readings of the indefinites, and tested whether children would scope each of the indefinites out above negation. An example item is provided in (18).

(18)Hi, my name is Joe. I am eating dinner. My mom said I have to eat all my dinner before I can have dessert. I really don't like peas. But I guess they are healthy. Ok, I will try and eat them. There, I did a pretty good job. There are only a few peas left, and those ones are mushy. I don't think I am supposed to eat the mush peas. I will probably get my dessert!

I was listening to the story, and I know what happened!

Condition 1: Joe didn't eat a pea.

Condition 2: Joe didn't eat some peas.

Condition 3: Joe didn't eat any peas.

Given that the character in the story ate all but a singleton pea (in Condition 1) or all but a few peas (in Conditions 2 and 3), participants were expected to accept the test sentences if the indefinites were allowed to take wide scope with respect to negation (i.e. *There is a pea that Joe didn't eat* / *There are peas that Joe didn't eat*), and to reject the test sentences if the indefinites took narrow scope (i.e. *It is not the case that Joe ate a pea / It is not the case that Joe ate (some) peas*). Xiang et al. found that like adults, the 17 children tested (4;05-5;05, M=4;10) consistently interpreted *any* narrowly.[13] The authors thus concluded that children between 4-5 years of age understand *any*'s status as an NPI.

To summarize, measures of elicited production and comprehension suggest that by 3 to 4 years of age, children correctly restrict *any* to the scope of negation in both production and comprehension.

3.5 A Problem: Target Performance vs. Target Representation

Based on the spontaneous production and experimental data discussed so far, it would appear that 4-year-olds know the licensing condition on *any*. Moreover we can tell from the experimental data that children differentiate *any* and *some* in production (O'Leary and Crain, 1994). But we cannot conclude from the data presented thus far whether children also know that *any*, unlike *some* or *a*, has a particular semantics that involves obligatory exhaustification of subdomain alternatives and potential for domain widening. It is con-

[13] The children were non-adult-like however in the *a* condition, where they interpreted *a* with wide scope only some of the time.

ceivable that young children might treat *any* as simply a "negative counterpart" of existential indefinites like *some*. Thus the previous studies do not probe children's sensitivity to any semantic differences that might exist between *any* and non-polarity-sensitive/plain indefinites. A possible scenario that must be ruled out is one in which the child (perhaps in an initial stage of development) hypothesizes a single categorial representation of an existential indefinite that must be realized as *some* in positive environments and *any* in negative environments.[14] On the surface, the child would appear to have target-like knowledge of *any*. Such a scenario however would involve a substantive gap in the child's knowledge of the target grammar; put differently, a child in such a scenario would have yet to acquire the target semantics of *any*.

In summary then, children's target-like performance involving *any* might reflect target-like knowledge of the distributional requirements of *any* (perhaps in relation to *some*), but may not necessarily reflect target-like knowledge of the semantics of *any*. In the next section, we will discuss the results of an experiment designed to address this gap in empirical coverage.

4. Experiment 2: Children's Knowledge of *any* as a Domain Widener

In Section 2, we considered the target of acquisition with respect to *any*, and in Section 3, determined that previous studies could not justify any conclusions about 4-year-olds' knowledge of the semantics of *any*; in fact, all of the previous studies generally neglected the semantics of *any*, focusing exclusively on its licensing condition (or put differently, its restricted distribution in the scope of an appropriate licenser). Given the experimental results from Chapter 2 however, we know that the target must include the potential for domain widening. This section presents an experiment that specifically tests children's sensitivity to the domain widening property of *any*. The research question in this study was whether children could interpret *any* as quantifying over wider domains than plain indefinites like *a* or bare plurals. In other words, we wanted to

[14] See among others Klima (1964) and Lakoff (1969) for original discussion of the idea (and subsequent arguments against the idea) that *any* and *some* are alternative forms, the former of which surfaces in so-called 'affective' contexts. My point is not to endorse or argue against this kind of theoretical proposal concerning the state of the *any/some* dichotomy in the adult grammar; rather, I wish to point out that *if* a child learner hypothesized a superficial relationship of complementary distribution between the two, without postulating any deeper semantic differences, s/he could nevertheless perform on target in the previous experimental studies.

determine whether children would treat *any* as more intolerant of exceptions than non-polarity-sensitive indefinites, as originally observed by Kadmon and Landman (1993).

4.1 Method

4.1.1 Subjects

The experiment described below was tested with 92 English-speaking children (3;05-5;08, M=4;03) recruited in Connecticut and Maryland daycares. 20 of the children were excluded from the analysis, as they failed to correctly answer at least 3 of the 4 control trials.[15] I will discuss the results from the remaining 72 children (3;06-5;08, M=4;03), 42 of whom were randomly assigned to three test conditions, and 30 of whom were randomly assigned to three control conditions, to be described in greater detail below.

4.1.2 Procedure

This experiment was a replication of Experiment 1, with children. We used the TVJT to test children's interpretation of negatively quantified sentences containing *any*, *a*, and bare plurals. A single experimenter told a series of short stories using cartoon pictures and animations created and displayed in PowerPoint. Prerecorded video clips of a puppet created the pretense that the puppet was participating in the task live via webcam. Children were told that the puppet ('Froggy') was still very little and not very good at paying attention to stories; they were asked to fill out a report card for him, with the goal of helping him to learn how to pay better attention. At the end of each story, the puppet was asked a question about the story. The child's task was to determine whether the puppet's statement was 'right', in which case s/he was instructed to put a stamp under the 'smiley face' column of the scorecard. If the puppet was 'wrong', the child was instructed to put a stamp under the 'sad face' column of the report card. We also elicited follow-up justifications from children to ascertain their reasons for providing *yes* or *no* responses. All children were tested individually,

[15] 12 of the excluded children were younger than 4 years of age; some of these children were inattentive and could not complete the task.

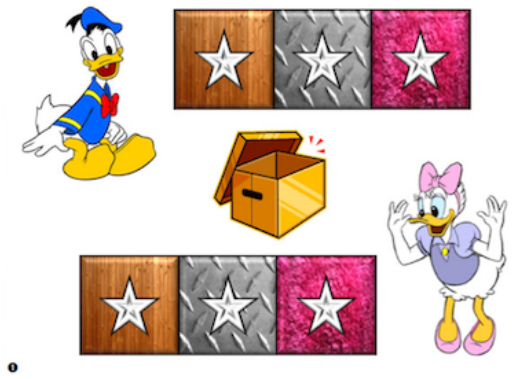
usually in a quiet room away from the classroom. Sessions were videorecorded for subsequent coding and analysis.

4.1.3 Materials

The stories used in the experiment made negatively quantified statements felicitous. Each context clearly provided different possible (sub)domains of quantification. On the critical test trials, the context would also make one of these possible subdomains highly salient; importantly, the relevant subdomain was not the largest of the possible domain alternatives but rather a smaller subdomain. Depending on whether children accepted the negatively quantified test sentence, we could infer whether they were associating the relevant indefinite with the more restricted subdomain, or whether it had to quantify over a larger domain alternative. *Yes*- and *no*-responses, along with appropriate follow-up justifications, were taken as a measure of children's ability to restrict the domain of quantification to one of the domain alternatives.

Each child received two training items, followed by four test and four control items, which were randomized and counterbalanced. The four test trials varied in the dimension along which widening could be expected (colour, pattern, size, and texture). An example test story is provided in Fig. 1.

Fig. 1. Experiment 2: Example test story



(Slide 1/8)

”This story is about Donald and Daisy. They’re doing some puzzles. See, they have to put a wooden star here, a metal star here, and a fuzzy star here.
Oh no! The puzzle box is empty! Where all the pieces?”

(Slide 2/8)

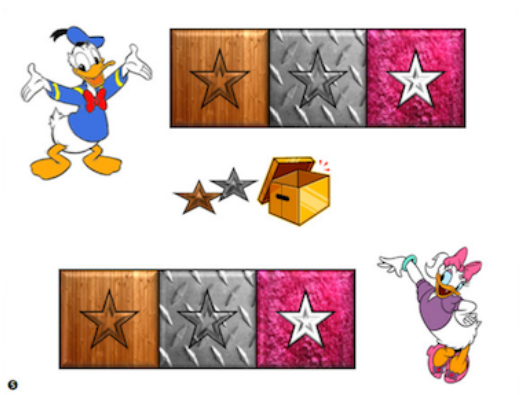
“Silly Goofy! He’s taken all the puzzle pieces and hidden them all over the attic! If Donald and Daisy want to finish their puzzles, they’re going to have to find some stars!”

(Slide 3/8)

“Can you find all the wooden stars? Can you find all the metal stars? What about the fuzzy stars? They’re all the way up on the clock! Good job. Let’s see if Donald and Daisy can find them.”

(Slide 4/8)

“Donald and Daisy find all the wooden stars and all the metal stars!”

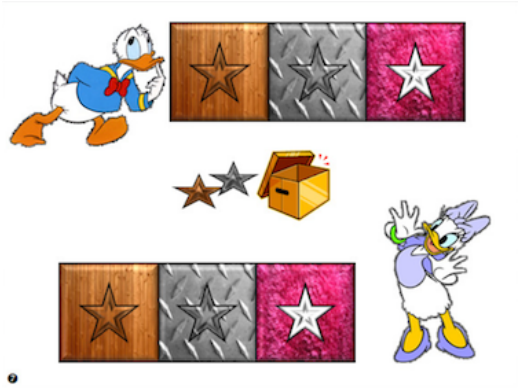


(Slide 5/8)

“They can fit their wooden stars and their metal stars perfectly! What they each need to finish their puzzle is a fuzzy star.”

(Slide 6/8)

“But Goofy did a really good job hiding the fuzzy stars up on the clock. Donald and Daisy look and look but they can’t find the fuzzy stars!”



Slide (7/8)

"So they can't finish their puzzles. Let's ask Froggy why."

(Slide 8/8)

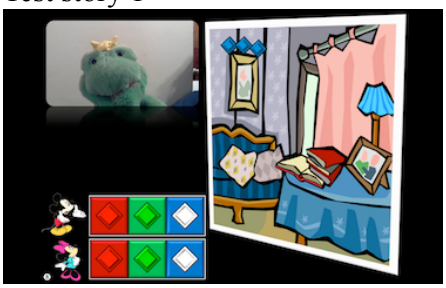
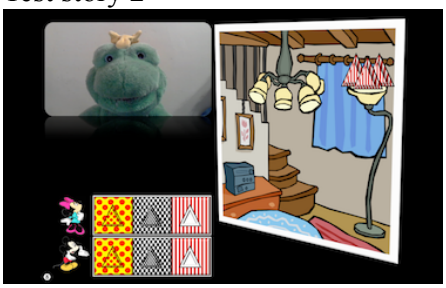
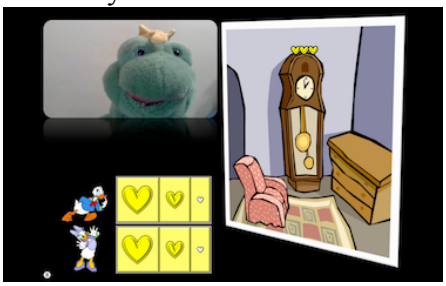
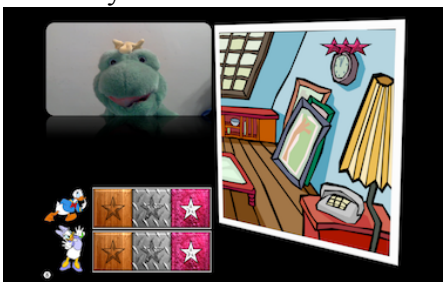
"EXP: Hey Froggy, why can't Donald and Daisy finish their puzzles?

(i)	'Hmm... Donald and Daisy both can't find any stars!'	(*ANY* condition)
(ii)	'Hmm... Donald and Daisy both can't find a star!'	(*A* condition)
(iii)	'Hmm... Donald and Daisy both can't find stars!'	(*BARE PLURAL* condition)"

In this test story, the domain of quantification consists of a set of nine stars which vary along the contextually determined dimension of texture, i.e. there are three wooden stars, three metal stars, and three fuzzy stars. The largest domain of quantification in this context is the one containing all nine stars. Possible subdomain alternatives in this context include: {wooden stars}, {wooden stars, metal stars}, {metal stars, fuzzy stars}, {fuzzy stars}, etc. In the story, Mickey and Minnie have to find the stars in order to finish a puzzle; at a critical juncture of the story, it is established that though they have been successful in finding the wooden stars and the metal stars, they cannot finish their puzzles because they cannot find the fuzzy stars. Thus what is at issue revolves around just one particular subdomain alternative (e.g., the fuzzy stars). At this point, a puppet appears on the screen to answer a question about the story: *Why can't they finish their puzzles?* with

a negatively quantified sentence containing one of the indefinites: “Mickey and Minnie both can’t find any stars!”/“Mickey and Minnie both can’t find a star!”/“Mickey and Minnie both can’t find stars!” The child’s task was to decide if the puppet’s statement was correct (*Did he say the right thing?*). If the child restricted the domain of the relevant indefinite to a smaller subdomain alternative (i.e. the fuzzy stars), s/he was expected to accept the statement; if the indefinite had to quantify over a larger domain, s/he was expected to reject the statement.

The critical test sentences from the four test trials, along with the final slides that children saw when presented with the test sentence, are provided in Table 6.

Table 6. Experiment 2: Puppet's statements on (4) test stories for (3) test conditions			
	ANY condition	A condition	BARE PLURAL condition
Test story 1 	'Mickey and Minnie both can't find any diamonds'	'Mickey and Minnie both can't find a diamond'	'Mickey and Minnie both can't find diamonds'
Test story 2 	'Mickey and Minnie both can't find any triangles'	'Mickey and Minnie both can't find a triangle'	'Mickey and Minnie both can't find triangles'
Test story 3 	'Donald and Daisy both can't find any hearts'	'Donald and Daisy both can't find a heart'	'Donald and Daisy both can't find hearts'
Test story 4 	'Donald and Daisy both can't find any stars'	'Donald and Daisy both can't find a star'	'Donald and Daisy both can't find stars'

The test sentences were pre-recorded with neutral intonation, and in particular without stress on the indefinite. Pre-recording the critical test sentences ensured consistency in stimuli across participants.

In addition to the four test stories, each child also saw four control trials. Two of the four control trials had test sentences containing negation without any indefinites, and the other two control trials involved sentences containing the relevant indefinite without negation (i.e. *some* in the ANY condition, *a* in the A condition, and the bare plural in the BARE PLURAL condition). These control items ensured that children had no problems comprehending negation and the relevant indefinites separately from each other. Test sentences in the control trials could be associated with a *yes*- or a *no*-target; depending on how the child was responding on the test trials, the experimenter selected the appropriate control sentences that would ensure a balance of *yes*- and *no*- responses overall. Any child who did not answer correctly on at least 3 of the 4 control trials was excluded from data analysis. The puppet's statements on the negation control stories are provided in Table 7, and the indefinite controls in Table 8.

Table 7. Experiment 2: Puppet's statements on (2) negation control stories

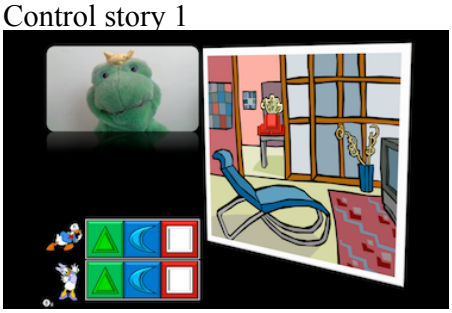
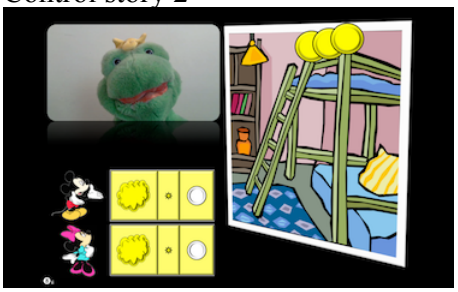
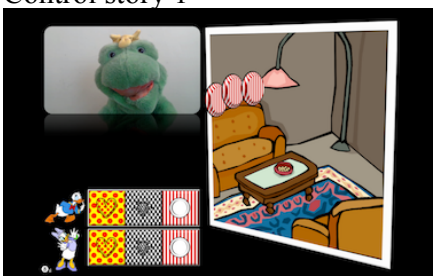
Control story 1 	'Mickey and Minnie both didn't find the squares' (target: *yes*) 'Mickey and Minnie both didn't find the moons' (target: *no*)
Control story 2 	'Mickey and Minnie both didn't find the circles' (target: *yes*) 'Mickey and Minnie both didn't find the suns' (target: *no*)

Table 8. Experiment 2: Puppet's statements on (2) indefinite control stories			
	ANY condition	A condition	BARE PLURAL condition
Control story 1 	'Mickey and Minnie both found some suns' (target: *yes*) 'Mickey and Minnie both found some circles' (target: *no*)	'Mickey and Minnie both found a sun' (target: *yes*) 'Mickey and Minnie both found a circle' (target: *no*)	'Mickey and Minnie both found suns' (target: *yes*) 'Mickey and Minnie both found circles' (target: *no*)
Control story 2 	'Mickey and Minnie both found some squares' (target: *yes*) 'Mickey and Minnie both found some clouds' (target: *no*)	'Mickey and Minnie both found a square' (target: *yes*) 'Mickey and Minnie both found a cloud' (target: *no*)	'Mickey and Minnie both found squares' (target: *yes*) 'Mickey and Minnie both found clouds' (target: *no*)

42 children were randomly assigned to one of the three test conditions. We treated indefinite type as a between-subject factor to avoid contaminating effects on subsequent trials. If a child happened to associate an indefinite with a more restricted domain of quantification for example, we wanted to ensure that this domain restriction would not influence how they interpreted subsequent sentences containing other indefinites. Thus children only heard one kind of indefinite across the four test trials.

In addition to the three test conditions described above, we also had three control conditions. The test stories in these control conditions were parallel to those in the test conditions except that the three puzzle shapes in each case did not vary along the relevant dimensions (colour, pattern, size, or texture); rather they were of three completely different shapes, thus eliminating potential widening of the domain as a factor. This allowed us to control for children's ability to simply interpret the literal truth conditional meaning of negatively quantified existential statements. The target truth values of these control sentences were the opposite of the target values in the test conditions, i.e. where we expected *yes*-responses on the plain indefinite test conditions, we expected *no*-responses on the plain indefinite control conditions, and where we expected

no-responses on the *any* test condition, we expected *yes*-responses on the *any* control condition. Examples of the test stories from the control conditions are provided in Tables 9 and 10. In these conditions as well, children received two training items, followed by four test and four control items, which were randomized and counterbalanced. The control items were the same as those in the test conditions (two negation controls and two indefinite controls), and were also dynamically presented to balance the total number of *yes*- and *no*- responses. In all, 30 children participated across the three control conditions.

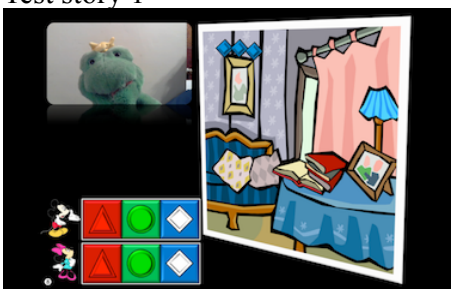
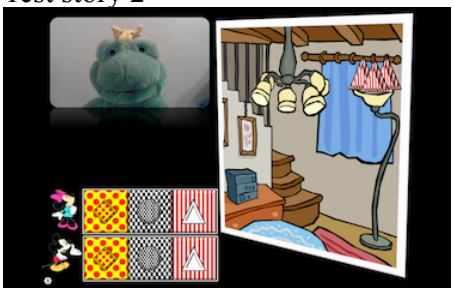
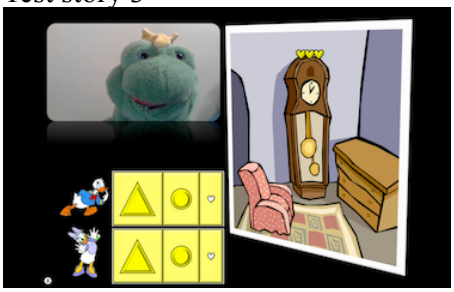
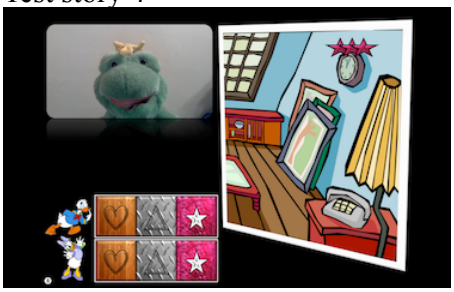
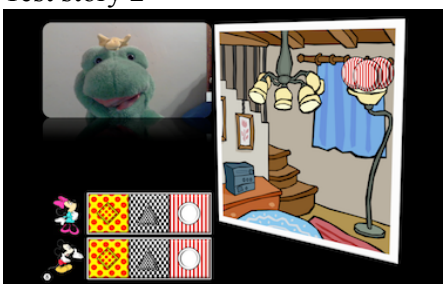
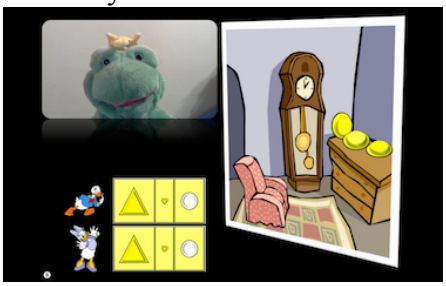
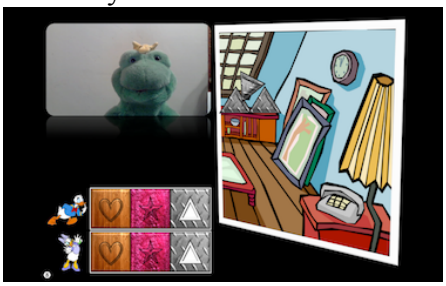
Table 9. Experiment 2: Puppet's statements on (4) test stories for ANY control condition	
Test story 1 	'Mickey and Minnie both can't find any diamonds' (target: *yes*)
Test story 2 	'Mickey and Minnie both can't find any triangles' (target: *yes*)
Test story 3 	'Donald and Daisy both can't find any hearts' (target: *yes*)
Test story 4 	'Donald and Daisy both can't find any stars' (target: *yes*)

Table 10. Experiment 2: Puppet's statements on (4) test stories for A and BARE PLURAL control conditions

	A condition	BARE PLURAL condition
Test story 1 	'Mickey and Minnie both can't find a diamond' (target: *no*)	'Mickey and Minnie both can't find diamonds' (target: *no*)
Test story 2 	'Mickey and Minnie both can't find a triangle' (target: *no*)	'Mickey and Minnie both can't find triangles' (target: *no*)
Test story 3 	'Donald and Daisy both can't find a heart' (target: *no*)	'Donald and Daisy both can't find hearts' (target: *no*)
Test story 4 	'Donald and Daisy both can't find a star' (target: *no*)	'Donald and Daisy both can't find stars' (target: *no*)

4.2 Results

4.2.1 Control Conditions

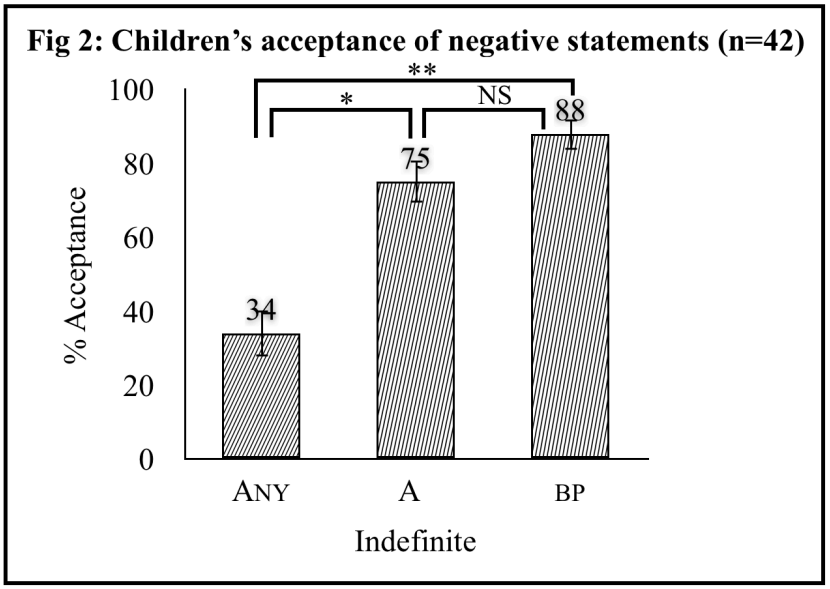
The results from the three control conditions are provided in Table 11. Children performed at or near ceiling on all three conditions. In other words, when domain widening was not at issue, children appeared target-like in their comprehension of sentences containing *any*, *a*, and bare plurals.

Table 11. Control results from child experiment (n=30)

Condition	Target response	N	Observations	# target responses	% target responses
ANY control	T	10	40	40	100
A control	F	10	40	39	98
BARE PLURAL control	F	10	40	40	100

4.2.2 Test Conditions

The results from the three test conditions are provided in Figure 2. A one-way ANOVA revealed a significant main effect of indefinite type ($F(2,39)=7.74$, $p<.01$). Children were significantly more accepting in the A-condition than in the ANY-condition (Tukey HSD, $p<.05$), and likewise were significantly more accepting in the BARE PLURAL condition than in the ANY-condition (Tukey HSD, $p<.01$). There were no significant differences between children's performance on the two plain indefinite conditions.



Let us now compare the children's performance to that of the adults in Experiment 1. A 2x3 ANOVA revealed a main effect of indefinite ($F(2,108)=51.74$, $p<.001$), a main effect of group ($F(1,108)=4.35$, $p<.05$), and a significant interaction ($F(2,108)=3.82$, $p<.05$) (Fig. 3). While children were adult-like in both plain indefinite conditions, they were more accepting of *any* than adults (Tukey HSD, $p<.05$). This asymmetry was driven primarily by four children who accepted *any* on at least 3 of the 4 trials, providing justifications consistent with domain restriction to the salient subdomain.

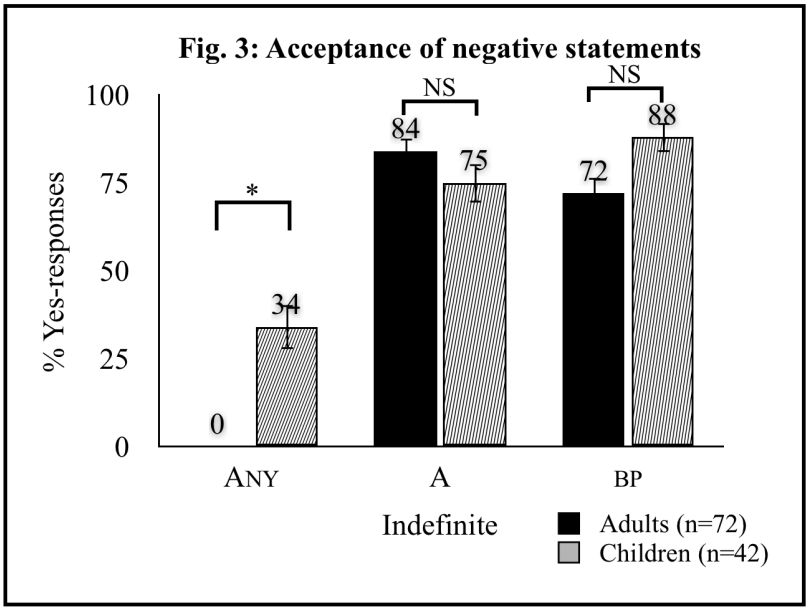
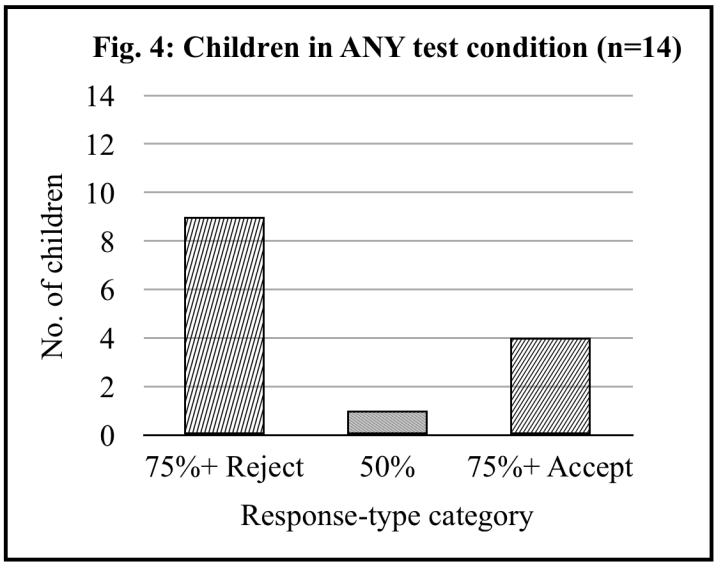


Figure 4 presents the distribution of children in the ANY-condition across three response-type categories: those who rejected at least 3 out of 4 test sentences, those who provided an equal number of *yes*- and *no*-responses, and those who accepted at least 3 out of 4 test sentences.



The individual responses thus reveal that the children were generally consistent in their responses, whether they interpreted *any* with a wider domain or a more restricted domain.

4.2.3 Follow-Up Justifications

We elicited follow-up justifications to ensure that children were accepting or rejecting the test sentences for the expected reasons. For example, following a *yes*-response, children were asked, "How do you know (Froggy's right)?" Following a *no*-response, they might hear, "How do you know (Froggy's wrong)?" or "What really happened in the story?"[16]

[16] Justifications were elicited following both positive and negative responses, so as not to bias the child towards one or the other. For example, we did not want the child to think that they would have to back up their answers only if they rejected the puppet's statement, potentially discouraging the child from providing *no*-responses. Consistent elicitation of justifications thus ensured that the experimenter was not responding differently to the children's *yes* and *no* responses.

Children's follow-up justifications for their responses were generally adult-like. In accepting the plain indefinite statements, children made reference to the salient subdomains:

(19) [CHI-44 (age 4;04), A condition]

PUPPET: Hmm... Donald and Daisy both can't find a heart.

CHI: Donald and Daisy both can't find a heart.

EXP: Was he right?

CHI: Yes!

EXP: Yes? How do you know?

CHI: Because they can't find these hearts. [gesturing to the small hearts]

(20) [CHI-07 (age 4;07), BARE PLURAL condition]

a. PUPPET: Hmm... Mickey and Minnie both can't find diamonds.

EXP: Was he right?

CHI: Yes!

EXP: Yes, good job!

CHI: They couldn't find the-

EXP: The...

CHI: The blue diamonds.

EXP: So did he say the right thing?

CHI: Yes.

b. PUPPET: Hmm... Minnie and Mickey both can't find triangles.

EXP: Was he right?

CHI: Yes! Striped ones.

Children who were adult-like in rejecting *any* statements were also adult-like in their justifications. Some made reference to the backgrounded subdomains, suggesting these could not count as exceptions to the domain of quantification:

(21) [CHI-03 (age 4;05), ANY condition]

PUPPET: Hmm... Donald and Daisy both can't find any stars.

EXP: Was he right?

CHI: [shakes head]

EXP: No? Was he paying attention or was he being silly?

CHI: No!

EXP: [laugh] Was he being silly?

CHI: Yeah!

EXP: Okay. Why- what should he have said? Did he say the wrong thing?

CHI: Yeah!

EXP: What should he have said? What do you think?

CHI: They couldn't find the fuzzy stars, but he said they couldn't find ANY stars.

(22) [CHI-14 (age 4;01), ANY condition]

PUPPET: Hmm... Donald and Daisy both can't find any stars.

EXP: Was he right?

CHI: [shakes head]

EXP: No? What should he have said?

CHI: They found two stars!

EXP: What did they find? They found...

CHI: Two woodens and two of the ...

EXP: Metal?

CHI: Yeah, the metal ones.

The children who were non-adult-like in accepting *any*-statements provided follow-up justifications that resembled those provided by children who accepted the plain indefinite statements. These made reference to the salient subdomain, suggesting the domain of *any* could be restricted to that alternative.

(23) [CHI-51 (age 5;01), ANY condition]

PUPPET: Hmm... Donald and Daisy both can't find any stars.

EXP: Was he right?

CHI: Mmhmm.

EXP: How do you know?

CHI: 'Cause (.) they're all the way up here. [*gesturing to set of fuzzy stars*]

Note also that CHI-51 was able to repeat the test sentence containing *any*, ruling out the possibility that he had simply misheard or ignored the *any*:

(24) [CHI-51 (age 5;01), ANY condition]

PUPPET: Hmm... Mickey and Minnie both can't find any diamonds.

CHI: He was right.

EXP: He was right? How do you know?

CHI: Because.

EXP: Because what. What did he say?

CHI: He said Minnie and Minnie (.) Minnie and Mickey can't find any diamonds.

EXP: Is that what happened in the story?

CHI: Mmhmm.

Finally, one child (who passed all the control trials) appeared to question the use of *any* (25i,iii) and had great difficulty deciding whether the puppet's statement was right or wrong. Her follow-up justifications suggested she was indeed focusing on the salient subdomain (25ii), but could not decide whether *any* was being used appropriately. She ultimately accepted the puppet's *any* statements (25iv), perhaps behaving charitably since the common noun phrase the puppet had used was correct.

(25) [CHI-55 (age 4;09), ANY condition]

PUPPET: Minnie and Mickey both can't find any triangles.

EXP: Was he right?

(i) **CHI: Any triangle?**

EXP: Yeah. Is that right or is that silly?

CHI: Hm... I don't know.

EXP: You don't know. It's kinda hard?

CHI: Yeah.

(ii) **EXP: What happened in the story?**

CHI: The striped triangles are up the light.

EXP: Yeah. So did he say the right thing or did he say something not so good?

CHI: I don't know anyway[?]

EXP: Hm?

CHI: I don't know anyways...

EXP: You don't really know?

CHI: Yeah...

[*The experimenter asks the puppet to repeat himself.*]

PUPPET: Minnie and Mickey both can't find any triangles.

(iii) **CHI: Any?**

EXP: Yeah.

CHI: Hm, I don't know...

EXP: You don't know?

CHI: I think...

EXP: What do you think?

CHI: xxx

EXP: This one's kinda hard, huh? Do you think we should give him a smiley or do you think he should say it better next time?

(iv) **CHI: I think... the smiley.**

In sum, regardless of whether the children's responses was target-like or not, the justifications were generally consistent with a particular interpretation of the indefinite, allowing us to ascertain how widely the relevant indefinite was quantifying.

4.3 Discussion

The widening analysis of *any* predicts a difference between *any* and plain indefinites in terms of their respective tolerance for exceptions. The 4-year-olds in our study indeed appeared to interpret the plain indefinites *a* and bare plurals as being more tolerant of exceptions; they interpreted these as quantifying over narrower domains compared to *any*. Moreover, for most of the children, *any* appeared to quantify over the widest domain alternative available in the context. Previous studies on *any* did not target this particular difference between *any* and plain indefinites. Experiment 2 thus provides novel evidence that most 4-year-olds are adult-like with respect to *any*'s domain widening property. Chapter 5 will examine the learnability of domain widening, i.e. how children arrive at the target knowledge of *any*'s semantics.

While the majority of our 4-year-olds were adult-like in rejecting *any* (and providing appropriate justifications), four children failed to widen the domain. This is a useful finding because it reveals that testing only for narrow scope is insufficient to fully assess knowledge of *any*. After all, we tested children in the same age range as those who were shown in previous studies to have adult-like knowledge of the licensing condition on *any*. It would be reasonable to assume that our child participants would also know the licensing condition on *any*. Yet we are left with a bit of a puzzle: our children appeared to interpret *any* as they would any plain indefinite (at least in terms of domain widening). What could be behind this non-adult-like behaviour?

One possible explanation is that these children were illicitly wide-scoping *any* above negation, assigning a specific, wide scope reading to the indefinite not available in the adult grammar. While logically possible, this scenario is unlikely, given that all other measures of children's sensitivity to the scope properties of *any* and plain indefinites suggest that they are able to restrict *any* to the scope of negation. Moreover, it is generally difficult to elicit the inverse, wide scope reading of indefinites above negation. Experimenters

have succeeded, but not without concerted effort to bias towards the wide scope reading (cf. Miller & Schmitt, 2004). One of the studies we reviewed in Section 3 specifically created contexts that would bias towards a wide scope reading, and found that children wide-scoped *a* and *some* significantly less often than adults did (Xiang et al., 2006). Given that we did not set out to target the wide scope reading of indefinites, it would be somewhat surprising if the children we tested happened to allow illicit wide scope of *any*.[17] But perhaps the clearest reason to reject this explanation is that the non-adult-like children were not among the youngest of the child participants; in fact, one was among the oldest, at 5;01. If by this age, these children have not yet acquired the licensing condition on *any*, let alone its semantics, it is not clear how or when they could. Moreover, spontaneous production data suggest that *any* can surface as early as around 2 years of age, and once productive enough to be observable in the transcripts, is virtually error-free.

Alternatively, the observed non-adult-like behaviour may lie in the semantics of *any*. On Kadmon and Landman's (1993) analysis, it is specified in *any*'s lexical semantics that it must widen the domain and consequently strengthen the assertion. Under such an analysis, our non-adult-like children would appear to lack this requirement, and thus would not interpret *any* as quantifying over 'wide' domains. This explanation would work a bit differently under Chierchia (2006), wherein *any* bears a focal feature [+F] that triggers obligatory exhaustification of subdomain alternatives, but widens the domain only when conditions on contrastive focus are met. On this analysis of *any*, one potential problem could lie in the focal feature specification on *any*, or the exhaustification process that should follow from the focal feature. In this case, a child

[17] If the domain of quantification of an indefinite were restricted to a singleton set, it would be impossible to tease apart the narrow scope and wide scope readings of the indefinite. This is in fact at the heart of Schwarzschild's (2002) analysis of so-called *singleton indefinites*. He argues that when a quantifier's domain restriction is reduced to a singleton set, the quantifier is effectively scopeless. On the one hand, if this is the case, then the potential scope confound in the *a*- condition is less pertinent; we would assume that the *any*, *a*, and bare plurals all took narrow scope, and any differences in interpretation arose from the respective choice of domain alternative (i.e. the size of the domain of quantification). On the other hand, if wide scope/specific readings of indefinites are truly indistinguishable from narrow scope 'singleton set domain' readings, then it can be argued that Experiment 2 did indeed involve contexts that biased towards a wide scope reading of the indefinites; each test story involved one of the subdomains being more salient than the others at the end of the story. Nevertheless, an explanation that says that the children were wide-scoping *any* is an explanation that says they did not know the licensing condition on *any*, which is difficult to reconcile with the findings of previous studies that very young children are adult-like with respect to NPI licensing.

might correctly assign an existential meaning to *any*, but without obligatory exhaustification, or without an adult-like ability to exhaustify, they would treat *any* like any other plain indefinite; that is, the non-adult-like children would merely interpret *any* as *a*. This might mean that they are free to restrict the domain of *any* to any salient domain in the context, just as they would with a plain indefinite. This story would explain why these children's justifications for accepting the *any*-statements resembled exactly those justifications from children who accepted plain indefinite statements. This explanation nevertheless runs into the same problem as the scope explanation: given the relatively late age of the non-adult-like children, it begs the question of when and how such children would cue in to the right feature specification for *any*. There is presumably no abrupt change in the kind of evidence for *any* that children receive after 5 years; what would then trigger the child to zero in on *any*'s [+F] feature? Moreover, this account would predict that the non-adult-like children would allow *any* to appear in non-licensing environments. If it is obligatory exhaustification that rules out *any* in non-DE environments and rules it in in DE environments, a child who lacks knowledge of obligatory exhaustification should not exhibit the target restricted distribution of *any*. While we did not specifically test for knowledge of NPI licensing (nor do we have spontaneous speech samples from the children tested in Experiment 2), the data from previous studies (particularly those from children younger than the ones we tested) are highly suggestive that children by 3 or 4 years of age are quite adept at restricting the distribution of *any* to the scope of appropriate licensers.

A final, more plausible explanation might lie in performance factors, which may underlie one of two problems. First, part of the exhaustification process involves identifying *any*'s (subdomain) alternatives, retaining them in memory throughout the story (until the critical test sentence is presented), and then exhaustifying all alternatives at that point. The observed non-adult-like performance may lie in difficulty identifying or storing relevant subdomain alternatives in memory.[18] If at the end of the story, one has only the salient subdomain and no other alternatives to consider, exhaustification is vacuous, and the *any*-statement essentially amounts to a plain negative existential statement quantifying over the salient subdomain. Thus these

[18] This could be because restrictions on memory prohibit storing the subdomain alternatives in memory, or because limitations on attention span lead to the exclusion of the previously mentioned alternatives as irrelevant, i.e. the child pays attention only to a limited set of objects in the story at a time, and disregards the previous subdomains as irrelevant to the outcome of the story.

children may very well have knowledge that *any* triggers obligatory exhaustification of subdomain alternatives, but may nonetheless fail to store the relevant alternatives, and thus appear to fail to "widen". Finally, somewhat relatedly, the same memory/attention limitations could yield a problem with contrastive focus, which is required to generate the "widening" effect. In order to satisfy conditions on contrastive focus, the domain of *any* has to be contrasted with smaller domains in the context. If the non-adult-like child has difficulty identifying or storing domain alternatives in memory, and by the end of the story is considering only the salient subdomain (e.g., of fuzzy stars, or blue diamonds), there is no antecedent domain with which to contrast that subdomain; in fact, since it is one of the more narrow domains, it itself does not have subdomain alternatives (only what would be referred to as superdomain alternatives). Without satisfying the conditions on contrastive focus, there can be no widening.

Most plausibly then, the subset of children who failed to widen the domain, for reasons of limited memory or attention span, disregarded the previously mentioned domain alternatives, thus appearing, on the surface, to allow exceptions to the domain of quantification for *any*.[19]

5. Summary

In this chapter, we identified the target set of syntactic, semantic, and pragmatic knowledge that children must acquire with respect to *any*. We saw that children as young as 2;06 exhibit what appears to be a target-like distribution of *any*, with extremely low rates of commission errors. We saw clear evidence from both naturalistic and experimental data that children have target-like knowledge of the syntax and structural licensing conditions on *any*, as well as the narrow-scope existential semantics of *any*. Finally, the TVJT results presented in this chapter provide novel experimental evidence that at least some 4- and 5-year-olds are sensitive to the domain widening property of *any*.

This naturally leads to the question of *how* children get to this adult-like state. In Chapter 5, we will discuss the nature of the evidence for NPI *any* in the parental input, and see that the evidence appears to be

[19] A follow-up study could attempt to reduce the required memory/attention load by reducing the complexity of the domain alternatives, for example by presenting only two kinds of objects rather than three (e.g., red and green diamonds).

asymmetrically more helpful for pointing the child to the more structural aspects of *any* (i.e. its licensing in the scope of negation) than to its semantics (i.e. domain widening). Chapter 5 will describe the puzzling learning problem that the semantics of *any* raises. Before moving to that discussion however, the next chapter will be devoted to a discussion of the other half of the *any*-puzzle, which I have thus far neglected, namely *any*'s free choice instantiation. We will see that despite producing free choice *any* rather infrequently in their spontaneous production, 4-year-olds are surprisingly adult-like in their interpretation of modalized sentences containing free choice *any*. Putting children's knowledge of NPI *any* and their knowledge of free choice *any* together as two halves of the same learning problem, Chapter 5 will then attempt an explanation of how children arrive at the full set of target knowledge regarding polarity-sensitive *any*.

Chapter 4

Children's Knowledge of Free Choice *any*

1. Introduction to Free Choice *any*

We have so far in our discussion largely neglected one dimension of *any*, namely its so-called 'free choice' (FC) instantiation. In this chapter, we turn our attention to the question of whether children are target-like with respect to (i) the distribution of FC *any*, and (ii) *any*'s semantic contribution to modal statements such as *You may choose any card*. The first we will determine by examining the same samples of children's spontaneous production from the CHILDES corpora that we reported on in Chapter 3. The second we will determine by experimentally investigating 4-year-olds' comprehension of sentences containing FC *any*. Along the way, I will introduce the relevant properties of FC *any*.

FC *any* is so-called because it generally expresses freedom of choice, as in the examples in (1)-(3); these examples give rise to so-called 'free choice inferences' (FCIs):

(1) You may write your paper on <u>any</u> topic.

→ You may write your paper on topic A, and you may write your paper on topic B, and you may write your paper on topic C, ...

(2) You can have any flower you like.

→ You can have flower A, and you can have flower B, and you can have flower C, ...

(3) Choose any card.

→ You can choose card A, and you can choose card B, and you can choose card C, ...

While NPI *any* is interpreted as a narrow-scope existential with respect to its licenser, FC *any* is usually interpreted as a wide-scope universal in modal statements (Horn, 1972; Ladusaw, 1979; Carlson, 1981; Dayal, 1998); it is generally compatible with a variety of modal bases, including epistemic, circumstantial, and deontic.

(4) Alexandre **will** read any book you give him.

(5) Ethan **would** do anything to help.

(6) Mathieu **might** take any of the trains.

(7) Sophie **could** take any bus to Storrs.

(8) Nicholas **is allowed to** attend any party.

(9) Press any key to continue.

FC *any* can be acceptable in episodic statements, but only with 'subtrigging', a phenomenon whereby post-nominal modification of an *any*-NP in an episodic sentence rescues it from ungrammaticality (LeGrand, 1975):[1]

[1] According to Dayal (1998), FC *any* must quantify over the widest possible domain that includes all possible individuals. A non-subtrigged, episodic sentence containing *any* would thus be unacceptable because it is impossible to quantify over the widest possible domain that includes all possible individuals, and to predicate something that is purely episodic of those individuals. Relative clauses or modifiers can provide a temporal or spatial bound that restricts the domain appropriately, and thus these forms of 'subtrigging' ameliorate the grammaticality of the sentence.

(10)a. *During her office hours yesterday, Sophie met with any student.

b. During her office hours yesterday, Sophie met with any student who dropped by.

FC *any* is also acceptable in generic statements:

(11) Any dog chases sticks.

(12) Any chef knows how to make pasta sauce from scratch.

As observed by Dayal (1998) however, FC *any* is not subject to quantificational variability effects: while the regular indefinite statement in (13a) typically acquires the quantificational force of the adverb *usually*, resulting in a meaning like (13b), the *any*-statement in (13c) only has a frequency reading (e.g., *any given owl usually hunts mice*).

(13)a. An owl usually hunts mice.

b. Most owls hunt mice.

c. Any owl usually hunts mice.

(Dayal, 2004:04)

FC *any* also appears in imperatives, but seems to carry existential force in such statements (Chierchia, 2013, among others). (13) and (14) for example do not require that all buttons be pushed.

(14) To proceed, push any button.

(15) For assistance, press any number and an operator will assist you.

The distribution of FC *any* thus differs from that of NPI *any*, and much debate has centered on the apparently distinct quantificational force of the two. This has led to two main camps: a uniformity camp that treats the two as a single lexical item, and a universal approach that treats FC *any* as a universal quantifier. In

many respects, FC *any* patterns with universals. For example, while NPI *any* patterns with existentials in its incompatibility with *almost*-modification (16)-(17), FC *any* patterns with universals (18)-(19) (Carlson, 1981; Kadmon & Landman 1993):

(16) *Almost some lawyer could answer that question.

(17) *I don't have almost any potatoes.

(18) Almost every lawyer could answer that question.

(19) Almost any lawyer could answer that question.

(Carlson, 1981; Kadmon & Landman, 1993:354,355)

According to Chierchia (2006, 2013), a uniformity approach better captures the observation that the polarity-sensitive/FC ambiguity is not restricted to English; in fact, *any* has parallels in many other languages, suggesting the apparent ambiguity is likely not coincidental.[2] Haspelmath's (1997) typological study of indefinite pronouns for example yields the observation that languages split roughly equally into two groups: those that, like English, use the same morphemes for FC and polarity-sensitive elements, and those that use separate ones, such as Italian. Among languages that pattern like English are the typologically unrelated Tagalog and Mandarin. The historical evolution of *any* also provides evidence of a strong relatedness between polarity-sensitive and FC items. Chierchia reports that the Proto-Indo-European word *oinos* 'one' evolved into a restricted number of possible indefinite types across languages: for example, it evolved into a

[2] Kadmon and Landman's (1993) analysis of *any*, which we introduced in Chapter 2 in our discussion of domain widening, is one example of a unified approach to NPI/FC *any*. Recall that under their analysis, *any*-NPs are existential indefinites, but contribute an additional semantic component: they widen the domain of quantification along a contextually given dimension. Regarding FC uses, Kadmon and Landman propose that *any* acquires its universal flavour in combination with a generic operator, the latter being what actually supplies the universal quantificational force. Thus the difference in quantificational force is essentially reduced to the difference between a non-generic and a generic indefinite. In contrast to this view, Dayal (1998) (see also Dayal, 2004 and discussion in Chierchia, 2013) treats FC *any* as a universal quantifier ranging over possible individuals. The difference between *any* and an ordinary universal quantifier like *every* lies in their respective domains of quantification: while *every* quantifies over a precise extensional domain, *any* quantifies over the widest possible domain consistent with its property denoting argument, making it essentially modal in nature. While some of the child data presented in this chapter will touch on the NPI/FC debate, the primary aim of the chapter will not be to contribute to the ongoing debate.

plain indefinite in German, NPI/FC *any* in English, and in Italian, a plain indefinite in the plural form but a pure NPI in the singular form.[3] Chierchia suggests that such items (e.g., plain indefinites, polarity-sensitive indefinites, items that oscillate between NPI and FC uses) form contiguous grammatical classes that easily transition from one to another. He provides a theoretically driven typology of possible polarity-sensitive indefinites one might expect to find across languages. This system assumes a deep, systematic connection between polarity sensitivity and free choice. In Chapter 5, we will turn to the question of how children acquire such a system of polarity-sensitive items, at which point we will examine Chierchia's typology in further detail, in particular considering how it might restrict the hypothesis space of the language learner. For now, our main aim is to determine whether 4- and 5-year-old English-speaking children are target-like with respect to the distribution and semantics of FC *any*.

2. Corpus Study 2: Children's Spontaneous Production of FC *any*

In this section I investigate children's knowledge of FC *any* by examining their spontaneous production of *any*. We have already seen that children are quite target-like in their spontaneous production of NPI *any*, producing it almost exclusively in well-licensed environments. Are they likewise aware of the distributional restrictions on FC *any*?

In addition, we will also consider the age at which FC *any* emerges, relative to when NPI *any* emerges. Just as there are two main camps in the theoretical debate over the lexical status of *any*, the child learner might similarly entertain two hypotheses: either NPI and FC *any* are distinct lexical items, or they are a single item. If children treat the two as a single lexical item, we might expect NPI and FC uses to emerge concurrently. On the other hand, if the children treat them as distinct lexical items, all else being equal, there is no particular expectation as to a relative order of acquisition.

[3] Citing a personal communication with G. Carlson, Chierchia reports that uses of English *any* were restricted to purely negative polarity uses in Old/Middle English, up until the early 16th century.

2.1 Method

I examined the spontaneous speech transcripts from the same 40 English-speaking children whose spontaneous speech transcripts were examined in Chapter 3. There were 18 American children, covering the age range 0;11,04-5;02,12, and 22 British children covering the age range 1;08,22-4;11,20; these corpora are available on the CHILDES database (MacWhinney, 2000), and are listed again in Tables 1 and 2.

Table 1. American English: Corpora under study

CORPUS	CHILD	AGE RANGE	NO. OF TRANSCRIPTS	NO. OF UTTERANCES
Bloom	Peter	1;09,07 – 3;01,21	20	23,000
Brown	Adam	2;03,04 – 5;02,12	55	45,371
	Sarah	2;03,05 – 5;01,06	139	31,195
	Eve	1;06,00 – 2;03,00	20	10,856
Demetras	Trevor	2;00,27 – 3;11,27	28	6,568
Kuczaj	Abe	2;04,24 – 5;00,11	210	22,684
Providence	Alex	1;11,16 – 3;03,21	56	31,423
	Ethan	0;11,04 – 2;11,01	50	21,898
	Lily	1;01,02 – 4;00,02	80	39,852
	Naima	0;11,28 – 3;10,10	83	43,542
	Violet	1;02,00 – 3;11,24	54	17,274
	William	1;04,10 – 3;04,15	44	21,220
Sachs	Naomi	1;02,29 – 4;09,03	93	15,542
Suppes	Nina	1;11,16 – 3;03,21	56	31,423
Weist	Emily	2;06,06 – 4;05,19	23	7,264
	Emma	2;07,08 – 4;08,04	28	6,669
	Mat	2;03,10 – 5;00,05	56	10,157
	Roman	2;02,20 – 4;07,20	42	11,064
		TOTAL	1,137	397,002

Table 2. British English: Corpora under study				
CORPUS	CHILD	AGE RANGE	NO. OF TRANSCRIPTS	NO. OF UTTERANCES
Belfast	Barbara	2;04,09 – 4;01,18	14	2503
	Conor	3;08,14 – 4;06,05	14	3045
	Courtney	3;04,00 – 4;00,11	7	2021
	David	2;00,03 – 4;02,03	14	2472
	Johnny	3;06,00 – 4;04,01	7	1678
	Michelle	2;04,28 – 4;04,19	14	3075
	Rachel	2;05,25 – 2;09,16	8	1184
	Stuart	3;05,12 – 4;05,04	11	3369
Lara	Lara	1;09,13 – 3;03,25	120	47,876
Manchester	Anne	1;10,07 – 2;09,10	68	19,866
	Aran	1;11,12 – 2;10,28	66	17,111
	Becky	2;00,07 – 2;11,15	68	23,300
	Carl	1;08,22 – 2;08,15	65	24,857
	Dominic	1;10,25 – 2;10,16	68	21,097
	Gail	1;11,27 – 2;11,12	68	16,947
	Joel	1;11,01 – 2;10,11	68	17,862
	John	1;11,15 – 2;10,24	64	13,303
	Liz	1;11,09 – 2;10,18	68	16,545
	Nicole	2;00,25 – 3;00,10	68	16,937
	Ruth	1;11,15 – 2;11,21	66	20,295
	Warren	1;10,06 – 2;09,20	67	16,587
Thomas	Thomas	2;00,12 – 4;11,20	379	198,647
		TOTAL	1,392	490,577

The analysis in Chapter 3 made use of the *kwal* and *combo* programs available on CLAN to extract all child utterances containing *any*. I discounted imitations, repetitions, routine utterances, single-word utterances (including those consisting solely of *any*+NounPhrase), and unclear utterances where "xxx" or "yyy" preceded *any* in the utterance, such that a potential licenser might be occluded. I then sorted out the FC occurrences from the NPI occurrences,[4] using as much preceding and following discourse context in the transcripts as necessary to interpret the children's uses. I then determined whether these were grammatical occurrences of *any*.

Next, to examine the question of whether both NPI and FC uses of *any* emerge concurrently, I determined whether there were statistically significant chronological gaps between the onset of each kind of *any*. If there is a high enough frequency of the two kinds of *any*, the Binomial Test (Snyder, 2007: Ch. 5) can be used to help judge whether the observed chronological gap between the two is simply due to a lower frequency of use of the construction emerging later. The rationale behind the Binomial Test is that if the grammatical knowledge for one construction is identical to the grammatical knowledge required for another construction, the two constructions ought to emerge around the same time. We thus adopt the null hypothesis that the polarity-sensitive and FC instantiations of *any* become available to the child concurrently. Of course, it is impossible for the first single occurrence of *any* to be simultaneously polarity-sensitive and FC, such that one will naturally surface 'before' the other;[5] the Binomial Test allows us to determine whether the gap that we find between the two is statistically significant. Assuming that the two kinds of *any* maintain the same relative frequency once they are available, non-significance of the Binomial Test based on relative frequency indicates that the observed chronological gap is fully consistent with concurrent emergence, given the lower probability of sampling the less frequent construction (Snyder, 2007).

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[4] In theory one can do this by separating those instances of *any* appearing in downward-entailing environments and questions from those appearing in modal or subtrigged sentences. In practice, separating the two kinds of uses was relatively straightforward, as most NPI uses involved sentential negation, and most FC occurrences involved overt modals.

[5] A distinct but unlikely possibility is that the first utterance containing *any* would contain two *any*'s, one polarity-sensitive and one FC. This was not observed in any of the corpora.

2.2 Results

As a group, the American children only produced 38 instances of FC *any*, 18 of them from Adam (Brown corpus). The British children as a group only produced 29 instances of FC *any*, 25 of them from Thomas (Thomas corpus). Collapsing the two groups, we find a total of 66 instances of FC *any*, 64 of which look unquestionably adult-like, occurring either in a dispositional statement or with some other overt modal. Of the 64 grammatical occurrences of FC *any*, 57 involved modal statements, 10 of which also involved a dispositional/characterizing meaning. Some examples are provided below:

(20) Abe (Kuczaj corpus), Transcript 192 (4;08,07), Line 285

*CHI: you **can** bring it anywhere you want to .

(21) Adam (Brown corpus), Transcript 52 (5;02,12), Line 3485

*CHI: you **can** paste it on anything .

(22) Emma (Weist corpus), Transcript 26 (4;04,18), Line 364

*CHI: I **can** eat anything I want to .

(23) Thomas (Thomas corpus), Transcript 351 (4;05,09), Line 1809

*CHI: it does anything your car does .

(24) Thomas (Thomas corpus), Transcript 351 (4;05,09), Line 1440

*INV: and she carries everyone's rubbish (.) out to the front .

*INV: and she collects everyone's recycling as well .

*CHI: ahh .

*INV: what do you recycle ?

*CHI: I recycle anything .

(25) Emily (Weist corpus), Transcript 4 (2;07,18), Line 638

*CHI: I can make him do anything .

(26) Emily (Weist corpus), Transcript 23 (4;05,19), Line 469

*CHI: she can hold her, and I can do anything I want, like jump .

Apart from the 64 relatively unquestionable adult-like occurrences of *any*, there were two instances of *any* that were less adult-like; while there appeared to be a universal meaning intended, these were cases where an adult would likely have produced *every* rather than *any*:

(27) Emily (Weist corpus), Transcript 6 (2;08,13), Line 380

*CHI: I saw my Uncle Dave .

*CAR: what'd he talk about with you ?

*CHI: he talked anything with me .[6]

*CHI: he talked and talked .

*CHI: like he knowded [: knew] how to build my puzzles .

(28) Joel (Manchester corpus), Transcript 33b (2;10,04), Line 1860

*CHI: I like pineapple .

*CHI: and this .

*CHI: and ready salted crisps .

*MOT: ready salted crisps .

*CHI: and salt .

CHI: I [0have] got anything in my cupboard .[7]

*MOT: oh .

*CHI: got lots in my cupboard .

*CHI: in here .

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[6] FC *any* is generally not licensed in episodic sentences, unless there is post-nominal modification of *any*, i.e. subtrigging. One could imagine an adult conveying (what is likely the intended meaning of) (27) with something like, *He talked about anything and everything with me*. 'Anything and everything' seems to introduce a modal dimension to the utterance, i.e. he talked about (or was capable of talking about) a wide array of possible topics. It may be a fixed expression (reversing the two conjuncts seems less natural to my ear). In any event, without the universal quantifier *everything* or subtrigging, (27) is ungrammatical.

[7] Given the discourse context, one could imagine the child is trying to say something like, *I've got anything (you could imagine) in my cupboard*. If there were sub-trigging, i.e. post-nominal modification of *anything*, the sentence would be grammatical. 'Covert sub-trigging' however, is not possible in the adult grammar, so despite the intended widened/universal meaning in (28), I've counted it as an error.

It is impossible to look at individual error rates, since only two children produced more than a few isolates of FC *any*. Emily produced only five instances of FC *any*, while Joel produced only one instance of FC *any*. The overall error rate however (2/66) is quite low; thus the children who produced FC *any* were quite target-like in their distribution of *any*.

Next, we consider the relative age of acquisition of NPI and FC *any*. 28 of the 40 children did not produce any FC *any* at all. For those who did however, the age of onset of FC *any* varied from 2;07,18 (Emily) to 4;02,13 (Mat). Note that the Binomial Test is based on First of Repeated Uses, i.e. the first clear use that is followed soon after by repeated uses (cf. Stromswold, 1996; Snyder & Stromswold, 1997); this excludes isolated uses in early stages where a construction is likely not yet productive.[8] As such, running the Binomial Test on a child's data requires that the child demonstrate repeated use of the two items. In this case, we require a sufficient frequency of NPI *any* and FC *any*. I chose 15 as an arbitrary cut-off for applying the Binomial Test. Using this conservative measure meant that only two children could be considered: excluding repetitions, imitations, and isolates, Adam (Brown corpus) produced 18 instances of FC *any*, and Thomas (Thomas corpus) produced 25 instances of FC *any*. The Binomial Test results for Adam and Thomas are given in Table 3.

Table 3. Binomial tests (NPI *any* vs. FC *any*)

Child	# of earlier type of *any* (NPI or FC) during gap	# of earlier type of *any* after gap	# of later type of *any* after gap	*p*-value
Adam (AE)	32 (NPI)	14 (NPI)	15 (FC)	<.001**
Thomas (UK)	229 (NPI)	227 (NPI)	24 (FC)	<.001**

Both children's *p*-values were highly significant, and remained so after a Bonferroni correction was applied. For both children, FC *any* came in significantly later than NPI *any*. Figures 1 and 2 below show Adam's and Thomas's use of NPI and FC *any* over time.

[8] For example, the first occurrence of FC *any* in Adam's transcripts appeared at 3;05,15. The next instance did not appear until 15 transcripts later, at age 4;03,13, after which point it appears repeatedly (with no larger than a three-transcript/three-month gap at most between consecutive uses). I therefore excluded the first instance as an isolate, and took 4;03,13 as the onset of productive use of FC *any*.

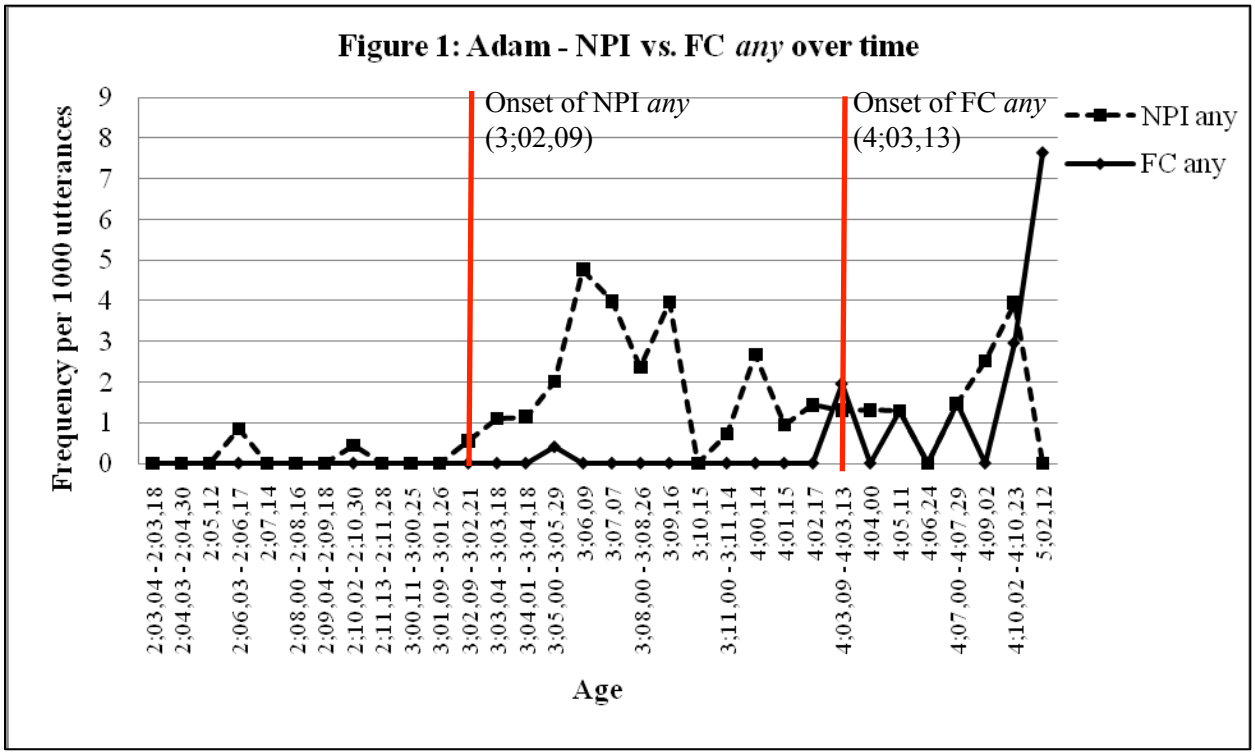


Figure 1: Adam - NPI vs. FC *any* over time
Frequency per 1000 utterances
Onset of NPI *any* (3;02,09)
Onset of FC *any* (4;03,13)
NPI any
FC any
Age

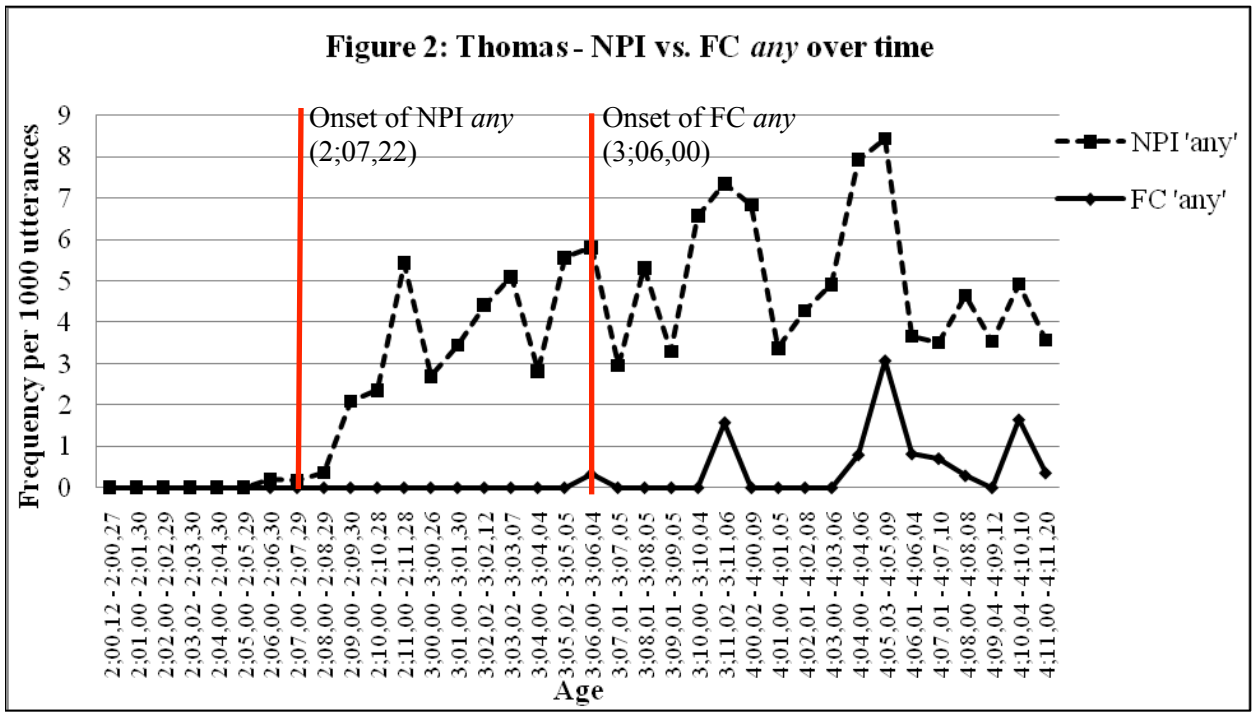


Figure 2: Thomas - NPI vs. FC *any* over time
Frequency per 1000 utterances
Onset of NPI *any* (2;07,22)
Onset of FC *any* (3;06,00)
NPI 'any'
FC 'any'
Age

Alongside these results from Adam and Thomas is the observation that 28 of the 40 children did not produce any FC *any* at all, despite producing a number of NPI *any*. If these children treated NPI and FC *any* as a single lexical item, it might be somewhat surprising that so many of them produced as many NPI *any* as they did without producing a single occurrence of FC *any*.

2.3 Discussion

Summarizing the corpus study then, we see that the American and British English-speaking children who demonstrated productive use of FC *any* were quite target-like in their spontaneous production. They rarely produced commission errors, with FC *any* occurring extensively with overt modals. Although we must be very cautious about drawing conclusions on the basis of two children's data, we have also seen some form of evidence that FC *any* emerges later than NPI *any*. This may suggest that (whatever the representation of *any* in the adult grammar), children initially treat NPI and FC *any* as two different lexical items. If they are encoded with different lexical semantics, there is no reason to expect a particular order of acquisition.

One possible objection to the idea that NPI and FC *any* are distinct categories for the children is the following: two items that are really the same should surface concurrently only if all else is equal; in this case, all else might be argued *not* to be equal. The FC use of *any* might be viewed as more complex, as it involves either co-occurring (c)overt modals or subtrigged sentence structures. Thus even if there were only a single *any*, we might see the FC use emerge later because it typically involves modals, which themselves might emerge later. Consider Adam, for example, who produced 18 FC *any*, 11 of which occurred with the overt modal *can*. One might object that perhaps Adam produced FC *any* significantly later because only later did he develop productive use of the modal *can*. But if we compare Adam's production of the modal *can* in the period during which he produced NPI *any* but not FC *any*, to his production of *can* in the period following the onset of FC *any*, i.e. when he had both uses of *any* available to him, we see that he in fact produced more occurrences of *can* per 1000 utterances before the onset of FC *any* (roughly 48 occurrences per 1000 utterances), than after (roughly 36 occurrences per 1000 utterances). Of course, we are using *can* as a stand-in for modals in general; but given that more than half of his eventual FC utterances involved *can*, it

seems unreasonable to hypothesize that Adam was initially prohibited from FC production due to a deficit in his ability to produce an accompanying modal.

In sum, we do not have a clear argument for or against a unified approach to NPI/FC *any* in the children's language. What we know is that FC *any* either does not show up at all in the children's spontaneous production, or shows up virtually error-free, if productive. One drawback to trying to derive generalizations from the spontaneous corpora is that FC *any* is generally not frequent in spontaneous production; in Chapter 5 we will see that FC *any* corresponds to roughly 1-4% of all occurrences of *any* in parental speech (according to three samples of parental spontaneous production). It is therefore difficult to make any generalizations about children's knowledge on the basis of spontaneous production. We will therefore turn next to an experimental investigation of children's knowledge of FC *any*.

3. Deriving Free Choice Inferences[9]

This section examines comprehension of FC *any*. Let's begin by considering a particular kind of inference that arises when FC *any* is used in a modal statement.

The use of a modal statement invites certain inferences, for example the "not-required-to" inference in (29).[10] Plain disjunctions give rise to so-called exclusivity inferences, as in (30). Putting a modal and disjunction together, as in (31), also invites an exclusivity inference. But in addition to this exclusivity inference, the utterance typically also invites a further 'conjunctive' inference, namely the so-called *free choice inference* (FCI) in (32). The existence of this inference is not expected under modal logic, and moreover is absent from the plain disjunctive statement (33) (which in fact typically conveys the negation of the conjunctive inference).

[9] Much of the material presented in this and the next section draws heavily on Zhou, Romoli, and Crain (to appear); see also Tieu, Romoli, Zhou, & Crain (2013) for further details.

[10] Following terminology used in Zhou, Romoli, and Crain (2013).

(29) Jack may have tea

↛ Jack does not have to have tea *not-required-to inference*

(30) Jack had tea or coffee

↛ Jack did not have both tea and coffee *exclusivity inference*

(31) Jack may have tea or coffee

↛ Jack may not have both tea and coffee *exclusivity inference*

(32) Jack may have tea or coffee

↛ Jack may have tea and Jack may have coffee *free choice inference*

(33) Jack had tea or coffee

↛ Jack had tea and Jack had coffee

Now consider a typical scalar implicature of the kind in (34), where the use of the weaker existential term *some* invites the inference that the stronger statement containing the universal *all* is false.

(34) Jack ate some of the fries

↛ Jack did not eat all of the fries

Notice that the inferences in (29) through (32), like the scalar implicature in (34), are all defeasible; they can be suspended without yielding a contradiction with the assertion:

(35) Jack ate some of the fries

...and in fact he ate all of the fries *scalar implicature*

(36) Jack may have tea

...and in fact he might even have to have tea *not-required-to inference*

(37) Jack had tea or coffee

...and in fact he might even have had both *exclusivity inference*

(38) Jack may have tea or coffee

...and in fact he might even be allowed to have both *exclusivity inference*

(39) Jack may have tea or coffee

...but I don‘t remember which *free choice inference*

Given this similarity, a recent approach to FCIs is to derive them as a kind of recursive scalar implicature. For the purposes of setting up the acquisition study that follows, I will briefly sketch the basic idea behind an analysis like Fox (2007) (for specific details and alternative implementations, see Schulz, 2005; Klinedinst, 2007; Chemla, 2010; Alonso-Ovalle, 2005; Franke, 2011).

Scalar terms typically invite so-called scalar implicatures. The basic Gricean reasoning is the following. When we hear an utterance A, we compare it with stronger alternatives that the speaker could have uttered. Assuming the speaker is co-operative and obeys the maxim of quantity, providing as much information as required, we reason that if the speaker could have truthfully uttered B, s/he would have. Given that the speaker chose not to, we make the inference that B is false in the speaker's mind. For example, this reasoning gives rise to the inference in (34), repeated below as (40): the speaker uttered the sentence containing *some*, when the alternative containing *all* (which entails the *some*-statement) would have been stronger. Given the speaker did not utter the *all*-statement, we infer that it must be false.

(40) Jack ate some of the fries

⇝ Jack did not eat all of the fries

Consider how this reasoning applies in the case of our FC disjunction. For a sentence like (41), we have to consider the individual disjuncts as alternatives (cf. Sauerland, 2004). That is, the disjuncts themselves are competitors of the disjunctive assertion. A second crucial ingredient in analyses such as Fox (2007), is the element of recursivity: we must consider not just the alternatives, but these alternatives enriched with any inferences they might themselves give rise to (see also Kratzer & Shimoyama, 2002; Alonso-Ovalle, 2005, among others), i.e. we must compare the assertion to its strengthened alternatives. Put differently,

exhaustification will apply to pre-exhaustified alternatives, i.e. alternatives that are themselves exhaustified. In a context where tea and coffee are salient alternatives, (41a) gives rise to the alternatives in (41b) and (41c).

(41)a. Ethan may have tea or coffee

b. EXH(Ethan may have tea)

i.e. Ethan may have tea and Ethan may not have coffee (*Ethan may only have tea*)

c. EXH(Ethan may have coffee)

i.e. Ethan may have coffee and Ethan may not have tea (*Ethan may only have coffee*)

The strengthened alternatives in (b) and (c) are both stronger than the assertion in (a); exhaustification therefore eliminates them:

(42)a. Ethan may have tea or coffee

b. NOT(EXH(Ethan may have tea))

i.e. it's not the case that Ethan may only have tea

c. NOT(EXH(Ethan may have coffee))

i.e. it's not the case that Ethan may only have coffee

d. Ethan may have tea and Ethan may have coffee

Given that Ethan is not restricted to one or the other, it follows that he may have either tea or coffee (he has free choice of the two). Thus we have our FCI in (42d).

FC indefinites like *any* have been analyzed on a par with FC disjunction (cf. Krifka, 1994; Chierchia, 2006, 2013). The literal meaning of (43a), in a context where the relevant alternatives include tea, coffee, and juice, corresponds to the disjunctive assertion in (43b). Recall that the alternatives of *any* are its contextually defined (sub)domain alternatives, in this case: {teas}, {teas, coffees}, {teas, juices}, {juices}, {coffees, juices}, etc. Obligatory exhaustification of the strengthened domain alternatives (43c-e), as in the

case of FC disjunction, gives rise to the FCI in (43f), which conveys that Ethan has free choice of these various subdomain alternatives.

(43)a. Ethan may have any$_D$ drink [where D includes tea, coffee, juice]

b. Ethan may have tea, coffee, or juice

c. NOT(EXH(Ethan may have tea))

i.e. it's not the case that Ethan may only have tea

d. NOT(EXH(Ethan may have coffee))

i.e. it's not the case that Ethan may only have coffee

e. NOT(EXH(Ethan may have juice))

i.e. it's not the case that Ethan may only have juice

f. ⇝ Ethan is allowed to have tea and Ethan is allowed to have coffee and Ethan is allowed to have juice

Returning now to the acquisition question, the next section presents an experiment designed to test children's ability to compute such FCIs arising from the indefinite under the deontic modal *is allowed to*.

4. Experiment 3: Children's Free Choice Inferences from *any*[11]

4.1 Method

We used a modified version of the Truth Value Judgment Task (Crain & Thornton, 1998, 2000) to investigate children's comprehension of FC *any* in deontic modal statements.

4.1.1 Subjects

16 English-speaking children from the Sydney area were tested at Macquarie University, Australia. One child failed the control items and was excluded from the analysis. The 15 remaining English-speaking

[11] This study is also reported in Tieu, Romoli, Zhou, and Crain (2013).

children were aged 4;01-6;08 (M=5;01). All children were acquiring English as a first language, according to the information provided on parental permission forms. Families were paid $20 for participating.

4.1.2 Procedure

The TVJT was carried out by a single experimenter using a laptop computer. Stories were told (by the experimenter) using cartoon pictures and animations created and displayed in PowerPoint. Pre-recorded video clips of a puppet created the pretense that the puppet was participating in the task live via webcam. Participants were told that the puppet was not very good at paying attention to stories, and were given a scorecard to fill out in order to help the puppet to learn how to pay better attention. At the end of each story, the puppet was either asked to recall something from the story or to describe something that had happened in the story. Participants were asked to determine whether the puppet's statement was 'right', in which case s/he was instructed to put a stamp under the 'happy face' column of the report card. If the puppet was 'wrong', the participant was instructed to put a stamp under the 'sad face' column of the report card. Follow-up justifications were elicited from subjects to ascertain their reasons for providing *yes* or *no* responses. All subjects were tested individually. Sessions were videorecorded for later coding and analysis.

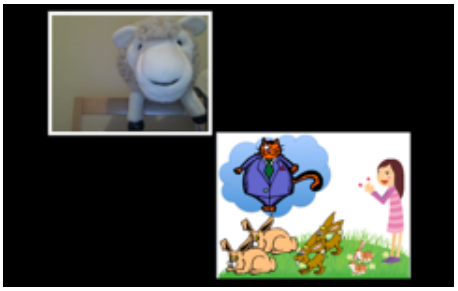
4.1.3 Materials

We designed stories that made free choice statements felicitous. The critical test stories revolved around a series of (child) cartoon characters and their babysitter Mr. Cat. It was established that Mr. Cat was in charge of setting rules for the children to follow. Each story context clearly provided different possible (sub)domains of quantification. On the critical test trials, Mr. Cat would utter a rule that indicated the cartoon character could interact with one of the possible subdomains in some particular way, e.g., *Lucy is allowed to hold the big rabbits*. Then the puppet was asked to recall the puppet's rule, and would utter a FC statement, e.g., *Lucy is allowed to hold any rabbit!* Depending on whether subjects accepted the FC statement, we could infer whether they were computing merely the literal meaning (the disjunctive assertion *Lucy may hold the big rabbits or the medium rabbits or the small rabbits*) or the FCI (the conjunctive

inference *Lucy is allowed to hold the big rabbits and Lucy is allowed to hold the medium rabbits and Lucy is allowed to hold the small rabbits*). The literal meaning (but not the FCI) was compatible with Mr. Cat's story, so if the child provided a *no*-response, we could infer that they were calculating the FCI. Thus *yes*- and *no*-responses, along with appropriate follow-up justifications, were taken as a measure of the child's ability to compute FCIs.

Each child received two training items, followed by four test and six control items, which were pseudo-randomized and counterbalanced. The four test trials varied in the dimension of the subdomain alternatives (size, colour, texture, and kind of animal). An example test story is provided in Fig. 3.

Fig. 3: Experiment 3: Example test story

	(Slide 1/3) "Today Lucy is visiting a rabbit farm. There are big rabbits, medium rabbits, and little baby rabbits! Will Lucy get to hold the rabbits? Let's see what Mr. Cat says. Remember, he knows all the rules!"
	(Slide 2/3) "Mr. Cat says, "Lucy, you may hold the big rabbits, but you may not hold the medium rabbits and you may not hold the small rabbits, because they're still growing."
	(Slide 3/3) EXP: Hey Baba, can you tell us something about the story? BABA: Hmm... Lucy was allowed to hold any rabbit! (target: *no*)

In this test story, the domain of quantification consists of a set of six rabbits which vary along the contextual dimension of size, i.e. there are two big rabbits, two medium rabbits, and two small rabbits. The largest

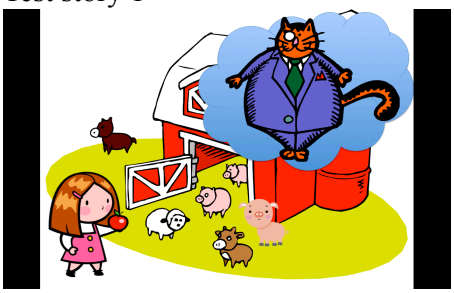
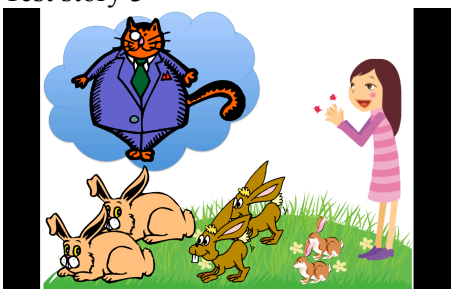
domain of quantification in this context is the one containing all six rabbits (two big, two medium, and two small). Possible subdomain alternatives in this context include: {big rabbits}, {big rabbits, medium rabbits}, {small rabbits, big rabbits}, {medium rabbits}, etc. In the story, Lucy is visiting a rabbit farm and is told by Mr. Cat that she is only allowed to hold the big rabbits, since the medium and small ones are still growing and rather fragile.[12] Next, a puppet appears on the screen and is asked to recall something about the story: *Can you tell us something about the story*? He answers with a free choice statement: "Lucy was allowed to hold any rabbit!" Participants were asked to decide if the puppet's statement was right or wrong. If participants computed only the literal meaning of the puppet's statement (44a), they were expected to accept the statement, as it was compatible with Mr. Cat's rule; if they computed the FCI (44b), they were expected to reject the sentence.

(44)a. Lucy is allowed to hold the big rabbits, the medium rabbits, or the small rabbits

b. ⇝ Lucy is allowed to hold the big rabbits and Lucy is allowed to hold the medium rabbits and Lucy is allowed to hold the small rabbits

The four test stories are provided in Table 4. All of the puppet's lines were pre-recorded with neutral intonation, and in particular without stressing *any*. Having the critical test sentences presented via video files ensured consistency in stimuli across subjects.

[12] An anonymous abstract reviewer raised the concern that the Condition of Plausible Dissent has not been satisfied in such a trial. The concern is that if Mr. Cat's rule makes reference only to the objects that Lucy is allowed to carry out the action with, the child may consider that the same rule can apply to the other objects, but has merely been omitted by Mr. Cat (rather than holding as prohibitions against carrying out the action with the other objects). This however, is not the case. In every test story, Mr. Cat not only explicitly prohibits against carrying out the action with the other (subsets of) objects, he also provides an explanation for the prohibition. In the rabbit story for example, Mr. Cat says that Lucy is not allowed to hold the medium or small rabbits because they are too small and fragile. Every story was consistent in this respect, satisfying the Condition of Plausible Dissent.

Table 4. Experiment 3: (4) free choice test stories	
Test story 1 	1. Today Emily is visiting a farm. Emily sees some pigs, some cows, and a sheep! Will Emily get to feed the animals? Let's see what Mr. Cat says. Remember, he knows all the rules! 2. Mr. Cat says, "Emily, you may feed the pigs, but you may not feed the cows and you may not feed the sheep, because they've already eaten." 3. Hey Baba, can you tell us something about the story? 'Emily was allowed to feed any animal'
Test story 2 	1. Today Billy's friends are going to come over and play with him. Billy sees some yellow trucks, some red trucks, and some blue trucks! Will Billy get to push the trucks around? Let's see what Mr. Cat says. Remember, he knows all the rules! 2. Mr. Cat says, "Billy, you may push the yellow trucks, but you may not push the red trucks and you may not push the blue trucks, because they belong to the other kids." 3. Hey Baba, can you tell us something about the story? 'Billy was allowed to push any truck'
Test story 3 	1. Today Lucy is visiting a rabbit farm. There are big rabbits, medium rabbits, and little baby rabbits! Will Lucy get to hold the rabbits? Let's see what Mr. Cat says. Remember, he knows all the rules! 2. Mr. Cat says, "Lucy, you may hold the big rabbits, but you may not hold the medium rabbits and you may not hold the small rabbits, because they're still growing." 3. Hey Baba, can you tell us something about the story? 'Lucy was allowed to hold any rabbit'
Test story 4 	1. Today Mary's daycare has some very special decorations up. Mary sees some fuzzy stars, some wooden stars, and some metal stars! Will Mary get to touch the stars? Let's see what Mr. Cat says. Remember, he knows all the rules! 2. Mr. Cat says, "Mary, you may touch the fuzzy stars, but you may not touch the wooden stars and you may not touch the metal stars, because they're very fragile." 3. Hey Baba, can you tell us something about the story? 'Mary was allowed to touch any star'

In addition to the four test stories, each child also saw six control stories. Control items consisted of: (i) sentences containing only the deontic modal *is allowed to* to ensure full comprehension of the modal without the FC indefinite; (ii) sentences containing the NPI *any* under negation;[13] and (iii) sentences containing FC *any* where the target response was *yes*, to ensure that children could plausibly give a *yes* response to a FC statement where appropriate.[14] While the four FC test trials and modal and NPI controls were randomized, the two FC control trials were presented last, so as not to contaminate the children's interpretations of the critical test trials.[15]

The control items allowed us to make sure subjects were on task, and controlled for children's knowledge of the relevant components of the critical test sentences. The modal and NPI control items could be associated with a target *yes* or *no* response. If a subject provided a *yes* response to a given test story, the following control item would have as its target a *no* response, and vice versa. This allowed us to balance the overall number of *yes* and *no* responses. Any child who did not answer correctly on at least 3 of the 4

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[13] Ordinarily one would include control sentences containing just the FC indefinite without the modal, but this was impossible, as *any* would be unlicensed in the resulting episodic sentence. Rather than introduce the complication of subtrigging (e.g., *Lucy held any rabbit that was close by*), we chose to test children's comprehension of *any* by using its NPI instantiation, which at least allowed us to definitively isolate *any* from the modal. Another reason to test *any* under negation was to control for the possibility that children might interpret FC *any* as a universal like *every* or *all* (e.g., they would interpret the test sentence as *Lucy was allowed to hold every rabbit*). Testing *every*-sentences in the same FC contexts would not help to tease apart children's comprehension of *any* and *every*, as presumably the target response in the case of *every* would also be *no* (assuming children might interpret the sentence as, *Every rabbit x is such that Lucy can hold x*). Justifications would also fail to tease apart the two interpretations, as they would be the same for rejections of FC *any* and rejections of *every* (e.g., it is false that *Lucy was allowed to hold any/every rabbit*, since *Lucy was only allowed to hold the big rabbits*). This is where the NPI controls came in handy; in control story 1 in Table 6 for example, where Emily fed one giraffe, the sentence *Emily didn't feed any giraffes* should yield a *no*-response, unless it was interpreted as *Emily didn't feed every giraffe*, in which case the target answer would be *yes*. Thus a child's response on such a trial could indicate whether that child's grammar distinguished *any* from *every*.

[14] In other words, we wanted to rule out the possibility that a child (with a non-adult-like grammar) might simply reject any sentence containing FC *any*, thereby giving the appearance of target-like performance on the critical test trials.

[15] Since the purpose of the FC control trials was to ensure that children could respond positively to a felicitous FC statement, situating these trials after all the test trials (with a *no*-target) arguably stacked the deck against us; if there were any contamination effect at all, it would go in the direction of children rejecting the FC controls. If they successfully accepted these controls however, then we could be assured that the children were not simply employing a reject-all strategy in their comprehension of FC statements.

control trials were excluded from data analysis. The puppet's statements on the modal control stories are provided in Table 5, the NPI controls in Table 6, and the FC controls in Table 7.

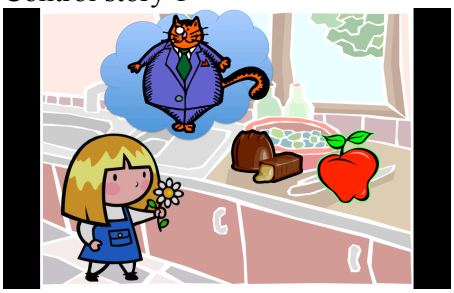
Table 5. Experiment 3: Modal control items (2)	
Control story 1 	1. Sally is feeling rather hungry and goes to the kitchen to find a snack. Sally sees some chocolate and an apple! Will Sally have a snack? Let's see what Mr. Cat says. Remember, he knows all the rules! 2. Mr. Cat says: "Sally, an apple is much healthier than chocolate. You may have an apple, but you may not have chocolate." 3. Hey Baba, can you tell us something about the story? (i) 'Sally was allowed to have an apple' (target: *yes*) (ii) 'Sally was allowed to have chocolate' (target: *no*)
Control story 2 	1. Billy has finished his dinner and is feeling rather bored. He could go for a swim or he could read some fun books. Will Billy find something to do? Let's see what Mr. Cat says. Remember, he knows all the rules! 2. Mr. Cat says: "Billy, it's not a good idea to swim right after eating. You may read a book, but you may not swim right now." 3. Hey Baba, can you tell us something about the story? (i) 'Billy was allowed to read a book' (target: *yes*) (ii) 'Billy was allowed to swim' (target: *no*)

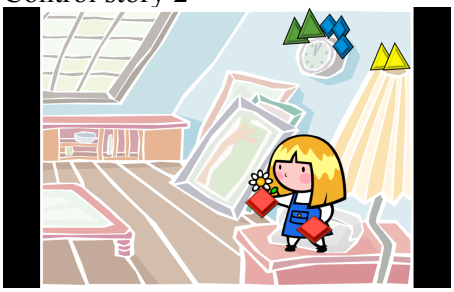
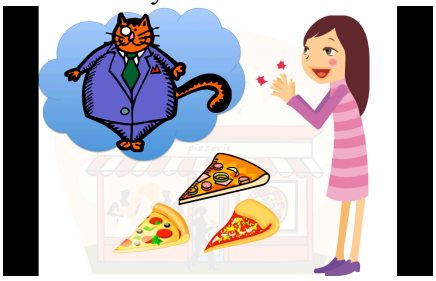
Table 6. Experiment 3: NPI control items (2)	
Control story 1 	1. Emily is at the zoo and sees some little donkeys and some big donkeys, and some little giraffes and some very tall giraffes! The donkeys have already eaten, but the giraffes are very hungry. Emily feeds the little giraffes but the tall giraffes are too tall, so she doesn't feed them. 2. Hey Baba, can you tell us something about the story? (i) 'Emily didn't feed any giraffes' (target: *no*) (ii) 'Emily didn't feed any donkeys' (target: *yes*)
Control story 2 	1. Sally is playing a game where she has to find some hidden shapes. She has to find some green and yellow triangles, and some red and blue diamonds. Sally finds the red diamonds but the triangles and the blue diamonds are hidden up too high so she doesn't find them. 2. Hey Baba, can you tell us something about the story? (i) 'Sally didn't find any diamonds' (target: *no*) (ii) 'Sally didn't find any triangles' (target: *yes*)

Table 7. Experiment 3: FC control items (2)	
Control story 1 	1. Today Mr. Cat brings Lucy to the pizzeria after school. Lucy sees a pepperoni pizza, a ham pizza, and a veggie pizza. Will Lucy get to order pizza? Let's see what Mr. Cat says. Remember, he knows all the rules! 2. Mr. Cat says: "Lucy, you've been a very good girl today. You may order a veggie pizza, and you may order a ham pizza, and you may order a pepperoni pizza." 3. Hey Baba, can you tell us something about the story? 'Lucy was allowed to order any pizza' (target: *yes*)
Control story 2 	1. Today Mr. Cat brings Mary to the ice cream shop after school. Mary sees some strawberry ice cream, some vanilla ice cream, and some chocolate ice cream! Will Mary get to have some ice cream? Let's see what Mr. Cat says. Remember, he knows all the rules! 2. Mr. Cat says: "Mary, you've been a very good girl today. You may have strawberry ice cream, and you may have vanilla ice cream, and you may have chocolate ice cream." 3. Hey Baba, can you tell us something about the story? 'Mary was allowed to have any flavour ice cream' (target: *yes*)

4.2 Results

Children's accuracy on the different trial types are provided in Fig. 6. Children performed at ceiling on the FC and modal control trials. They accepted all FC control trials, and accepted and rejected the modal control trials accordingly. They also performed well on the NPI control trials, with an accuracy rate of 87%.[16,17] Finally, children were also target-like on the FC test trials, rejecting these FC statements 95% of the time.[18]

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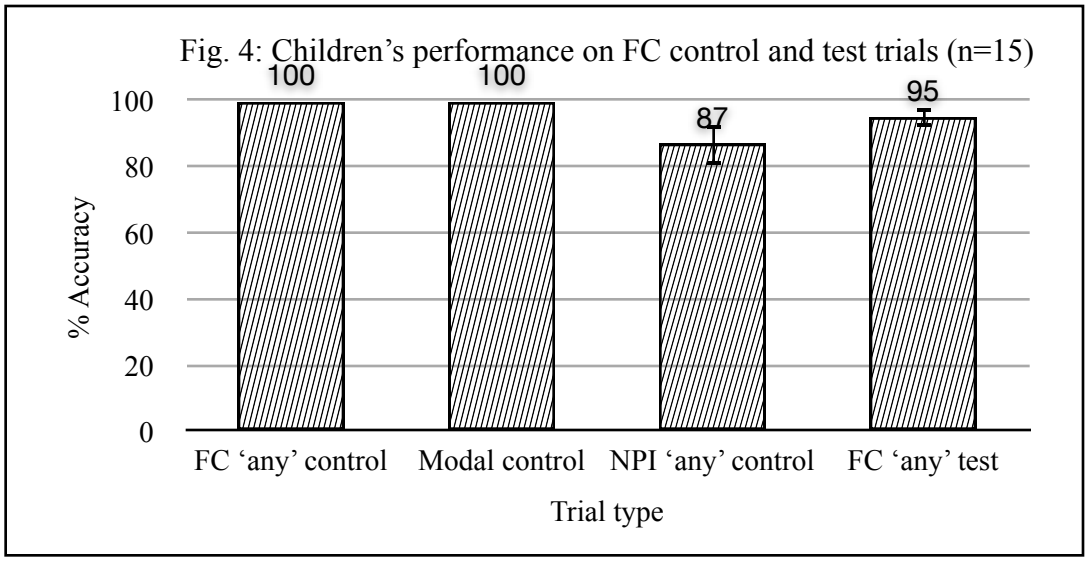
[16] The reader may recall that children as a group were only 66% accurate on the *any* test condition from Experiment 2. The *any* control items here however are not directly comparable to the *any* test items from Experiment 2. The test items on Experiment 2 all hinged on domain widening: if the sentences were interpreted with a wider domain of quantification, *no*-responses were expected. The NPI controls here had two possible versions/targets: the one that was used on 28/30 trials did not hinge on domain widening, and thus are more comparable to the NPI control condition from Experiment 2 (on which children performed at ceiling). Successfully accepting *Emily didn't feed any donkeys* in Story 1 (Table 6) for example, only required comprehension of the test sentence as a plain negative existential statement (i.e. because there was only one 'kind' of donkey in the story). The control could however also be associated with a *no*-target, in which case domain widening *was* at issue (Emily fed only a subset of the giraffes, so the child was expected to reject *Emily didn't feed any giraffes*). The purpose of this was the following: this version of the control would only be used if the child was providing non-target responses on the test trials, i.e. accepting the FC test trials. We wanted to know if a child who was accepting the FC test trials could nevertheless be shown to be sensitive to the domain alternatives in the context. Testing them on NPI items where sensitivity to the domain alternatives was required was a way to do this. (Children who were target-like on the FC test trials would already be demonstrating sensitivity to domain alternatives, so the NPI controls would not be required for this particular purpose.) Ultimately however, only two out of the 30 total NPI control trials (across all 15 children) involved a *no*-target, and both trials were answered correctly by the relevant children.

[17] One question that might arise is why children did not perform at ceiling on the NPI controls. A one-way ANOVA on the control conditions revealed a significant main effect of control type ($F(2,42)=5.09$, $p<.05$), with the children being significantly less accurate on the NPI controls than either the FC or modal controls (Tukey HSD, both $p<.05$). Moreover, recall that the children from Experiment 2 were at ceiling on the NPI control condition. The reason this version of the NPI control may have been harder in comparison to the NPI control condition in Experiment 2 is the following: these controls involved two kinds of objects, one of which also involved subsets, e.g., *donkeys* vs. *tall and short giraffes*, while Experiment 2 NPI controls merely involved three different shapes (and no subsets), e.g., *triangles* vs. *hearts* vs. *circles*. It is possible that having to sort out the two kinds of objects and additionally two subsets of one of the kinds of objects made the items slightly harder for the children. Nevertheless, what is important for us is that children generally did well on all control conditions, with every child answering correctly on at least 3 out of 4 control trials.

[18] Although children's accuracy overall was lower on the NPI condition than on the FC test condition, the mean accuracy on the two conditions did not differ significantly ($t(27)=-1.08$, $p=.29$).



Follow-up justifications from the the children allowed us to ascertain their reasons for accepting or rejecting the statements. Justifications for rejecting the FC statements sometimes made explicit reference to the subdomain alternatives that were and were not "allowed", according to Mr. Cat's rule. Children's construction of domain alternatives was also attested by their frequent use of the focus operator *only*, e.g., "Lucy was only allowed to hold the big rabbits." Some examples of justifications are provided below.

(45) [CHI-03 (age 4;09)]

PUP: Hmm... Emily was allowed to feed any animal.

CHI: Wrong.

EXP: Wrong? How come?

CHI: 'Cause he wasn't paying attention.

EXP: He wasn't paying attention. He didn't say the right thing. Do you remember what the rule was? What Mr. Cat said?

CHI: Mr. Cat said Billy, he's only allowed to feed the pigs.

(46) [CHI-05 (age 5;03)]

PUP: Hmm... Emily was allowed to feed any animal.

CHI: No.

EXP: No. How come?

CHI: She was only allowed to feed the pigs.

EXP: That's right, and what did he say?

CHI: He said Sal- he said Emily's allowed to f- allowed to feed any animal.

EXP: That's right. And is that good or is that silly?

CHI: That's silly.

(47) [CHI-06 (age 5;09)]

PUP: Hmm... Billy was allowed to push any truck.

CHI: He was being silly!

EXP: He was being silly, how come?

CHI: Billy wasn't allowed to touch any truck.

EXP: Yeah? What was the rule? What did Mr. Cat say?

CHI: Um, he's only allowed to um push the um yellow trucks.

Summarizing the data then, 4- and 5-year-old children appear quite target-like in their ability to compute FCIs from FC *any* in deontic modal statements.

4.3 Discussion

4.3.1 Spontaneous vs. Experimental Data

We have thus far examined two sources of data pertaining to children's knowledge of FC *any*: their spontaneous production, and their comprehension in a carefully controlled experimental setting. There are two observations worth considering in light of these two sets of data. The first is a commonality between the two: both sources indicate target-like knowledge with respect to FC *any*. What little spontaneous production

of FC *any* we could find was extremely target-like, suggesting that the children who produced it productively were aware of the distributional constraints on *any*. The experimental data on the other hand, showed us that the children we tested knew how to compute *any*'s semantic contribution in a FC statement. That is, by the age of 4, children know how to compute FCIs from *any*.

The second observation has to do with the relative ages covered by the two data sets. We do not have spontaneous production samples from the children who were tested on the FCI experiment, and conversely we do not have experimental data from the children whose speech was recorded for the spontaneous corpora. Thus we have to be somewhat cautious in generalizing across the two groups. But let us nevertheless consider for a moment the relative age ranges. According to the spontaneous production data from the two children who did exhibit productive use of FC *any*, FC *any* did not emerge until 3;06 (Thomas) and 4;03 (Adam), significantly after the onset of NPI *any* in both cases. The children tested on the FCI experiment on the other hand all did quite well, including the youngest at age 4;01. Thus it seems the age of emergence of FC *any* corresponds roughly to the later end of our spontaneous age range, and roughly to the lower end of our experimental age range, i.e. roughly around 4 years of age.

One could nevertheless hypothesize that children have knowledge of FC *any* earlier, perhaps from as early as they have knowledge of NPI *any*, but that FC *any* statements are simply too infrequent to adequately capture in the corpora examined (setting aside Adam's and Thomas' corpora). Perhaps the circumstances that would invite modal statements containing FC *any* are not as numerous, and thus we see what looks like an absence of FC *any* in many of the children's earlier transcripts. The lack of longitudinal speech samples and experimental data from the same set of children makes it difficult to draw such a conclusion however, and we must be satisfied with a rough estimate of an upper limit; in other words, FC *any* appears to be acquired by about 4 years of age, possibly earlier.

In summary, from the onset of their productive use of FC *any*, children appear to be target-like in their spontaneous production, and moreover from as young as we can test them using the TVJT, also appear quite target-like in their comprehension of FC *any*.

4.3.2 On Children's Knowledge of Alternatives

The experiment described in Section 4 builds on previous work by Zhou, Romoli, and Crain (to appear), though this latter study had a slightly different focus and examined FCIs from disjunction rather than FC indefinites. In this section, I'll briefly compare the two studies, and discuss the implications of the findings for children's knowledge of alternatives (see Tieu, Romoli, Zhou, & Crain (2013) for details).

Zhou, Romoli, and Crain (to appear) (hereafter ZRC) examined children's ability to compute FCIs from disjunction in Mandarin, and found excellent performance. Their goal was to compare children's performance on FCIs and on scalar implicatures (SIs); if FCIs really are a kind of SI, one might expect children to have some difficulty computing FCIs, given previous literature demonstrating children's persistent difficulties with SIs (see among many others, Chierchia et al., 2001; Gualmini et al., 2001; Guasti et al., 2005). ZRC conducted a TVJT with 22 monolingual Mandarin-speaking children (3;07-4;09, M=4;03). Children heard four free choice test trials and four scalar implicature control trials. On all trials, if children computed the relevant inference (whether FC or typical SI), they were expected to reject the test sentence. An example FC test story is provided below:

(48) Typical FC test trial

[Context contains a green car, an orange car, and a purple car] Kung Fu Panda and Batman are participating in a car-pushing competition. Before the competition, Mr. Owl (the judge) explained the rules, telling Kung Fu Panda that he was only allowed to push the green car, and telling Batman that he was only allowed to push the orange car. But Kung Fu Panda and Batman were forgetful, so when the game was about to start, they asked the puppet to remind them of the rules.

Puppet's statement:

gongfu	xiongmao	keyi	tui	lusexiaoche	huozhe	jusexiaoche
Kungfu Panda		may	push	green car	or	orange car

'KungFu Panda may push the green car or the orange car'

Notice that the puppet's statement on its literal interpretation is compatible with the context; on its FC interpretation however, it contradicts the owl's rule. Thus depending on whether children computed the literal meaning or the FCI, ZRC could determine whether children had successfully computed the FCI.

Children heard two kinds of SI controls. On one kind of control, children heard disjunctive statements in conjunctive contexts. For example, in a context where the red mermaid found both a white shell and a blue shell, the puppet would utter the sentence:

(49) hongse meirenyu zhaodao-le baise beike huozhe lanse beike
red mermaid found white shell or blue shell
'Red mermaid found a white shell or a blue shell'

If children computed the exclusivity inference (that the mermaid did not find both), they were expected to reject the statement.

On the other control type, children heard an existential modal statement in a context compatible with a universal modal statement. For example, in a context in which Mr. Owl said that Winnie the Pooh must eat a green pepper, the puppet would utter the sentence:

(50) weinixiong keyi chi qingjiao
Winnie.Bear may eat green.pepper
'Winnie the Pooh may eat a green pepper'

Again, if children computed the "not-required-to" inference, they were expected to reject the statement.

ZRC found that children computed FCIs at a rate of 91%, compared to an SI rate of only 18%; their performance on the two conditions differed significantly (Wilcoxon Signed Ranks Test, $z=4.52$, $p<.001$). On the face of it, this finding challenges the SI approach to FCIs. If FCIs are derived in the same way as SIs, why should children succeed on one kind of inference but not the other?

Building on recent work suggesting that children are better at computing SIs when the alternatives are explicitly mentioned in the discourse context (among others, see Gualmini et al., 2001; Chierchia et al., 2001; Barner et al., 2010), and more generally that children's inability to derive SIs lies in a difficulty with alternatives (Reinhart, 2004, 2006; Chierchia et al., 2001; Barner et al., 2011; Barner & Bachrach, 2010), ZRC suggested that the reason their children succeeded on the FC condition was because the alternatives required to compute the FCIs were provided explicitly as substrings of the disjunctive assertions. Thus children performed well because the alternatives were explicitly mentioned as substrings of the test sentences themselves, and not merely present in the discourse context. This account makes the prediction that if the alternatives were not provided explicitly as substrings of the assertion, children might fail to compute FCIs, as they often do with SIs. The data presented in Section 4 speak directly to this point; FC indefinites are argued to give rise to the same kinds of FCIs as FC disjunctions, but the *any*-statements, unlike the disjunction statements, do *not* explicitly provide the alternatives as substrings of the assertion. Thus explicit mention as substrings cannot be the factor responsible for children's success on FCIs. Rather, Tieu, Romoli, Zhou, & Crain (2013) pursue a more fine-grained hypothesis based on the following observation: children succeed on inferences involving alternatives that do not have to be: (i) learned as co-scalar, or (ii) retrieved from the lexicon. Consider first the cases where children have been shown to have difficulties: computing the *not-all* implicature from *some*, the *not-and* implicature from *or*, or the *not-must* implicature from *may*. In these cases, there are (at least) two crucial ingredients for success. First, the child must learn the co-scalar status of these terms, i.e. they must learn that *some* and *all* lie on the same quantifier scale, and that they are related in terms of strength. Second, in order to compute the implicature when presented with a *some*-statement (i.e. on an experimental task), the child must be able to retrieve the stronger alternative *all* from the lexicon in order to compute the implicature. Failure to compute the implicature could result from a deficit in either ingredient; that is, either the child has yet to learn the co-scalar status of *some* and *all*, or the child is unable to retrieve *all* from the lexicon during the experiment.

In contrast, consider the inferences where children have been shown to succeed: SI conditions where the alternatives are made explicit in the discourse context, FC disjunctions where the alternatives are explicitly provided as substrings of the assertion, and FC indefinites where the domain alternatives are made salient

and explicitly mentioned in the discourse context. What these inferences have in common is that the child does not have to: (i) learn the co-scalar status of the alternatives, as they are either pragmatically or explicitly provided; or (ii) retrieve the relevant alternatives from the lexicon, as, again, they are pragmatically or explicitly provided.

Returning our discussion to *any*, what we have learned in this section is that children are quite adept at computing FCIs off of *any*'s domain alternatives. This is consistent with the results from the NPI study reported in Chapter 3, where many of the children we tested were also shown to be sensitive to *any*'s subdomain alternatives. In general, children's performance on SIs and FCIs suggests children can be quite adept at making use of contextually provided alternatives. This allows them to succeed in the comprehension of NPI and FC *any*: in the case of the former, the adult-like children successfully select the largest domain and exhaustify the subdomain alternatives, and in the case of the latter, they succeed at identifying the relevant subdomain alternatives and computing FCIs from those alternatives.

5. Summary

In this chapter, we have seen more evidence of 4- and 5-year-olds' target-like knowledge of the semantics of *any*. In particular, we began by examining the distribution of FC *any*, and determined that if productive, children's spontaneous production of FC *any* is target-like. From the onset of productive use of FC *any*, children use *any* in well-licensed modal statements and very rarely make commission errors. We then turned our attention to the semantics of FC *any*, in particular examining the FCIs that arise when *any* is used in a deontic modal statement such as, *Lucy is allowed to hold any rabbit*. The results of the TVJT reported in this chapter revealed that 4- and 5-year-olds have no difficulty computing FCIs from FC *any*. The results were shown to converge with previous work on FC disjunction in Mandarin. We discussed how these findings bear on children's knowledge of alternatives, and proposed that children are quite adept at computing inferences based on alternatives that are provided in the discourse context or in the assertion itself. In particular, as concerns *any*, children appear sensitive to *any*'s contextually determined domain alternatives. This particular finding converges with a large part of the NPI data reported in Chapter 3.

In sum, 4- and 5-year-old children are quite sensitive to the semantics of *any*. In the remaining chapter of this dissertation, we will turn to the *how* question: how exactly do children arrive at the target semantics for *any*?

Chapter 5

The Learning Problem

1. Where We Are Now

Up to this point in the dissertation, we have largely focused on what children know about *any*. After characterizing the negative polarity item (NPI) *any* in the adult grammar (Chapter 2), we examined in detail whether 3-5-year-old children were target-like with respect to their production and comprehension of *any*. We began Chapter 3 by highlighting the fact that previous studies exclusively targeted children's knowledge of the restricted distribution of *any*. These studies demonstrated that children by the age of 3-4 years are sensitive to the licensing condition on *any*. In addition to these studies, we examined samples of children's spontaneous production, which also clearly demonstrated young children's sensitivity to the licensing condition. But the objection raised in Chapter 3 was that merely targeting children's knowledge of the NPI licensing condition is not sufficient to tap into children's knowledge of the semantics of *any*. The experiment presented in Chapter 3 demonstrated that as a group, 4-year-olds were sensitive to *any*'s subdomain alternatives, and moreover interpreted *any* as quantifying over the widest possible domain in the context (although not all the children were fully adult-like in this respect, a point we will come back to in the discussion in this chapter). In Chapter 4, we saw the results of an experiment with children in the same age range who were shown to be adult-like in their ability to compute free choice inferences (FCIs) from *any*. That study provided fur-

ther evidence of children's adult-like competence with respect to *any*'s semantic contribution to the sentences in which it appears.

In this chapter, we will finally turn our attention to the *how* question, discussing how children arrive at the target knowledge of *any* (on both its NPI and FC uses). According to the results of our experiments, the acquisition of the semantics of *any* is for the most part complete by roughly 4 or 5 years of age.[1] How do children get to this stage? Critical to this discussion is the nature of the evidence that children receive in their linguistic input. I assume without question that the input must somehow lead the child to the target grammar; the question is what precise aspects of the input are informative to the child in this respect, and *how* they are informative in leading the child to the target. For example, does the superficial distribution of *any* lead the child to its semantics? Does the relative frequency of *any* in different environments lead the child to its licensing properties? Do the larger discourse contexts in which *any* appears lead the child to its semantics? Is there explicit evidence of *domain widening*, or of the process by which FCIs arise? These are the questions we will address in Section 3, where we examine some samples of child-directed speech.

Ultimately, the proposal I will make roughly follows the following narrative (to be made more precise in this chapter): we have seen experimental evidence that by the age of 4, children have knowledge of the exhaustification of *any*'s subdomain alternatives, of domain widening, and of FCIs from *any* under deontic modals. We will see that the parental input provides distributional information as to the dual nature of *any*, i.e. that it appears in DE environments and certain modal and sub-trigged statements.[2] In contrast, it is not at all clear whether the input provides evidence for how to exhaustify alternatives, how to widen the domain, or how to compute FCIs -- all properties which we have demonstrated are adult-like in most 4-year-olds. I

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[1] In Chapter 3, I provided an explanation for the "non-wideners" (children who appeared to allow restriction of the domain of *any*), which appealed to performance factors. In this chapter I'll aim to first provide an account of the target-like children's performance, and then within the same proposal, provide an alternative explanation for the non-wideners.

[2] This could in itself pose a challenge to the learner, who has to sort out the two different uses of *any*. If a learner is sensitive to the relevant properties of the two environments (i.e. to DEness in one, and to the presence of a modal in the other), the child might be able to keep track of the two licensing contexts, and make generalizations on the basis of the dual distribution. If the child was not (or could not be) attuned to these properties of the context however, it's not clear that the child could make accurate generalizations about *any*'s restricted distribution.

propose that the child must make use of the relatively clear evidence concerning the distribution of *any* in order to arrive at the target grammar, where the target is the analysis of *any* as a polarity-sensitive element that is interpreted as both an NPI and a FC item. I argue that the key lies in restricting the hypothesis space of available options from which the learner must choose. When we look cross-linguistically, we see a restricted space of possible polarity-sensitive indefinite (PSI) types, which vary in systematic and predictable ways. Ultimately I will propose that the child does not need explicit, positive evidence for how to exhaustify subdomain alternatives, how to widen the domain, or how to compute FCIs. Put more strongly, the child *cannot* rely on such explicit evidence, because it simply does not exist in the input. Given a restricted set of options however, the distribution of *any* in the input is sufficient to allow the child to map *any* to exactly that type of indefinite that triggers obligatory exhaustification of subdomain alternatives, that has the potential to widen the domain of quantification, and finally, that gives rise to FCIs in certain modal contexts.

2. Revisiting the Target of Acquisition

Before we turn to the child-directed speech, let us reiterate what must be acquired, i.e. what exactly we consider to form part of the target grammar at which the child must ultimately arrive.[3] Once we have the target in hand, we will be in a position to determine whether there is ample evidence in the input to derive these target properties.

In Chapter 3, we attempted to identify the target along a couple of dimensions: on the one hand, we identified a more structural dimension, which included a number of distributional facts about *any* as well as its syntactic licensing condition; on the other hand, we discussed its semantics. With respect to *any*'s distribution, we identified the following relevant properties: (i) *any* surfaces as an indefinite determiner which can

[3] The reader might object to the use of the term "target grammar", as I am focusing on the development of a particular lexical item, *any*. But ultimately I view the development of this lexical item as an integral (or rather, representative) part of the development of the polarity sensitive system, which does, on the account we'll adopt, root polarity sensitivity within the domain of "grammar". I do not view the development of *any* as uniquely a phenomenon of word learning; of course the child must learn the word *any* and what meanings it maps to, but on the view I adopt here (by and large, that presented in Chierchia (2013)), grammatical operations (such as the generation of focal alternatives, exhaustification of these alternatives, the checking of focal features that trigger exhaustification, etc.) will be part and parcel of the development of the meaning of *any*. Thus to know the meaning of *any* is to know all of these aspects of grammar.

take an NP complement (which itself can be elided); (ii) it can occur within an NP as part of a complex indefinite such as *anything* or *anyone;* (iii) it can be used as a modifier of the comparative adverb *more*. With respect to the syntax of its licensing, we stated that the child has to learn that *any* must be c-commanded by its licenser. Finally, with respect to the semantic dimension of *any*, we discussed the exhaustification of its alternatives, as well as its domain widening property.

At this point, I'd like to be a bit more precise about what exactly needs to be learned about the licensing condition on *any*. I take it for granted that the child's grammar incorporates a notion of c-command that does *not* need to be learned from the input, or at the very least, that such a notion is in place well before the emergence of *any* in the child's production. Thus I will not focus too much on the structural licensing condition. I would however like to be more precise about the semantic nature of the licensing condition. First, recall Kadmon and Landman's (1993) condition on *any*:

(1) Strengthening: *any* is licensed only if the widening that it induces creates a stronger statement, i.e., only if the statement on the wide interpretation => the statement on the narrow interpretation.

(Kadmon & Landman, 1993:369)

This account, while descriptively valid, is not particularly informative when transferred over to our discussion of the acquisition of *any*. On this account, and in fact on any account that merely states a licensing condition, what the child must learn about *any* is a lexically specified constraint on its distribution.[4] On the one hand, if we assume (1) to be the target semantic property, it is not clear how to go about probing for children's knowledge of the property. Presumably, once the child has learned that (1) is part of *any*'s lexical semantics, its restricted distribution (i.e. its restriction to DE environments) will fall out naturally, since the

[4] Alternative proposals like Giannakidou's (1998, 2011) non-veridicality account will similarly require that the child learn some condition that is built into the lexical semantics of *any*; in the case of non-veridicality for example, the child must learn, as part of *any*'s lexical semantics, a constraint against its appearance in the scope of a veridical operator. Thus whatever the relevant licensing property is, accounts that merely state the licensing condition in terms of a restricted distribution, will require that the child learn, as part of the meaning of *any*, a stipulated licensing condition.

condition is only satisfied in such environments. Thus one could take the child's ability to restrict *any*'s distribution as indirect evidence that they had knowledge of (1).[5]

But considering more compositional accounts along the lines of Krifka (1995) and Chierchia (2013) that build on the intuitions underlying (1) will allow us to better unpackage the precise elements that constitute the target of acquisition. According to Krifka (1995), *anything* introduces a set of alternatives, of which *anything* is the most 'general' property; the alternatives of *anything* are all properties that are stronger (or more specific) than the most general property of *thing*. A statement such as *John saw anything* asserts that John saw something of the most general kind, but also generates a scalar implicature, leading to the negation of the stronger alternative propositions. Doing so yields a contradiction, for it is impossible for John to see something of the most general kind, while not seeing anything more specific. Essentially the sentence asserts that John saw something, but generates an implicature that he did not see anything in particular. This semantic contradiction is what rules out *any* in non-DE environments. Chierchia (2006, 2013) builds on this proposal but implements it in slightly different terms. For him, *any* triggers a set of subdomain alternatives, which obligatorily must be exhaustified. The obligatoriness of this exhaustification is implemented through a system of feature-checking, whereby *any* is lexically specified with a focal feature that requires checking by a covert exhaustification operator. As we saw in Chapter 2 (and as in the case of Krifka's proposal), exhaustification of the subdomain alternatives succeeds in DE environments but yields a logical contradiction in non-DE environments; this is how the restricted distribution of *any* is derived on this account. But note that within this analysis, there is no formal correlate of "domain widening" or strengthening per se. To explain true widening of the kind seen in Kadmon and Landman's examples, Chierchia invokes contrastive focus. Given that *any*'s alternatives are subdomain alternatives, this nicely explains why, when contrasted with a preceding plain indefinite statement, *any* is felt to create a stronger statement: the domain of *any* is being contrasted with the more restricted domain of the preceding plain indefinite. But if there is no contrastive focus (i.e. no antecedent indefinite quantifying over a more restricted domain), *any*'s domain can be as restricted as that of a plain indefinite. Finally, Chierchia also attempts to derive the NPI/FC dichotomy in a

[5] Of course there will be other prerequisites to the production and comprehension of *any*; for example the child will also have to have DE operators and modals in place in order to produce and comprehend *any*.

principled way, that is to say, not as a coincidental ambiguity. For him, indefinites like *any* (that oscillate between NPI and FC uses) always trigger exhaustification of their subdomain alternatives; the key is that they also allow for pre-exhaustified alternatives (i.e. recursive exhaustification). This is what allows us to generate FCIs in the modal contexts we examined in Chapter 4.

On the Krifka/Chierchia-style analysis then, there are a few ingredients that the child needs to have in place in order to produce and comprehend *any* in an adult-like way. First, the child has to learn that *any*'s alternatives are subdomain alternatives. I take it for granted that the child's grammar allows for the generation of alternatives; the possibility of activating alternatives is not specific to NPIs, and is thus independently required elsewhere in the grammar. Scalar quantifiers and elements forming Horn scales for example all have the potential to activate alternatives. What the child must learn is the nature of the alternatives for any given scalar term. In the case of *any* in particular, the child must learn that it activates subdomain alternatives. I also assume that the child's grammar will allow for exhaustification of alternatives, again, a process required independently of any account of NPIs. Specifically with respect to *any*, the child must learn that *any* carries a focal feature that triggers obligatory exhaustification of its (subdomain) alternatives.[6] And to be able to carry out this exhaustification, the child must have covert exhaustification operators in place. Additionally, in order to achieve 'domain widening' effects of the Kadmon-and-Landman type, the child must have knowledge of contrastive focus (cf. Rooth, 1992). That is, the child must know how to generate or identify a set of focal alternatives (in this case, more restricted subdomain alternatives), and exhaustify with respect to these focal alternatives.

Finally, consider briefly the acquisition of FC *any*. While both the Kadmon and Landman and Chierchia analyses can be considered examples of unified analyses of *any*, they lead us to define the target of acquisition slightly differently. The Kadmon and Landman analysis, as we said above, requires that the child learn the lexical meaning of *any*, which will include a condition that it must strengthen the assertion. There is no

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[6] Again, strictly speaking, there are other prerequisites that I will assume are already in place by the relevant point in development when the child acquires *any*. For example, in order to check *any*'s focal feature, the child must have a grammar that allows for feature-checking. Since syntactic feature-checking is required on independent grounds (or at least, is in place before she produces her first NPI, as evidenced by the ability to produce appropriate subject-verb agreement, past tense agreement, etc.), we will not focus on how the child acquires feature-checking.

distinction between NPI and FC *any* in this respect. Chierchia's analysis requires that the child learn that *any* triggers obligatory exhaustification of its subdomain alternatives, and moreover that (unlike NPI-only indefinites) *any* allows for pre-exhaustified alternatives. Moving to the other end of the spectrum, a non-unified account such as Dayal (1998, 2011) leads us to expect that the child must learn the two *any*'s independently. The child must learn the licensing condition on NPI licensing (whichever conception of it one chooses), and the child must also learn the universal quantifier *any*, which (glossing over details) differs from universal *every* in that it quantifies over possible individuals. In this case, we might expect the input to provide evidence for NPI licensing as well as for *any*'s universal quantificational force. But it's not clear whether this alone will get the child to domain widening/strengthening, or FCIs of the kind children were shown to be able to compute in Chapter 4. To acquire these properties, we might expect the input to also provide evidence for strengthening/widening, and for the computation of FCIs.[7] Thus on an account like Dayal's, we can conceive of the required evidence as coming in two parts: whatever the input would need to provide on any account of NPI *any* (let's say, what we proposed would be needed on Kadmon and Landman's account), plus evidence of the modal nature of FC *any*, including evidence of the FCIs that are possible in these modal contexts.

Let us now turn to an examination of child-directed speech to see if the input provides any evidence of the kind that might lead the child to infer the target properties of *any*.

3. Corpus Study 3: What the Input Provides

3.1 Evidence for *any*

Let us now consider the question of what evidence exists in the child-directed speech for the various target properties of *any* that we discussed in Section 2. I'll consider here data from three longitudinal corpora available on CHILDES (the Kuczaj corpus (US) and the Lara and Thomas corpora (UK)).[8] The basic fre-

[7] It is not obvious what kind of evidence would be informative for the procedure of computing a FCI. I'll discuss this further in Section 3.

[8] Of the 40 corpora I reported on in Chapters 3 and 4, these three corpora contained the greatest number of transcripts; the Lara and Thomas corpora also contained the largest number of total child utterances.

quencies of *any* in the input are provided in Table 1.[9] After reporting on these basic frequencies, I'll discuss (in a more qualitative manner) the kind of evidence that the input provides for the syntactic dimension of *any*, and then move on to *any*'s semantics.

Table 1. Frequencies of *any* in Kuczaj, Lara, and Thomas parental speech samples

Corpus	**Total parental utterances**	**Total *any***	**NPI *any***	**FC *any***
Kuczaj (*Abe's father*) (ABE'S AGE RANGE: 2;04,24-5;00,11)	12,753	130 (1.02% of all utterances)	125 (96.15% of all *any*)	5 (3.85% of all *any*)
Lara (*Lara's mother*) (LARA'S AGE RANGE: 1;09,13-3;03,25)	78,701	428 (0.54% of all utterances)	423 (98.83% of all *any*)	5 (1.17% of all *any*)
Thomas (*Thomas' mother*) (THOMAS' AGE RANGE: 2;00,12-4;11,20)	324,778	2528 (0.78% of all utterances)	2429 (96% of all *any*)	99 (3.92% of all *any*)

Of the 130 instances of *any* in Abe's father's speech (Kuczaj corpus), 125 (96.15%) were instances of NPI *any*; here licensing primarily involved sentential negation (81=64.8%) and interrogatives (38=30.4%).[10] The

[9] In analyzing the parental speech samples, I also discounted any repetitions, imitations, routine or idiomatic expressions containing *any*, and any unclear utterances where a potential licenser was occluded by xxx in the transcripts. The adult examples of *any* were generally grammatical; only Thomas's mother's speech revealed any exceptions; I classified five of her 2434 total NPI *any* as ungrammatical (for example, *you've had enough now, please do take anymore out, Thomas*). It's not clear whether these were merely transcription errors, but they were nevertheless classified as ungrammatical.

[10] According to Guerzoni and Sharvit (2007), *any* is subject to a disjunctive licensing condition: it is licensed by downward entailment in declaratives but *strong exhaustivity* in interrogatives. Giannakidou (1998) subsumes interrogatives with other non-veridical operators. Importantly, Nicolae (2013) builds on Guerzoni and Sharvit's observation regarding strong exhaustivity, and analyzes interrogative licensing within an exhaustification-based framework, such that NPI *any* in declaratives and interrogatives is licensed in the same way, i.e. by successful exhaustification of its subdomain alternatives. I will return to the issue of licensing in questions in Section 5.3.2. See also Tieu (2010) for relevant discussion.

remaining 4.8% of NPI *any* involved licensing by other DE operators. Finally, 5 (3.85%) of all occurrences of *any* were instances of FC *any*. In the Lara corpus, 423 (98.83%) were instances of NPI *any*; here too licensing was primarily by sentential negation (342=80.85%) and interrogatives (69=16.31%); 2.84% of NPI *any* involved licensing by other DE operators. Finally, 5 (1.17%) of the occurrences of *any* were instances of FC *any*.[11] Finally, 2429 (96%) instances of *any* in Thomas' mother's speech were instances of NPI *any*, with 1718 (=70.73%) of these involving licensing by sentential negation, and 436(=17.95%) involving licensing in interrogatives; the remaining 11.32% of NPI *any* involved licensing by other DE operators. 99 (3.92%) of the total occurrences of *any* were instances of FC *any*.

On the whole, the input seems to provide fairly robust (positive) evidence of *any*'s restricted distribution.[12] Next, let's take a qualitative look at the kinds of examples of *any* children hear in the input, and determine in particular whether there is evidence for the structural dimension of *any*, under which we included: (i) the determiner/modifier status of *any*; (ii) the c-command requirement on licensing; and (iii) the non-clausebounded nature of the licensing/c-command relation. As seen in the examples in (2), *any* consistently showed up either as a determiner or as a modifier of the comparative adverb *more*. The parental input also provides positive evidence of the c-command requirement on licensing: all instances of *any* in declarative statements involved *any* c-commanded by a DE operator, as seen in all of the examples in (2).[13] We also find evidence that the structural dependency between licenser and NPI is not clause-bounded; as can be seen

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[11] Note that even though Lara heard the lowest frequency of *any* in the input, she was not the slowest to acquire *any* nor did she struggle with productive use of *any* in her own spontaneous speech. Abe's first productive use of *any* was at 2;06,14, Lara's at 2;06,28, and Thomas' at 2;07,22. Moreover, comparing the ages at the end of the transcripts for the three children, Lara was much younger than either Abe or Thomas. Finally, of the 40 children examined overall, Lara produced the third largest absolute number of *any* across all transcripts.

[12] There is however no direct negative evidence telling the child that *any* cannot appear outside of these licensed contexts.

[13] There is however no direct negative evidence indicating that NPI *any* is ungrammatical outside the scope of a DE operator.

in the examples in (3), the parental input provides positive evidence that *any* in an embedded clause can be licensed by a negation in the higher clause.[14]

(2) a. *FAT: we do**n't** have <u>any</u> hot chocolate . (Kuczaj, Transcript 118, Line 19)

b. *FAT: we did**n't** get you <u>any</u> new socks . (Kuczaj, Transcript 166, Line 448)

c. *FAT: I do**n't** think we have <u>any</u> more . (Kuczaj, Transcript 110, Line 619)

d. *MOT: he has**n't** got <u>any</u> feet . (Lara, Transcript 98, Line 559)

e. *MOT: Lara has**n't** got <u>any</u> shoes on . (Lara, Transcript 100, Line 252)

f. *MOT: you do**n't** need <u>any</u> more . (Lara, Transcript 119, Line 3621)

(3) a. *FAT: I do**n't** think that there's <u>anything</u> cooking in that pan (.) Abe . (Kuczaj, Transcript 23, Line 53)

b. *FAT: I do**n't** think we have <u>any</u> honey (.) Abe . (Kuczaj, Transcript 182, Line 308)

c. *MOT: I do**n't** think <u>anybody</u> can really . (Lara, Transcript 101, Line 8953)

Next, consider evidence for FC *any*. Children hear *any* in episodic, sub-trigged statements, as well as modal environments (with overt and covert modals). The total 10 utterances containing FC *any* produced by Abe's father and Lara's mother are provided below (with sufficient context to derive the intended meanings):

(4) Abe's father (Kuczaj corpus)

a. *FAT: okay (.) Abe look you put this on the paper then you keep the pencil against the edge of this and draw see (.) then you end up with a animal .

[14] It is worth noting that almost all such instances of a matrix negation and an embedded NPI *any* in Abe's father's speech involve neg-raising predicates such as *think*. Such neg-raising sentences are often interpreted as though the negation appeared in the embedded clause, and the grammatical status of the construction is controversial. Assuming traditional syntactic "raising" accounts (Fillmore, 1963; Ross, 1973; Prince, 1976, a.o.), according to which the negation is base-generated within the embedded clause, the instances in (3) may not actually constitute evidence for the child that NPI licensing is not clause-bounded in English. Assuming a semantic/pragmatic analysis (cf. Bartsch, 1973; Gajewski, 2007) however, according to which the internal negation reading is generated via a presupposition, these instances would, like non-neg-raising examples, provide evidence for the lack of clauseboundedness.

*CHI: what animal ?

*FAT: any animal that you want . (Transcript 12, Line 169)

b. *FAT: being around you two drowsy people would make anyone feel tired . (Transcript 53, Line 734)

c. *FAT: why don't you tell me a story?

*CHI: what kind of story?

*FAT: any kind . (Transcript 130, Line 587)[15]

d. *CHI: Dad (.) are you going to throw these away ?

*FAT: pick up anything you don't want me to throw away . (Transcript 151, Line 251)

e. *CHI: Dad (.) do you believe a dog could be that big ?

*FAT: anything's possible but was it really that small ? (Transcript 201, Line 442)

(5) Lara's mother (Lara corpus)

a. *MOT: you pop some bricks on there .

*CHI: where does this go ?

*MOT: it can go anywhere you want it to . (Transcript 47, Line 503)

b. *MOT: you're supposed to just guess .

*MOT: just pick one .

*MOT: any one . (Transcript 53, Line 762)

*DAD: <pick a> [/] pick a card .

*DAD: any card . (Transcript 53, Line 764)

c. *MOT: what does Amy eat ?

*CHI: hay .

*MOT: no she doesn't .

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[15] In analyzing children's spontaneous production of *any*, I excluded two-word utterances containing *any*, as the issue was whether children could produce grammatical, licensed instances of *any*; I thus did not count such examples, since in many cases, (i) it was impossible to determine what the intended meaning was (and therefore what, if anything, was licensing *any*); (ii) we wanted to make sure children were capable of producing full sentences containing *any*. The examples in (4c) and (5b) however involve apparently elided material whose meaning is easy to reconstruct given the linguistic antecedents in the immediately preceding utterances; thus I have included these in our discussion.

*MOT: she eats anything and everything, doesn't she ? (Transcript 66, Line 794)

d. *MOT: they'll eat the horse .

*MOT: they'll eat anything they can . (Transcript 109, Line 1450)

*CHI: why've we got to shut that bit ?

*MOT: so that the lions don't get out and eat everyone .

e. *CHI: I don't like the water on me .

*MOT: there .

*MOT: now any water will go on the cushion . (Transcript 116, Line 985)

*MOT: not on you .

Beyond evidence for licensing of *any*, we might expect to find evidence for the quantificational force of *any*: existential on NPI uses and universal on FC uses. The examples in (2)-(5) are again relevant. In order to understand what NPI *any* contributes to the truth conditions of a sentence in which it appears, for example, what the child needs to learn is to interpret it as an existential within the scope of negation. Crucially, the successful acquisition of this meaning is reliant on sentence-meaning pairs, i.e. hearing the sentence uttered in a situation that makes the sentence true. For example, Abe's father presumably uttered (2a) in a context where there truly was no hot chocolate. Abe would have had to be able to perceive the truth of the assertion in the absence of the hot chocolate. Likewise, we assume that Lara's mother uttered (2e) in a situation where Lara in fact did not have shoes on. Assuming (that children assume that) parents utter their sentences truthfully, the child must be able to glean the meaning of *any* in the scope of negation by interpreting these sentences in the relevant contexts, thus deriving the appropriate truth conditions.[16] The cases of FC *any* are considerably more subtle, given the modal meanings that accompany them. Certainly to map FC *any* to an existential quantifier scoping under the modal in the cases in (4) and (5) would yield rather strange results; these

[16] Another prerequisite is that children have some notion of DEness in place. The input provides positive evidence of *any* in the scope of DE operators, but it does not provide explicit evidence of what a DE inference is, or how to distinguish DE from non-DE operators. See Gualmini and Crain (2002) for claims that children do not in fact need to learn downward entailment (i.e. they have innate knowledge of the logical property of downward entailment).

are contexts where the parents seem to be making generalized, universal claims.[17] Presumably with the help of the larger situational context in which these sentences are uttered, the child arrives at the universal meaning of *any* in these modal contexts. In (5d) for example, when the mother says that they have to try to prevent the lions from eating anything they can, the context (along with knowledge of what the modals in the sentence mean) should direct the child to the intensionality of *any*: no individuals have yet been eaten, and they are trying to prevent all of the animals in the context from potentially being eaten. Thus relying on these sentence-meaning pairs in context might well lead the child to infer that *any* quantifies over a (wide) set of possible individuals.[18]

3.2 The Gap Between the Input and the Target (*Poverty of the Stimulus*)

So far, we have seen that the input provides unambiguous evidence for the fact that *any* has a restricted distribution (i.e. to its DE and modal licensing contexts). It is perhaps not surprising then that 3- and 4-year-old children can restrict *any* to the scope of operators like negation in both their production and comprehension. But let us now turn our attention to the semantic dimension of *any*, namely to the properties that we tested in Chapters 3 and 4.

Most 4-year-olds on Experiment 2 were sensitive to *any*'s subdomain alternatives, and interpreted *any* as quantifying over the largest domain alternative in the context; that is, in the same experimental contexts, children interpreted *any* as quantifying more widely than plain indefinites. In order to succeed on this task, children first need to know that *any*'s alternatives include subdomain alternatives; on top of this, they need to know how to exhaustify these alternatives; finally, to quantify as "widely" as possible, they also need to know how to contrast *any*'s domain with alternative domains in the context. What evidence in the input

[17] Note also that the evidence should indicate the difference between *any* and *every*; under Dayal's analysis, *any* is crucially different from *every* in that it quantifies over possible individuals; this seems to be apparent in the characterizing modal statement in (5c), which contains both *anything* and *everything*, hinting at the subtle difference between the two.

[18] I would nevertheless expect the intensionality of FC *any* to make the learning task more difficult (than the task of inferring the existential meaning of *any* under negation).

could lead the child to these three ingredients? Consider again the parental samples of NPI *any*, repeated below:

(6) a. *FAT: we do**n't** have <u>any</u> hot chocolate . (Kuczaj, Transcript 118, Line 19)

b. *FAT: we did**n't** get you <u>any</u> new socks . (Kuczaj, Transcript 166, Line 448)

c. *FAT: I do**n't** think we have <u>any</u> more . (Kuczaj, Transcript 110, Line 619)

d. *MOT: he has**n't** got <u>any</u> feet . (Lara, Transcript 98, Line 559)

e. *MOT: Lara has**n't** got <u>any</u> shoes on . (Lara, Transcript 100, Line 252)

f. *MOT: you do**n't** need <u>any</u> more . (Lara, Transcript 119, Line 3621)

(7) a. *FAT: I do**n't** think that there's <u>anything</u> cooking in that pan (.) Abe . (Kuczaj, Transcript 23, Line 53)

b. *FAT: I do**n't** think we have <u>any</u> honey (.) Abe . (Kuczaj, Transcript 182, Line 308)

c. *MOT: I do**n't** think <u>anybody</u> can really . (Lara, Transcript 101, Line 8953)

It is not immediately clear to me how such examples indicate that *any*'s alternatives are subdomain alternatives. Of course, we can imagine the subdomain alternatives that might be active in the utterances; in (6a) for example, Abe's father could be saying that they don't have any kinds of hot chocolate -- not the one Abe usually drinks at home, or the one that Abe usually drinks at his grandparents', or the kind he once drank at school. But there is nothing in the utterance itself that forces this interpretation, and in fact, it's not immediately clear what prevents the child from simply interpreting *any* as *a* (or the entire noun phrase as a bare noun *hot chocolate*). So while it's possible (and in fact, necessary, on Chierchia's account) that *any* always activates subdomain alternatives, the sentences themselves do not force these subdomain alternatives to be salient, and they certainly don't force the child (in any obvious way) to adopt the hypothesis that *any*'s alternatives are in fact, subdomain alternatives. In other words, it isn't at all clear how these examples in the input are informative regarding the nature of *any*'s alternatives.

The kind of evidence that would be informative regarding the nature of *any*'s (subdomain) alternatives would, I believe, be the same kind of evidence that would be informative about *any*'s potential for domain widening. It is precisely those contexts containing salient subdomain alternatives that would allow for con-

trastive focus on *any*; parental productions that involve contrasting the larger domain of *any* with more restricted domains in the context would cue the child into: (i) the fact that *any* can activate a set of subdomain alternatives, and (ii) the fact that when there are more restricted domains available in the context, *any* yields the familiar domain widening effect. What would this evidence look like? Consider the following (hypothetical) examples:

(8) a. I don't have a crayon.
    b. I don't have any crayon.
    c. I don't have ANY crayon!

The difference between (8a) and (8b,c) is the widening that is possible in (8b) and certainly present in (8c). The use of *any* triggers a set of subdomain alternatives which need to be exhaustified;[19] if there are salient subdomains in the context, we will get the widened interpretation, according to which the claim that the speaker doesn't have a crayon is meant to apply to even exceptional instances of what might count as a crayon. How obvious is this kind of widening in the examples of *any* in the input? Consider these examples from Lara's mother:

(9) *MOT: we haven't got any seeds . (Lara, Transcript 111, Line 1354)

(10) *MOT: I don't know any Harrys . (Lara, Transcript 115, Line 497)

It's not immediately clear how the child could learn, just by hearing (9), the contrast between it and the statements *We haven't got a seed* or *We haven't got seeds*, and likewise for the difference between (10) and the statement *I don't know a Harry*. It's generally not clear from the transcripts whether the children hear

[19] If there are no salient subdomains, exhaustification will be vacuous, and the statement will amount to a run-of-the-mill negative existential statement.

utterances like (8c), where stress on *any* might offer a more salient indicator of widening.[20] One might imagine that another possible kind of evidence that might helpfully indicate the widening properties of *any* could be the explicit use of *even* focus on some element that might be considered exceptional to the domain, as seen in the following hypothetical examples:

(11) I don't have <u>any</u> crayons, not even a fake plastic one.

(12) I don't have <u>any</u> money, not even a penny.

(13) I don't like <u>ANY</u> clowns, not even cartoon ones.

Note however that even regular indefinites can co-occur with such indicators of widening or exhaustivity:

(14) I don't have crayons, not even a fake plastic one.

(15) I don't have money, not even a penny.

(16) I don't like clowns, not even cartoon ones.

Given that the overt marker of exhaustive widening is not unique to *any*, it's not entirely clear that instances like (11)-(13) would actually be helpful in highlighting the domain widening induced by *any*. Even if these were hypothetically useful, we observe that of the 130 utterances of *any* produced by Abe's father, and the 428 utterances of *any* produced by Lara's mother, there is not a single instance akin to the examples in (11)-(13). We do find however, one example that may hint at domain exhaustivity, from Abe's father:[21]

(17) *FAT: you mean you didn't do <u>anything</u> at all all day long ? (Abe, Transcript 75, Line 218)

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[20] Of course we'll recall that neither Kadmon and Landman nor Chierchia claim that stress is required for widening. On Chierchia's account, contrastive focus is required. But for the child, presumably prosodic salience would provide a much stronger cue to widening than an unstressed *any*, even if there were domain alternatives floating around in the context.

[21] And in fact this one example is complicated by the fact that *at all* is itself considered an NPI.

Examples such as (17) might in principle be helpful for pointing out the exhaustive nature of the widened domain, though it's unclear how useful they are in practice given that we found only one instance across all of Abe's father's uses of *any* (and none across Lara's mother's). If the domain widening properties of *any* are to be gleaned from the linguistic context in which *any* appears, namely those contexts which also include some overt marker of exhaustivity such as *at all*, we might expect such markers to occur more frequently than they apparently do.

To ensure that the lack of explicit evidence tying *any* to (even a potential for) domain widening is not restricted to the three parents' whose speech we've examined, let me briefly provide further evidence for the paucity of evidence we are dealing with, from a greater set of parental speech samples. In addition to the three longitudinal corpora we have already discussed, I also examined caregiver productions of *any* in the Warren corpus (also available on the CHILDES database), which contains 20 files, each a transcript of a play session involving a child interacting first with one parent and then with the other.[22] Although this corpus contains less data per parent, it provides data from 20 different mothers and 20 different fathers. Using the CLAN program, I was able to isolate 29 different instances of NPI *any*. Of these, only one could arguably provide evidence for domain widening:

(18) *MOT: no , the rabbit is silent .
*CHI: only they can make rabbit noise .
*MOT: well , what kind of rabbit noise ?
*CHI: oo !
*MOT: no , I don't think the rabbit makes <u>any</u> noise .

(Warren corpus, George transcript, Line 456)

[22] According to the CHILDES database manual entry for the Warren corpus, all children were from white, middle-class, nonprofessional families. Ten of the transcripts are from the younger group of children (1;06-3;01) and ten are from the older group (4;06-6;02). Each session with mother or father lasted from 15-30 minutes. Given each child conversed for at least half an hour, the data cover a minimal (total) timeframe of 10 hours of transcribed speech.

This example is quite like the theoretical ones that we are familiar with, and we can easily apply Chierchia's analysis to explain the widening effect. Salient in the discourse context is the restriction of the domain of quantification to noises made by rabbits; the *any*-statement can be seen as invoking a contrast between this previously restricted domain of rabbit noises, and a larger domain containing non-rabbit noises. It is this contrast that gives us the strengthening effect of the mother's assertion.

While this example may be reason for some optimism, consider the following. Of the 577 instances of NPI *any* across the Lara, Kuczaj, and Warren corpora combined, we found only two instances of apparent widening like that in (18): this amounts to roughly 0.35% of NPI *any* that explicitly demonstrates domain widening. Contrast this with the 431 instances of NPI *any* occurring in the scope of sentential negation. In other words, while 75% of instances of NPI *any* provide evidence that *any* is licensed in the scope of negation, a mere 0.35% provide evidence of domain widening. What I want to emphasize here is the overwhelming imbalance in the nature of the evidence for the different dimensions of *any*. It is not at all clear that there is evidence in the input explicitly tying *any* to domain widening.

The reader might object that some of the cases of FC *any* reviewed in this section could also provide evidence for widening; in fact, it seems that there are more clear cases of contrastively focused FC *any* than contrastively focused NPI *any*. The following examples from the Kuczaj and Lara corpora seem particularly relevant:

(19)a. *FAT: okay (.) Abe look you put this on the paper then you keep the pencil against the edge of this and draw see (.) then you end up with a animal .
*CHI: what animal ?
*FAT: <u>any</u> animal that you want . (Kuczaj corpus, Transcript 12, Line 169)

b. *FAT: why don't you tell me a story?
*CHI: what kind of story?
*FAT: <u>any</u> kind . (Kuczaj corpus, Transcript 130, Line 587)

c. *MOT: you're supposed to just guess .
*MOT: just pick one .

*MOT: any one . (Lara corpus, Transcript 53, Line 762)

*DAD: <pick a> [/] pick a card .

*DAD: any card . (Lara corpus, Transcript 53, Line 764)

In (19a), Abe questions what kind of story he should tell, and we can imagine that the *wh*-indefinite comes with a contextual domain restriction, e.g., to the typical kinds of stories that Abe and his father are used to telling, or to the kinds of stories that his father usually likes to hear, let's say; Abe's father's use of *any* seems to invite a widening of this domain, such that Abe is free to choose any kind of story he desires, even if outside of the typical domain. (19b) is similar in this respect. The contrast in the wider domain of *any* with a previously restricted domain is even clearer in (19c), where Lara's father's use of *any* immediately follows up on an imperative containing the plain indefinite *a*.

We should therefore add such FC examples as well to our collection of evidence that potentially ties *any* to domain widening. But even with the addition of such examples, recall that Abe's father's set of transcripts and Lara's mother's set of transcripts each contained only 5 instances of FC *any* overall. This makes it very difficult to hinge (the child's making) the connection to domain widening on evidence from FC *any*.

Finally, it is not entirely clear what evidence would be required to lead the child to the ability to compute FCIs from *any* in modal statements (as they were shown to be able to do on Experiment 3). The FCI is what underlies the 'freedom of choice' meaning of *any*, and the examples in (19) of course express freedom of choice; the question is how the child figures this out. An example like (19a), which makes explicit reference to the addressee's desires might perhaps be the most salient indicator of the addressee's 'freedom of choice', since it directly involves the child's making a choice. But it's very difficult to say how the child pieces together the mechanics of FCIs from the evidence available in the input. What in the input could tell the child that she must consider pre-exhaustified alternatives in the case of FC *any*? What tells the child how to exhaustify with respect to these pre-exhaustified alternatives? The answer to such questions is not at all clear from our examination of the parental speech samples. Moreover, even if we could identify the relevant cues in the examples we have seen, recall that FC *any* is not very frequent in the parental speech. While it might be sufficient to indicate to the child that FC *any* is possible in modal contexts, it's not clear to me whether

the examples are abundant enough to allow the child to derive the kind of sophisticated semantic knowledge that was required for success on Experiment 3. If the 4-year-olds we tested did not have this knowledge, i.e. if they had failed to compute the relevant FCIs, they would have provided non-target truth value responses. Yet recall that the children performed at 95% accuracy.

In summary, while the input provides unambiguous evidence for the restricted distribution of *any*, as well as for its licensers, it is not quite so clear what evidence allows children to pick up on its particular semantics, which ultimately gives rise to domain widening and FCIs of the kind we saw in Chapters 3 and 4. Table 2 summarizes the list of target properties and whether we can find evidence for them in the input.

Table 2. Input vs. target

Target property	**Evidenced in the input**
Syntactic category/distribution	*yes*
Quantificational force	*yes*
Licensing condition (DE restriction)	*yes*
Domain widening: Activation of subdomain alternatives with contrastive focus	?
NPI *any*: Exhaustification of alternatives	?
FC *any*: Pre-exhaustification of domain alternatives	?

4. Solving the Learning Problem

We have now identified the learning problem that is posed by *any* to the child learner. By the age of 4, children show extremely sophisticated knowledge of the semantic properties and semantic operations associated with *any*, which allows them to produce and comprehend *any* (on its NPI and FC uses) in an adult-like way. Yet there is little to no explicit evidence in the input that ties *any* to these particular semantic operations. How then, can we explain how the child arrives at the target grammar? In this section, I propose that children do not have to learn these semantic properties and operations per se, from evidence in the input. Rather, they must use the distributional information that is available in the input to guide their choice from among a

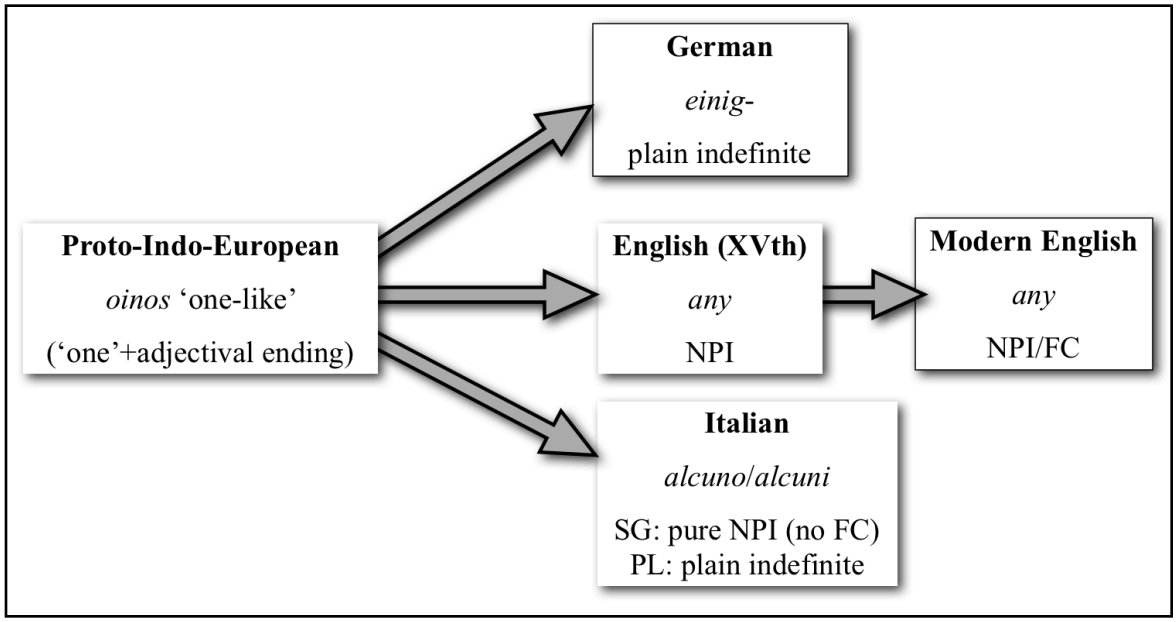
constrained hypothesis space of indefinite types. The child's task as a learner is therefore not to "search" for evidence of domain widening or recursive exhaustification per se; rather the child must pay attention to the distribution of the indefinite in the input, and on the basis of this information, map *any* to the right category of indefinite (among a set of restricted options). I will argue that the evidence from the parental input we have examined thus far is sufficient (or rather, must be sufficient) to allow children to make this choice.

4.1 An Innately Constrained Hypothesis Space: Chierchia's Typology

To solve the learning problem that we've raised, I'll suggest that what we need to do is take a step back and look at how *any* fits into the cross-linguistic typology of PSIs. Up to this point, I have been pinpointing very specific aspects of Chierchia's proposal that successfully capture the behaviour of NPI and FC *any*; but in fact, one of the greatest merits of the proposal is that the analysis extends beyond *any* to PSIs across languages. So let us take a step back and look at the range of indefinite types across languages.

First, it is insightful to consider the historical evolution of *any*, which suggests the formation of related classes of indefinites. Chierchia discusses how the Proto-Indo-European *oinos* 'one-like' (literally *one* plus an adjectival ending), evolved into different kinds of indefinites in different languages. In German, *oinos* evolved into *einig*-, a plain indefinite. In English, it evolved into NPI *any* (around the 16th century), only later becoming ambiguous between NPI and FC *any* in Modern English. In Italian on the other hand, *oinos* evolved into *alcuno/alcuni*, a pure NPI in the singular form, but plain indefinite in the plural form. This is summarized in Fig. 1.

Fig. 1: Evolution of *any* (Chierchia, 2013)



Chierchia suggests that these different indefinite types correspond to contiguous grammatical classes that can shift from one to another. Chierchia's theory derives the distribution/behaviour of PSIs by allowing free variation along two particular dimensions: (i) the kinds of alternatives that the polarity-sensitive terms activate, and (ii) the possible modes of exhaustification, i.e. the ways in which these alternatives get factored into the meanings of the sentences that contain them. His full typology is provided in Table 3; note however that I will only focus on the part of the typology that is relevant for our present discussion of *any*.

Table 3. Chierchia's theory-driven typology				
	Modes of exhaustification			
Types of alternatives	**Weak**		**Strong**	
Degree-alternatives (emphatic NPIs)	E *koii bhii, ek bhii, give a damn*		E^S *sleep a wink*	
Simple D-alternatives + σ-alternatives (pure NPIs)	O *ever, mai, alcun*		O^S *in weeks, N-words*	
Exhaustified D-alternatives + rich scale (Total variation ∃-FC)	O *irgendein, un qualsiasi NP* (total ∃-FCI/NPI)		O^S ?	O^{PS} *un NP qualsiasi, un oarecare, un quelconque* (total pure ∃-FCI)
Exhaustified singleton D-alternatives + rich scale (partial variation ∃-FC)	O *irgendein* (partial ∃-FCI/NPI without anti total variation)	O_{ATV} *vreun* (partial ∃-FCI/NPI with anti total variation)	O^{PS} *un qualche* (partial pure ∃-FCI without anti total variation)	$O^{PS}{}_{ATV}$? (partial pure ∃-FCI with anti total variation)
Exhaustified D-alternatives + reduced scale (∀-FCI)	O *any* ∀-FCI/NPI		O^S ?	O^{PS} *qualsiasi* (pure ∀-FCI)

(Chierchia, 2013:367, Ex.112)

Along the first dimension, we find two kinds of alternatives: domain alternatives and degree alternatives. PSIs that activate domain alternatives include *any*, and are exhaustified via a covert *only*-like operator (O) (as we saw in Chapter 2). PSIs that are associated with degree alternatives, e.g., alternatives that can be aligned along a scale of degrees are called *emphatic NPIs*, and include English *give a damn*; these are exhaustified via a covert *even*-like operator (E). The E-operator requires that the assertion be the least likely among the alternatives (with likelihood defined in terms of entailment). The least likely alternative is the strongest, as it entails all other alternatives. This is represented as follows:

(20) $p \rhd_c q$ if $p \rightarrow q$ and $q \nrightarrow p$ (p is less likely than q iff p entails q and q does not entail p)

(Nicolae, 2012:235)

Next, within the group of PSIs that activate domain alternatives, we see variation in whether or not the PSI tolerates pre-exhaustified alternatives. Those that do not tolerate pre-exhaustified alternatives, like *ever*, are so-called "pure NPIs", and only appear in the typical NPI licensing/DE contexts. PSIs that do tolerate pre-exhaustified alternatives however, like *any*, additionally exhibit the FC effect in certain modal contexts.

Along the second dimension, there are essentially two modes of exhaustification: weak and strong. Weak exhaustification only takes into account truth-conditional meanings, while strong exhaustification involves enriched meanings (i.e. truth conditions along with implicatures and presuppositions). The further distinctions made within the various subclasses of PSIs are not immediately relevant for our current purposes. It suffices here to note that fully exploiting the possible variation along the two dimensions yields a typology of 14 different kinds of PSIs.[23] And herein lies our solution to the learning problem: the learner's task can now be thought of as navigating this typological space, making a finite set of decisions to arrive at the target PSI, as symbolized in Fig. 2.

Fig. 2: Simplified representation of the target within Chierchia's typology

	Mode of exhaustification	
Types of alternatives	Type 1	Type 2
Type A		
Type B		
Type C		
Type D		
Type E	NPI/∀-FCI	

Put very simply, the idea is the following. We can mitigate the learning problem by invoking a restricted hypothesis space: the child only has to entertain a limited set of options. The child does not have to *learn* that

[23] In fact, Chierchia refers to it as a generative matrix, rather than merely a descriptive typology. We expect to be able to fill out all of the cells of the table with cross-linguistic data. There remains some work to be done in this respect.

subdomain alternatives (and pre-exhaustified alternatives) exist. The child does not have to learn how to activate subdomain alternatives, or that there exist different modes of exhaustification that "use up" these alternatives, nor does the child need to learn *how* to exhaustify these alternatives. All of these semantic mechanisms of interpretation come for free. Restricted variation with respect to these mechanisms means that only a finite set of possible PSIs can be generated; this in turn means that the child need only entertain a restricted hypothesis space. The child's learning task is reduced to mapping *any* to the right category among a restricted set of options.

In our discussion of the ingredients that would in principle be required to generate the target-like performance that we observed in Experiments 2 and 3, we posited that the child would need to learn that *any* activates subdomain alternatives, that these alternatives must be exhaustified via an *only*-like operator, and that these alternatives can be pre-exhaustified, giving rise to FC effects. But we've now seen that the input does not provide direct/explicit positive evidence for these semantic mechanisms. What the input does provide evidence of is the dual nature of *any*, namely that it is the type of PSI that oscillates between NPI and FC uses. In other words, the child receives evidence for *any*'s restricted distribution. I propose that this is precisely what the child needs to map *any* to the right category within the typology. The strongest cue that children receive with respect to *any* is its unique distributional pattern; given the paucity of the input regarding the specific semantic mechanisms underlying *any*, this distributional pattern must be sufficient to allow the child to map *any* to the target PSI.[24]

I should be very clear here that I am not claiming that there is no learning involved in the acquisition of *any*. It is not the case that the child's grammar comes pre-equipped with knowledge of *any*. Rather, the grammar provides the child with a set of semantic mechanisms required to construct appropriate meanings,

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[24] It may seem as though there are two independent ingredients required to solve the learning problem: (i) a restricted hypothesis space and (ii) innate semantic mechanisms like exhaustification. In fact, they are inseparable. On Chierchia's account, these semantic mechanisms (and the variation that they can give rise to) are what derive the typology, i.e. the child's restricted hypothesis space on our proposal. Thus it is impossible to have one without the other. Children start off with innate semantic mechanisms which can only generate a restricted set of PSI possibilities. They then have to map *any* to the target PSI among these possibilities. In other words, the innate mechanisms derive the typology, rather than the other way around; children do not start with an arbitrary set of possibilities and then derive the mechanisms on the basis of this arbitrary set.

e.g., the ability to activate and exhaustify alternatives. As a consequence of these semantic mechanisms (and the variation they can give rise to), the grammar thus constrains the options that are available to the child, since only a finite set of PSI types can possibly be generated. What the child then has to do is map a particular surface string in the input to a semantically rich, innately constrained PSI category. In the next section, I will speculate about how the child might use the distributional pattern to lead to a particular cell within the typology.

4.2 The Mapping Task

The basic idea of the proposal in this section is very simple. Assuming PSIs can vary with respect to the types of alternatives that they activate, and the modes of exhaustification that are available, acquiring a particular PSI amounts to choosing the right setting along each dimension. The learning task reduces to mapping a particular word or string, to the right PSI within the typology of restricted options, on the basis of its unique distributional pattern.

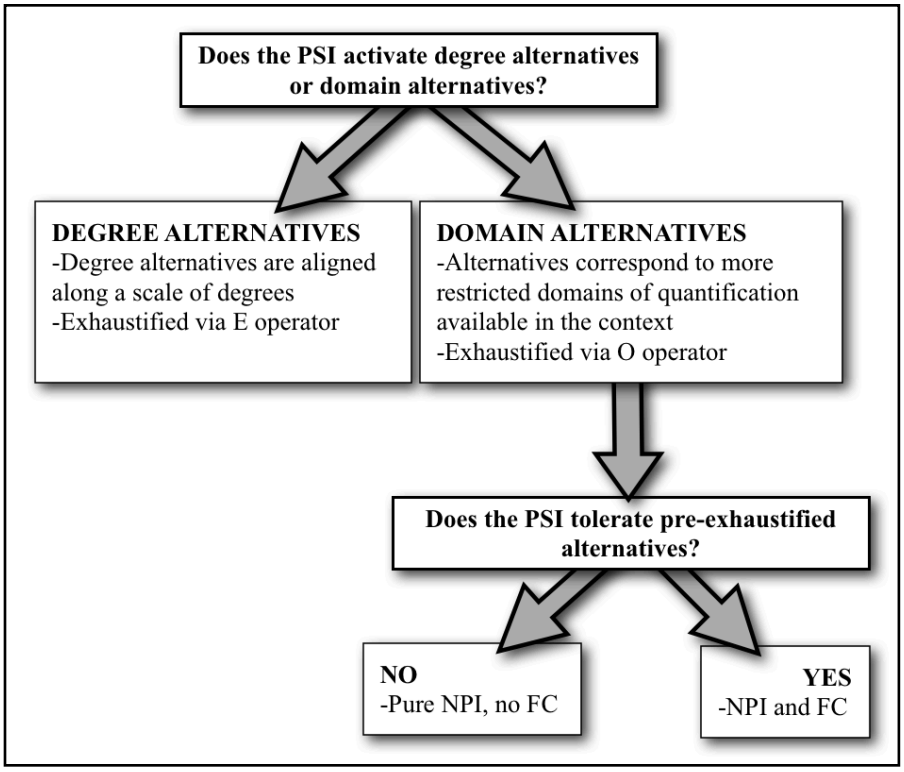
Note however that reducing the hypothesis space is not particularly revealing about how the mapping task actually takes place. Navigating within the set of possible options in order to narrow down the possibilities to just the target category is not a trivial task. But we do know one thing about the evidence that the child uses, which is almost tautological in its simplicity: the child must make use of the evidence that is available to her; after all, this is all the help she will get from the input. Given the ingredients of Chierchia's typology and the way that the two parameters interact, there are minimally two questions that the learner must answer for any given PSI. First, does the PSI in question activate degree alternatives or domain alternatives? Second, does the PSI in question tolerate pre-exhaustified alternatives? Let us consider how the mapping task might work for just one slice of the typology, so that we can highlight both the kinds of decisions the learner has to make and the kinds of evidence that would in principle be informative for making these decisions.

Consider the following, very restricted partial typology that will suffice for the purposes of illustrating the mapping task:

Table 4. Partial typology of polarity-sensitive items (partial representation of Chierchia's typology)	
Types of alternatives	**Mode of exhaustification: Weak**
Degree-alternatives (emphatic NPIs)	**E** (e.g., English *give a damn*, Hindi *koii bhii*, *ek bhii*)
Simple domain alternatives and scalar alternatives (pure NPIs)	**O** (e.g., English *ever*, Italian *alcun*)
Exhaustified domain alternatives (∀-FCI)	**O** (∀-FCI/NPI, e.g., English *any*)

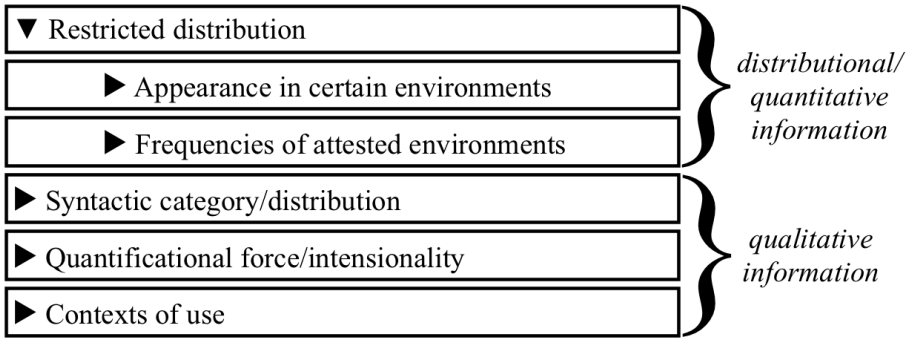
Recall that PSIs like *any* activate domain alternatives; moreover, these alternatives are exhaustified by means of a covert O-operator. Emphatic NPIs and minimizers like English *give a damn*, *sleep a wink*, etc., on the other hand, activate degree alternatives. These alternatives are exhaustified by the E-operator, requiring the assertion be the least likely (and the strongest). Now imagine a toy learning situation where a child acquiring English must figure out whether a particular PSI she is hearing in the input corresponds to the *give a damn*, *ever*, or *any* category of PSI. The child must make the following decisions:

Fig. 3: The learner's decision tree



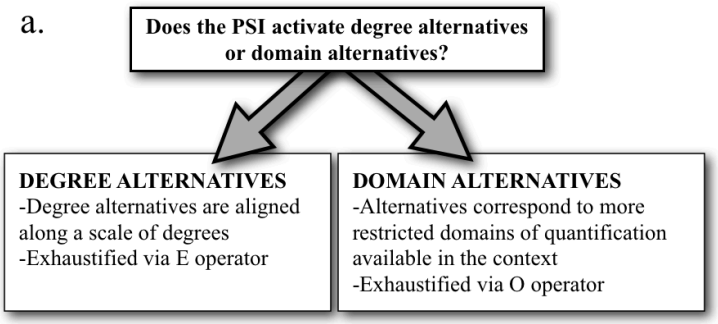
Recall the evidence that is available to the child, summarized in the following figure:

Fig. 4: Evidence available to the learner



The idea is that any informative cues from the input must be among the list in Fig. 4; that is, the child must use either all or a subset of the information in Fig. 4 in order to make the required decisions. Consider the first decision concerning the nature of the alternatives that the target PSI activates:

Fig. 5: Decision 1: The nature of the alternatives



b.

Types of alternatives	
Degree alternatives	*give a damn*
Domain alternatives	*any*/*ever*

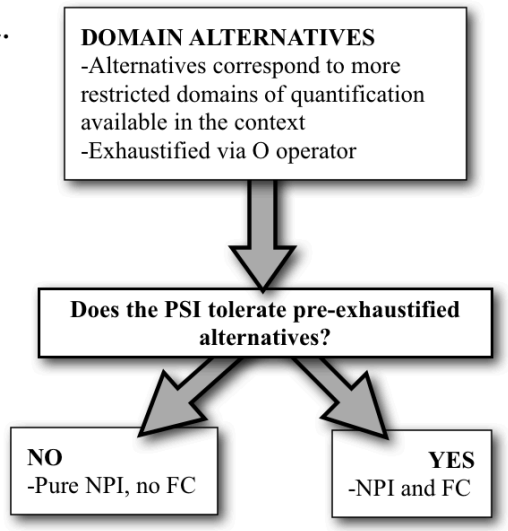
The question is whether the target PSI is of the *give a damn*-type, which activates degree alternatives, or of the *any/ever* type, which activates domain alternatives. In this case, I suggest that *contexts of use* might provide one useful cue to the learner (there may of course be others). The contexts in which domain alternatives are relevant (as in the case of the *any*/*ever*-type) are presumably different from the contexts in which degree alternatives are relevant (as in the case of emphatic NPIs like *give a damn*). Domains are relevant for quanti-

fying, while degrees are concerned with expectations about likelihood of values on a scale. Contexts in which we quantify can be completely neutral without any bias or expectation (e.g., recall our example in which a person walks into a department store and asks if they sell any cameras), while contexts in which emphatic NPIs like *drink a drop* or *give a damn*, which involve knowledge of scales and likelihood of different values on a scale, are usually used in contexts where such scales are salient. A person who is asked at a bar whether she would like a drink typically does not respond with, "I won't drink a drop." Thus a learner who has sufficient semantic knowledge to construe intended meanings in any given discourse context might be able to pay attention to what is at issue in the context, and consequently construe the appropriate meanings that are relevant for domain-PSIs vs. degree-PSIs.[25]

Now let us assume that the child has decided that the target PSI is not the emphatic minimizer type but rather the *any/ever* type, which activates domain alternatives. The learning task is still not complete, because the child has yet to determine whether the target PSI is a pure NPI without FC uses (i.e. *ever* in English) or one which oscillates between the two (i.e. *any* in English):

Fig. 6: Decision 2: Tolerance for pre-exhaustified alternatives

a.



b.

Types of alternatives	
Degree alternatives	*give a damn*
Simple domain alternatives	*ever*
Exhaustified domain alternatives	*any*

[25] I leave open the question of whether the child would have to have an innate sensitivity to the difference between neutral and negatively biased contexts, or could learn such a distinction simply by paying attention to different conversational contexts.

Recall that the input provides evidence for *any*'s particular (restricted) distribution, i.e. to DE and FC/modal contexts. Here is where I suggest the distributional information that children receive about *any* may be absolutely critical in leading the child to map *any* to the right category within the typology. The distributional information may help in (at least) two ways.

First, the learner could make use of information about the syntactic distribution of the PSI in question. Assuming that the learner could map distributional information to a syntactic category, the syntactic category of a given PSI could guide her to the target PSI within the typology. Syntactic category for example, distinguishes adverbial PSIs from quantificational ones. As far as I know, there are no known adverbial PSIs that tolerate pre-exhaustified alternatives, i.e. there are no "free choice" adverbial PSIs. If the learner could pay attention to the syntactic environments in which the relevant PSI appeared, i.e. to the PSI's syntactic distribution, she might be able to infer its syntactic category, and this syntactic category could help to narrow down the possible options.

Second, the learner could pay attention to the semantic/logical properties of the environments in which the PSI appeared. A PSI like *ever*, which does not tolerate pre-exhaustified alternatives, has a distribution distinct from that of a PSI like *any*, which does tolerate pre-exhaustified alternatives. We know that *any* is restricted to two kinds of environments: the scope of DE operators, and modal (FC) environments. PSIs like *ever* on the other hand are restricted to DE environments. This kind of distributional difference between the two could be informative, provided the learner was sensitive to it.

Yet another way in which the distribution might be informative lies in the relative frequencies of the attested environments. *Any* appears in DE and FC environments at particular frequencies in the input, which, incidentally, were fairly similar across the three parental speech samples we examined. If two PSIs in the typology differ categorically in the environments in which they appear, this in principle should make it easier to tease the two apart on the basis of distributional information. But even if they overlap in their licensing environments, they might differ in the relative frequencies at which they appear in the overlapping environments. *Any* for example shows up in its 'NPI' environments 96-99% of the time, while *ever* should show up in such environments 100% of the time. The evidence we've examined cannot tell us whether this is suffi-

cient to allow the learner to distinguish the two categories, but my suggestion is that it is one logically possible cue for the learner, given that it *is* available in the input.

To summarize, if any aspect of the acquisition of the semantics of polarity sensitivity is to be derived from the input, the relevant information must be observable in the input, whether it takes the form of qualitative or quantitative information.

Note that the present proposal requires that the learner go into the learning task 'looking for' certain kinds of information. To distinguish contexts in which degree alternatives are relevant from contexts in which domain alternatives are relevant for example, the learner has to be sensitive to the difference between biased and neutral contexts in which the two kinds of alternatives would be relevant. To use the varying distribution of *any* and *ever* in order to distinguish the two kinds of PSIs, the learner has to be aware of and sensitive to the difference between DE and non-DE environments. That is, the learner must be attuned to certain properties in the input, in order to use these properties as informative cues.[26]

Finally, whatever information is relevant, we expect to find that it is also useful for acquiring PSIs in other languages. In other words, the solution proposed here should not be restricted to English. Each PSI category in the typology should have its own unique, observable 'signature' in the input, whatever the nature of the signature, be it statistical or qualitative.

5. Discussion

5.1 Predictions for the Journey to the Target PSI

One of the predictions of the proposal in Section 4 is that children may make wayward choices on their way to the target PSI. Given the restricted hypothesis space, one might expect to find children in various developmental stages where they have analyzed a given string as belonging to a non-target PSI category in the typology. In Chapter 3, I presented the results of Experiment 2, one of which was that some children did not

[26] The goal here has been to identify, in principle, the potential cues that could be informative to the learner. The data we have reviewed so far cannot tell us which cues would in practice lead the learner to the target, or how strong each cue would have to be in order to be informative. It is my hope that identifying the potential cues here will lead to further research that can more definitively characterize the exact learning path that the child learner takes.

correctly reject *any*-statements that quantified too narrowly. While I speculated as to the status of the children who did not perform in an adult-like manner, let me now raise another possible way of looking at that data. In addressing this point, I'll attempt to simultaneously present a prediction of the story presented in Section 4.

If, as proposed in Section 4, the child's task as a learner is to map the PSI they hear to the right PSI category within the typology, we might expect that children can go through developmental stages during which they temporarily map the PSI to the wrong category. In such a stage, we would nevertheless expect that the (non-target) representation should correspond to one of the other possible options within the restricted typology. Given the assumption that the semantic mechanisms and operations underlying these PSIs are innate, there is only a finite set of options available to the child. Might our little "non-wideners" have been stuck on an intermediate choice, on the way to the target *any*?

I suggest that the answer might be *yes*, but only if we invoke one further detail of the typology. Recall from Fig. 1 that the PSI *any* evolved from the Proto-Indo-European word for *one*, which evolved into the non-polarity-sensitive plain indefinite *einig-* in German, but into an NPI in English. On Chierchia's account, this split can be represented in terms of a lexical stipulation on the relevant indefinite's features: *any* acquired a focal feature that requires obligatory exhaustification of alternatives, while plain indefinites only optionally activate these alternatives.[27] If we consider non-polarity-sensitive plain indefinites to be yet another possible indefinite "type" or category to map to (perhaps envisioned as a cell adjacent to the PSI ty-

[27] This dissertation is decidedly not a study of the historical development of *any*. It would nevertheless be interesting to compare children's development of *any* with the historical development of *any*. Chierchia's story of the switch from NPI to FC item treats the change as a switch in a feature/parameter specification, namely in whether the PSI allowed recursive exhaustification of its alternatives. This switch from NPI-only uses to NPI/FC uses is particularly striking in light of the fact that the emergence of FC *any* appears to be significantly later than the emergence of NPI *any* in children's spontaneous production. Within the same perspective, we might say that children initially treat *any* as disallowing recursive exhaustification of alternatives. This would crucially correspond to an allowed option within the typology of possible PSI types. Perhaps, given the relatively low frequency of FC *any* in the parental input, it simply takes longer for children to ascertain that *any* is indeed a PSI that allows for recursive exhaustification of its alternatives. A future study could investigate the parallel between the historical development and the child's development of the polarity sensitivity system more generally (beyond the specific example of *any*). In this respect, it would also be worth comparing the historical evolution of PSIs in other languages with the acquisition of these items in those languages.

pology), we might also expect children to consider this category as an option.[28] Of course, plain indefinites are not subject to the licensing conditions that PSIs are; this means that if a child has incorrectly mapped *any* to a non-PSI (thus giving rise to the inappropriate domain restriction observed in the non-wideners), the same child could be expected not to restrict *any* to the scope of appropriate licensers. For all intents and purposes, the child would be expected to treat *any* as *a*. Unfortunately, without production and comprehension data from the same child, we cannot definitively answer this.

Whatever the status of the non-wideners, i.e. whether the performance factor explanation in Chapter 3 is right, or the possibility raised here is right, the typological account proposed in Section 4 does predict that children may go through stages where they map an indefinite to a non-target category. A challenge of testing this prediction is that the semantic knowledge that we would want to test for is rather sophisticated, and given our children performed well by 4 or 5 years of age, it's not clear whether we could gather parallel data from younger children.

5.2 Implications of the Universal Account of FC *any*

Chierchia's view of the NPI/FC *any* dichotomy can viewed as a unified account. It's worth considering how a non-unified account would fit with the acquisition data. Under a universal account of FC *any* for example, such as Dayal (1998, 2011), FC *any* is a(n intensional) universal quantifier distinct from NPI *any*. Recall that FC *any* showed up very infrequently in the parental speech (1.17-3.92% of all occurrences of *any*, in the three samples that we examined). On such an account, child must learn FC *any* independently of NPI *any*. The infrequency of FC *any* makes the learning problem that we have outlined for *any* all the more difficult. In Abe's father's sample for example, there were only a total of five instances of FC *any*. The learning prob-

[28] If we consider the plain indefinite as a contiguous class, we might be able to explain examples of true production errors (unlicensed *any*): such errors might be indicative of the child struggling to determine that *any* is not just a plain indefinite but rather a PSI within the typology. The child data might well mirror the historical evolution of the item itself (*plain indefinite>>NPI>>FC*). The robustness of evidence of licensing of *any* might be what leads the child away from unlicensed *any* relatively early on (recall that there was in fact very little evidence of an error-prone developmental stage). In contrast, there is much less evidence for FC *any*, so it takes more time for the child to decide that *any* also has FC uses; thus FC *any* emerges significantly later than NPI *any*.

lem that we outlined for *any* would be considerably exacerbated if the child had to learn all of the semantics from the very few instances of FC *any* in the input.

The reader may notice that there is a very subtle, underlying tension in our proposal here: the children have to hear enough FC *any* to recognize that it has FC uses, and consequently, on the proposed account, to then map *any* to the kind of PSI that oscillates between the two uses (in other words, to distinguish it from something like *ever*, which only has NPI uses). Yet these very few instances of FC *any* in the input seem insufficient for the learner to acquire the specific semantic mechanisms underlying *any*. The input might be enough for the child to derive a restricted distribution and perhaps to ascertain the target quantificational force; but given the overwhelming amount of evidence for the narrow scope, existential interpretation of NPI *any*, we might expect children to interpret *any* exclusively as an existential quantifier. Yet Experiment 3 shows that they're able to do something much more than this. It is extremely difficult to see how they could get to this target state on the basis of so few examples in the input.

5.3 Extensions of the Exhaustification-Based System

One of the merits of the exhaustification-based system is that it allows us to capture deep connections across different kinds of PSIs, and moreover across different languages. Variation along the two dimensions we've mentioned can generate a particular finite set of possible PSIs (fourteen in Chierchia's typology); but others have since used the exhaustification-based semantics to make connections with yet other PSIs, including positive polarity items (PPIs). PPIs are particularly relevant to acquisition, as children have been reported to have difficulties with such items. The next subsection will therefore discuss an extension of the exhaustification-based system to PPIs, and its relationship with the child data. The second subsection will discuss how licensing of NPIs occurs in questions, again within the exhaustification-based framework; here too I will discuss a connection with child data.

5.3.1 An Extension to Positive Polarity Items

Positive polarity items (PPIs) like *someone* or *something* can only take wide scope with respect to strongly negative elements such as clausal negation and negative quantifiers:

(20) I didn't eat <u>something</u>

a. There is a thing such that I didn't eat it ∃>¬

b. *There is nothing that I ate *¬>∃

PPIs have been of interest in child language because children appear to have difficulties with the scope restrictions of *some*. Musolino (1998) investigated the comprehension of sentences such as (21) in a context where the detective found two of four guys participating in the story. Musolino found that children as old as 5;09 were non-adult-like in rejecting the sentence, i.e. they allowed a narrow scope reading of the existential quantifier.[29]

(21) The detective didn't find <u>some</u> guys

a. There are some guys that the detective didn't find

b. It is not the case that the detective found any guys

Since Musolino's original study, Gualmini (2004) has reported that manipulating the experimental materials to increase compliance with felicity conditions on the test sentences leads to improved performance. Children's reported difficulties with PPIs however are not restricted to comprehension. Recall O'Leary and Crain's (1994) elicited production study which found that children sometimes produced the sentence, 'No, this dog did not get <u>some</u> food,' where an adult would produce *any*. Looking to children's spontaneous production, it is also possible to find examples of *some* in the scope of negation (where it is interpreted on a par

[29] The reader will recall Xiang et al.'s (2006) study which we reviewed in Chapter 3; these authors also found some proportion of narrow scope interpretation of *some* under negation.

with *any* under negation). The following examples are from Abe's transcripts (Kuczaj corpus); (24) in particular may suggest that he has not entirely distinguished the two:

(22) Abe (Kuczaj corpus), Transcript 15 (age 2;06,14), Line 298

*CHI: uhhuh momma (.) I don't want any more milk don't want any more milk .

*MOT: you don't want any more milk today ?

*CHI: uhuh (.) today do**n't** want <u>some</u> .

*MOT: okay (.) it's up to you .

(23) Abe (Kuczaj corpus), Transcript 33 (age 2;08,25), Line 450

*CHI: uhhuh I need some pennies I ca**n't** get <u>some</u> I ca**n't** get <u>some</u> .

(24) Abe (Kuczaj corpus), Transcript 33 (age 2;08,25), Line 684

*FAT: Abe (.) I think you have enough pennies .

*CHI: I saw some in there I did**n't** get any <u>some</u> .

*FAT: yes you did you have four pennies .

Yet samples from the same corpus indicate that Abe is (eventually) able to use both lexical items (*some* and *any*) in an adult-like manner, and can even use both in the same utterance:

(25) Abe (Kuczaj corpus), Transcript 110 (age 3;06,16), Line 354

*CHI: oh my throat is so thirsty I can't eat <u>any</u> more cereal until I drink <u>some</u> milk (.)
so get me some milk now get me some milk now .

Although the nature of children's difficulty with PPIs is not entirely clear, I'd like to suggest that there may lie an explanation of the *any*/*some* asymmetry within the exhaustification-based framework we've been adopting.

Nicolae (2012) proposes that PPIs, like NPIs, also activate alternatives that require exhaustification. Instead of activating subdomain alternatives as *any* does however, PPIs like *some* activate so-called *super-*

domain alternatives, i.e. larger domains of quantification available in the context. Another difference between *any* and *some* is that whereas *any*'s alternatives are exhaustified by the O (*only*-like) operator, *some*'s super-domain alternatives are exhaustified via the E (*even*-like) operator. I briefly sketch the main idea of the analysis here (see Nicolae, 2012 for details).

Recall that the operator of choice for emphatic NPIs and minimizers like *give a damn*, *sleep a wink*, etc. is E, which requires that the assertion be the least likely among the alternatives (with likelihood defined in terms of entailment). The least likely alternative is the strongest, as it entails all other alternatives. In the case of minimizer NPIs, Nicolae demonstrates that the requirements of the E operator are met in DE but not in upward-entailing (UE) environments. Similarly to how O-exhaustification of *any*'s alternatives succeeds in DE environments but fails in UE environments, E-exhaustification of the degree alternatives likewise fails in UE environments but succeeds in DE environments. Without going into details, exhaustifying *Mary slept a wink* requires that the assertion that Mary slept the minimal amount be the least likely of the alternatives, entailing all alternative propositions according to which Mary slept more than the minimal amount. This is clearly contradictory. On the other hand, exhaustifying *Mary didn't sleep a wink* requires that the assertion that Mary did not sleep the minimal amount be the least likely of the alternatives, i.e. the strongest. Since the scales are reversed, exhaustification succeeds; if Mary did not sleep the minimal amount, then she did not sleep for any amount greater than the minimal amount.

Crucially, because *some*-PPIs activate super-domain alternatives, we end up with the reverse situation: E-exhaustification succeeds in UE environments but fails in DE environments. In an UE context, if something holds true of a domain, it will also hold true of any super-domain. If *John saw Bill or Mary*, it is also true that *John saw Bill or Mary or Bob*. Thus when we exhaustify with the E-operator in an UE context, the assertion will indeed entail all other alternatives. Nicolae formalizes the result of exhaustifying in UE and DE contexts as follows:

(26) John saw someone[$+D_E$]

a. Assertion: $\exists x \in D[saw(John,x)]$

b. Alternatives: $\{\exists x \in D'[saw(John,x)]: D \subset D'\}$

c. $E_{[D_E]}$ John saw someone$_{[+D_E]}$

$= \exists x \in D[saw(John,x)] \wedge \forall D' \supset D\ [(\exists x \in D\ [saw(John,x)]) \lhd_c (\exists x \in D'\ [saw(John,x)])]$

(27) *John didn't see someone$_{[+D_E]}$.

a. Assertion: $\neg\exists x \in D[saw(John,x)]$

b. Alternatives: $\{\neg\exists x \in D'[saw(John,x)]: D \subset D'\}$

c. $E_{[D_E]}$ John didn't see someone$_{[+D_E]}$

$= \neg\exists x \in D[saw(John,x)] \wedge \forall D' \supset D\ [(\neg\exists x \in D\ [saw(John,x)]) \lhd_c (\neg\exists x \in D'\ [saw(John,x)])]$

(Nicolae, 2012:235)

Now let us return to the acquisition question. It is reported that children have difficulties with the scope properties of PPIs but not of NPIs. In the exhaustification-based system, NPIs must appear in the scope of DE operators because these are the environments in which exhaustification is consistent; PPIs on the other hand must appear in UE environments because these are the environments in which exhaustification is consistent. Within the typological proposal of Section 4, difficulties arise when children have not yet mapped a string to the target PSI within the typology. The question becomes the following: why should mapping *some* to the right PSI category be more challenging than mapping *any* to the target category? Here I suggest three possible explanations for children's difficulty with PPIs (compared to NPIs). These potential explanations lie in the key differences between the two kinds of items, within the exhaustification-based framework.

First, *any* activates subdomain alternatives, while *some* activates super-domain alternatives. While there may not be an a priori reason why one ought to be more difficult than the other, no study to my knowledge has examined children's sensitivity to super-domains. Experiments 2 and 3 of this dissertation are among the first attempts to experimentally probe children's sensitivity to subdomain alternatives. It remains an empiri-

cal question whether children can likewise be shown to be sensitive to super-domain alternatives, and whether these might pose more difficulty to children. Recall the kinds of experimental contexts we created in Experiments 2 and 3: domains of discourse containing six rabbits (in Experiment 3), or domains containing nine diamonds (in Experiment 2). In these cases, in order to identify subdomain alternatives, what the child has to do is identify "subkinds" of a type, i.e. more specific kinds of rabbits, or more specific kinds of diamonds. Now imagine if the child, rather than having to identify subkinds had to identify superordinate categories. In other words, given blue diamonds, the child to generalize to a larger class of diamonds of different colours, or if given a set of small rabbits, the child had to identify a larger set containing rabbits of different sizes. It's not clear whether one ought to be more difficult than the other, but one could imagine that children's conversations tend to revolve more around specific tokens rather than general kinds (i.e. *Spot the dog* rather than *canines*). I leave it open as an empirical question whether one can be shown to be more challenging than the other. In theory, a difference between sub- and super-domains could be behind the *some*/*any* asymmetry in child language.

Another potential difference that could be behind the asymmetry is the nature of the exhaustification process. Recall that exhaustification of *any*'s subdomain alternatives is carried out via the O-operator, while *some*'s super-domain alternatives are exhaustified via the E-operator. If we could experimentally determine that children perform better with O-exhaustification than E-exhaustification, this might be suggestive that the asymmetry lies in the exhaustification process. It's not entirely clear how one could compare children's performance with these covert operators, but one could easily look to children's performance with the overt counterparts (which may not be identical, but could serve as good approximations for our purposes). Kim (2011) in fact investigates children's performance with the English focus particles *only* and *even* and finds that children perform better on comprehension of *only* than *even*. This kind of data is exactly what would be required to more carefully investigate the hypothesis that the *some*/*any* asymmetry derives from an asymmetry in children's ability to perform O- vs. E-exhaustification.

Finally, a reason that the PPI *some* might be delayed relative to NPI *any* lies in an ambiguity of *some*. In English, *some* can also have an epistemic indefinite use:

(28) Lisa married some student from the psychology department

Items such as *some student* give rise to ignorance inferences, signaling the speaker's ignorance as to the identity of the relevant object (cf. Kratzer and Shimoyama, 2002; Alonso-Ovalle & Menéndez-Benito, 2010; Fălăuş, 2010; Chierchia, 2011 for relevant discussion). Although the two uses are semantically distinct, the overlap in surface form could result in some difficulty for children, who must sort out the different uses in the input.[30]

In sum, within the exhaustification-based framework pursued here, *some* and *any* differ in key ways, and any of these key differences may underlie the developmental asymmetry between *some* and *any*.

5.3.2 An Extension to NPIs in Questions

The exhaustification-based framework makes a straightforward extension to licensing in questions, and thus we can also discuss children's acquisition of NPIs in questions within the same framework. Interrogatives have long been a thorn in the side of the DE account, because although they license weak NPIs like *any* and *ever*, they are not strictly speaking DE. Polar questions (root or embedded) (29)-(30) and the nucleus of matrix *wh*-questions (31) license weak NPIs such as *any* and *ever*:[31]

(29) Has Nicholas ever been to Paris?

(30) Sophie wonders whether Nicholas has any interest in visiting Paris.

(31) Who has ever been to Paris?

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[30] One might think that such an overlap in surface form, if problematic for *some*, should also be problematic for *any*, which has both NPI and FC uses. It is possible that the differential distribution of the two kinds of *any* is somehow easier to observe; if DEness and modals are the two major licensing contexts for *any*, then NPI and FC *any* are generally in complementary distribution. PPI *some* and epistemic indefinite *some* on the other hand overlap more in their distribution (e.g., the following are both fine: *Lisa married someone* / *Lisa married some guy*).

[31] Following Guerzoni and Sharvit (2007) and others, the "nucleus" refers to the material following the *wh*-phrase.

Guerzoni and Sharvit (2007) observe that weak NPIs like *any* and *ever* are licensed only in certain interrogative environments. For example, *any* is acceptable in *wh*-questions embedded under *wonder* (32a), and for some speakers under *know* (32b), but not under *realize* or *surprise* (32c,d).

(32) Embedded *wh*-questions

a. Sally **wonders** who brought any cake

b. %Sally **knows** who brought any cake[32]

c. *Sally **realized** which students brought any cake

d. *It **surprised** Sally which students brought any cake

Guerzoni and Sharvit propose that what licenses weak NPIs in questions is the property of strong exhaustivity. The strong/weak exhaustivity distinction is exemplified as follows:

(33) Sally knows who brought cake.

a. Weakly exhaustive reading: For every x, if x brought cake, Sally knows that x brought cake.

b. Strongly exhaustive reading: For every x, if x brought cake, Sally knows that x brought cake, and if x didn't bring cake, Sally knows that x didn't bring cake.

The strongly exhaustive reading in (33) is available because it is possible for Sally to know both of the x's who brought cake that they brought cake and of the x's who didn't bring cake that they didn't bring cake. While *wonder* provides a strongly exhaustive environment, *know* exhibits inter-speaker variation (the authors report that those who can access the strongly exhaustive reading accept the NPI licensing in (32b)), and *surprise* does not support a strongly exhaustive reading.[33] Polar questions are inherently strongly exhaustive, so the NPIs in the polar questions in (29) and (30) are also correctly predicted to be acceptable.

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[32] Following Guerzoni and Sharvit (2007), % indicates inter-speaker variation in judgments.

[33] *Surprise* can license NPIs in declaratives, and has been argued to be Strawson-DE (von Fintel, 1999). *Wh*-questions embedded under *surprise* however are neither strongly exhaustive nor Strawson-DE, and thus do not license NPIs.

Nicolae (2013) provides an explanation of these facts (and of NPI licensing in questions more generally), extending Chierchia's exhaustification-based approach. For her, question-embedding predicates semantically subcategorize for either weakly or strongly exhaustive questions. Unlike weakly exhaustive questions, strongly exhaustive questions have a null *only* operator adjoined at the level of the question nucleus, which associates with the trace of the *wh*-phrase. The result is that NPIs are acceptable only in strongly exhaustive questions because in these cases the question nucleus creates a Strawson-DE environment.[34] In other words, Nicolae's is a unified approach to NPI licensing in declaratives and questions: in either case, licensing is satisfied via O-exhaustification.

Given that there is a single NPI *any* that is licensed the same way in declaratives and questions (i.e. via exhaustification of subdomain alternatives), this analysis gives rise to the prediction that once children acquire the semantics of *any*, they should be able to use *any* in both declaratives and questions.[35] Let us see if this prediction is borne out.

There are, to my knowledge, only two previously reported acquisition studies of NPIs in questions, one of which we reviewed in Chapter 3. Thornton (1995) examined children's comprehension of *any* in questions and found adult-like comprehension by the age of 3;06. In Tieu (2010), I examined children's spontaneous production of *any* and provided evidence for the concurrent emergence of *any* in declaratives and questions. Of the 40 children I examined, four produced at least 15 instances of NPI *any* in questions and at least 15 instances of NPI *any* in declaratives. For these four children, there was no statistically significant chronological gap between the onset of *any* in one environment and the onset of *any* in the other (by Binomial Test). The chronological gap between the onset of *any* in the two constructions is consistent with concurrent emergence, suggesting that once the children know how to use *any* in one environment (e.g., in declaratives), they also know how to use it in the other (e.g., in interrogatives).

One final thing to note is that it may not be surprising that children catch onto licensing in questions; a look at samples of parental input reveals that children get fairly robust evidence that *any* can be licensed in

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[34] The licensing is therefore parallel to the case of NPIs licensed by the overt *only* in declaratives, as in *Only John ate anything*.

[35] A prerequisite of course is that the children must also have interrogative structures and semantics in place.

questions. Besides sentential negation in declaratives, the next largest proportion of NPI *any* involves licensing in questions:

Table 5. NPI *any* in the input				
Corpus	Total utterances	Total NPI *any*	Licensing by sentential negation	Licensing in questions
Kuczaj (Abe's father)	12,753	125 (=.98% of all utterances)	81 (=64.8% of all NPI *any*)	38 (=30.4% of all NPI *any*)
Lara (Lara's mother)	78,701	423 (=.54% of all utterances)	342 (=80.85% of all NPI *any*)	69 (=16.31% of all NPI *any*)

In sum, children's acquisition of *any* is consistent with a unified treatment of licensing in both declaratives and questions.

6. Conclusion

This dissertation has examined the acquisition of a particular PSI, namely *any*. Chapter 2 began the dissertation by identifying the target set of knowledge underlying *any*, including both structural and semantic kinds of information. Chapter 3 argued that previous studies targeted only one half of the story. The experiments presented in Chapters 3 and 4 presented the other half of the story: children in fact can be shown to demonstrate incredibly sophisticated semantic knowledge of polarity sensitivity. The sophistication of their knowledge is made all the more remarkable when we consider the (paucity of the) evidence that is available to them in the input. While children receive positive evidence for *any*'s restricted distribution, they do not receive evidence for a number of semantic properties and mechanisms that are part and parcel of the polarity sensitivity system: activation of subdomain alternatives, exhaustification of alternatives, and contrastive focus. Chapter 5 identified the starkness of the learning problem through an examination of parental speech samples, and then proposed one way that children could, despite absence of direct evidence for these semantic mechanisms in the input, nevertheless arrive at the target grammar. By expanding our view beyond any

single PSI, to more generally consider polarity sensitivity as a complex system derivable from a finite set of lexical parameters, we can capture not only variation within the polarity sensitivity system (as well as cross-linguistic variation), I argue we can also explain the learnability of PSIs.

More generally speaking, when considering the acquisition of semantics, one may have the perhaps naïve impression that in this domain (i.e. the domain of meaning, as opposed to syntax), children might be able to depend more heavily, or more exclusively on evidence in the input. After all, how can the child come to know the meaning of any word without hearing it in use, in appropriate contexts? But ultimately the data reviewed and presented in this dissertation lead us to the conclusion that in fact the context may not be sufficient at all, for many aspects of semantics. It is my hope that I have provided some compelling evidence that the input is simply not rich enough to derive all the semantic knowledge of polarity sensitivity that children can be shown to have. Even in the acquisition of semantics, we need to assume some innate machinery, which can generate an accordingly constrained space of possible hypotheses for the learner to entertain. At the same time, as I have tried to elaborate on in Sections 3 and 4, there is learning involved, and much work needs to be done in order to better understand the process by which this learning takes place. In the case of polarity sensitivity, I have suggested that the learner must be keyed to certain properties and distributional patterns in the input. It is by identifying signature patterns of distribution in the input that the learner can map a superficial string to an underlying category, given a sufficiently constrained hypothesis space.

To conclude, this dissertation has taken as its target of study the acquisition of the semantics of a particular PSI, i.e. *any*, in a particular language, i.e. English. But the proposal we have put forth should be able to be extended to the development and acquisition of other PSIs, in other languages, given the theoretical tools provided within an analysis such as Chierchia (2013). Although I have tried to be very precise in my object of study, what we have ultimately examined is how children acquire some very complex, sophisticated semantic knowledge concerning a rather complex system. The polarity sensitivity system is one that blurs the line between grammar and logic, and in choosing to focus on the development of a particular PSI, it is my hope that this study has more generally furthered our understanding of how children acquire logic within the grammar.

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