Choice Functions & Binder Roof Constraint

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1. Introduction

Across languages, indefinites have been shown to differ from genuine quantificational expressions in their scopal behavior. While scope of quantificational expressions obey island constraints, the upward scope of indefinites is insensitive to island boundaries. This exceptional scope property of indefinites has led to approaches that take them to be inherently different from generalized quantifiers. There are two main approaches within this group to explain the exceptional scope of indefinites: (i) movement-based approaches, which posit that indefinites have access to special movement-based scope taking mechanisms, unavailable to generalized quantifiers (Charlow 2014, 2020, Demirok 2019), and (ii) in-situ approaches, which posit that indefinites do not depend on syntactic movement in order to take scope (Reinhart 1997, Winter 1997, Kratzer 1998, Brasoveanu & Farkas 2011).

The bare bone of in-situ approaches to the scope of indefinites is the idea that the existential quantification and the descriptive content of indefinites are syntactically separated. Under in-situ approaches, indefinites are taken to only contribute some kind of variable. The existential power of indefinites is then attributed to the freely available existential closure mechanism (Abusch 1993, Reinhart 1997, Winter 1997, Jäger 2007, Onea 2015).

Since in-situ theories posit no limitation on the upward scope of indefinites, it has been widely argued that they overgenerate. It has been shown that an indefinite cannot scope over a quantifier that binds into its restrictor. This limitation on the scope of indefinites, which Brasoveanu & Farkas 2011 dub as the Binder Roof Constraint, has resulted in accounts that completely rule out wide scope readings of indefinites over operators that bind into them. The problem with such accounts, however, is that it has been cross-linguistically reported that not all indefinites are subject to the Binder Roof Constraint. A well-attested group of indefinites do in fact exhibit an unlimited scopal property, just as in-situ theories predict. A successful account of indefinites thus needs to distinguish between the two kinds of indefinites (Schwarz 2001, 2011). In light of the difficulties to find a unified account of indefinites' exceptional scope properties, it has been argued that multiple scope mechanisms are needed to account for the diversity of indefinite expressions.

Focusing on the distribution of *'a/some'* and *'a certain'* indefinites in English, this paper argues for a unified in-situ mechanism for both kinds of indefinites. I propose an account that separates the functional dependency between DPs from the semantics of determiners. I will formulate this idea within a choice functional treatment of indefinites but I believe that this proposal can be incorporated in other in-situ accounts as well. I show that this solution avoids generating unattested readings for (Binder Roof Constraint). The advantage of this analysis is that it relies on familiar and independently needed mechanisms. Thus, no new machinery is introduced to the syntax or semantics for the sole purpose of solving the overgeneration problem for the in-situ accounts of indefinites. I attribute the difference between the two kinds of indefinites with respect to the Binder Roof Constraint to the espistemic contribution of the NP determiner *'certain'*. Finally, I argue that the analysis provided in this paper makes a novel typological prediction about the correlation between the espistemic status of indefinites determines whether or not they are subject to the Binder Roof Constraint.

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2. Choice functions & the overgeneration problem

An influential in-situ account posits that indefinites denote a variable over choice functions (Reinhart 1997, Winter 1997, Kratzer 1998, Matthewson 1999, Steedman 2012). A *choice function* is a function that maps any non-empty set onto an element of that set. Put it formally, it is a function of type $\langle\langle e,t\rangle, e\rangle$, which applies to the property denoted by the nominal predicate of type $\langle e,t\rangle$ and returns an individual of type e that has that property. Choice functional accounts of indefinites diverge when it comes to how this choice function variable takes its value. According to Reinhart 1997 and Winter 1997, the choice function variable introduced by the indefinite can be bound by a freely available existential closure. Since the existential closure can appear at any level, this analysis predicts that an indefinite may have narrow, intermediate, or wide scope with no sensitivity to scope islands. Kratzer 1998, in contrast, takes choice function variables to be free variables whose values are determined in the context. Under Kratzer's indexical treatment of choice functions, the intermediate readings of indefinites are generated via the mechanism of *Skolemization*, which parameterizes choice functions with an individual argument. *Skolemized choice functions* are choice functions with an additional individual argument, which in effect yields different choice functions depending on the value of the individual argument.

Choice functional analyses have been successful in accounting for the exceptional wide scope of indefinites as well as in deriving the functional interpretation of indefinites. Since like other in-situ accounts, there is no limitation on the exceptional upward scope of indefinites under the choice functional analyses, it has been shown that they generate unattested readings irrespective of whether the choice functional variable is existentially closed or remains free (Chierchia 2001, Schwarz 2001). Brasoveanu & Farkas 2011 dub a general form of the overgeneration problem for in-situ accounts of indefinites *Binder Roof Constraint*, and describe it as following: an indefinite cannot scope over a quantifier that binds into its restrictor. This restriction on the scope of indefinites, however, only really persists in downward entailing (DE) contexts (Schwarz 2011). To see why this problem arises, consider (1) in the following scenario: Sue wrote two papers SP=$\{S_1,S_2\}$ but only submitted S_1, and Mary wrote two papers MP=$\{M_1,M_2\}$ but only submitted M_2.

(1) No candidate$_1$ submitted *a* paper they$_1$ had written. (Schwarz 2001)

This sentence is judged false in this scenario. Under choice functional analyses, however, the sentence (1) can be assigned an LF whose corresponding truth-conditions are verified in the given scenario. We will have the LF given in (2-a) if we assume an existential closure over choice functions, and the LF in (2-b) if we adopt Kratzer's free Skolemized choice functions. Both of these LFs roughly convey that there is a way of choosing papers, such that no candidate submitted the paper that is selected for them. As such a method of picking is in fact available, namely a function that picks S_2 for Sue, and M_1 for Mary, choice functional analyses wrongly predict that the sentence (1) should be true in the scenario described above.

(2) a. $\exists f$[No candidate λ_1[t_1 submitted f [paper they$_1$ had written.]]]
b. No candidate λ_1[t_1 submitted $f(1)$ [paper they$_1$ had written.]]

Given the unavailability of this construal, there have been several attempts, both within in-situ and movement theories of indefinites, to rule out such readings (Brasoveanu & Farkas 2011, Onea 2015, Charlow 2020). The problem with such accounts, however, is that they are often too successful in doing so. There are indefinite expressions that are not subject to the Binder Roof Constraint. Schwarz 2001, 2011 and Kratzer 2003 show that a corresponding sentence containing *a certain* indefinites does in fact have the reading (1) lacks. The sentence (3) is judged true in the scenario described above.

(3) No candidate$_1$ submitted *a certain* paper they$_1$ had written.

The cross-linguistic studies on the scopal properties of indefinites have also revealed that many languages have indefinite expressions that pattern with English *a certain* indefinites in their ability to give rise to the wide scope reading over an operator that binds into their restrictor (e.g. Farsi (Mirrazi 2023), Ga (Renans 2018), Kipsigis (Bossi 2023), Tiwa (Dawson 2020), Russian (Martí & Ionin 2018)). This is problematic for accounts that completely rule out violations of the Binder Roof Constraint. They undergenerate attested readings of a well-attested group of indefinites. I conclude with Schwarz 2001, 2011

that a successful account of indefinites needs to distinguish between two kinds of indefinite expressions: indefinites that are subject to the Binder Roof Constraint (*a*-type indefinites), and those that are not (*a certain*-type indefinites).

Crucially, despite the difference in obeying the Binding Roof Constraint, the two kinds of indefinites share the exceptional scope taking property. For instance, both indefinite expressions *a relative* and *a certain relative* can escape the relative clause island and be interpreted as scoping under *every linguist*. This construal roughly conveys that the problem for which every solution is studied can vary for each linguist.

(4) Every linguist studied every solution that a (certain) problem that intrigued them might have.

A successful theory of indefinites should ideally give a unified account of this common property, and derive (or be at least compatible with) the differences between the two types of indefinites (Chierchia 2005). Our theoretical options to fulfill these desiderata are very limited. The recent movement accounts that efficiently derive the exceptional scope of indefinites make it impossible for an operator to bind into an indefinite that scopes over it (Charlow 2014, 2020, to appear), thus cannot be generalized into a unified account of indefinites (see also Mirrazi 2023 for more arguments from cross-linguistic variations in the intensional properties of indefinites). The same problem afflicts in-situ accounts that rule out any violations of the Binder Roof Constraint (Brasoveanu & Farkas 2011, Onea 2015). The existing attempts to save the choice functional accounts have been argued to be unexplanatory as they rely on stipulative constraints on the existential closure over choice functional variables in the presence of an operator that binds into the restrictor of an indefinite. These constraints either make reference to the monotonicity of such an operator (Schwarz 2001, 2011), or restrict the syntactic position of the existential closure with respect to it (Chierchia 2001, 2005). In light of the difficulties in finding such a unified account, it has been argued that multiple scope mechanisms are needed to account for the diversity of indefinite expressions. I believe that it is too soon to give up on a unified account of indefinites.

3. An overview of the proposal

My goal in this section is to provide a unified account of indefinites that can in principle generate wide scope readings over an operator that binds into the indefinite's restrictor, while also explaining the unavailability of such readings in certain environments. I propose a new formalization of Skolemization that incorporates the important insight from Solomon 2011 that functional interpretations are not inherent in the semantics of indefinites. Rather, as Solomon 2011 argues, functional interpretations arise when sentences containing an indefinite have functional witnesses. "This is the semantic content of Skolemization that is lost in on Skolemized choice function approach" (Solomon 2011), and that has been integrated back into the semantics of Skolemization in my proposal. [1] Under this new account, indefinites make a uniform semantic contribution, and Skolemization is reformulated as a more familiar, independently needed Partee type-shifting mechanism.

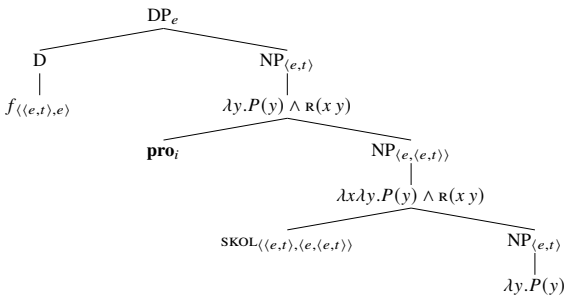
I take indefinite determiners to uniformly denote variables over choice functions. That is, they are type rigid $\langle\langle e,t\rangle, e\rangle$ functions. Following Matthewson 1999, I postulate that the choice functional variables introduced by the indefinite determiner is existentially closed in the topmost level of the derivation. To overcome the problems mentioned for choice functional accounts, I propose a new formalization of Skolemization that divorces functional dependencies between DPs from the semantic content of indefinite determiners. I posit that functional dependencies between a DP and a higher quantifier are built in the NP level via a type-shifter that I call SKOL. This type-shifter introduces a functional dependency by shifting a $\langle e,t\rangle$-type noun to an $\langle e,\langle e,t\rangle\rangle$-type noun. As a result, a *functional* variable R, and an individual variable are introduced. R is a free variable that receives a denotation from the context of utterance (à la Kratzer 2003's contextualist account). The type e variable pro_i (where i is an index) is bound in the larger structure, thus its value systematically co-varies with the values of other co-indexed variables in the sentence.

(5) $[\![\text{SKOL } P]\!] = \lambda x\,.\,\lambda y\,.\,[\,P(y) \wedge \text{R}(x,y)]$, where R is a function.

[1] I thank an anonymous reviewer who brought to my attention the connection between my proposal and Solomon's view on Skolemization.

The choice function f denoted by the indefinite determiner takes this function as argument, and chooses a unique witness for each value of the individual variable. Notice that at this point of derivation, the NP is of type $\langle e, t\rangle$ again, as it has been fed a bound pronoun pro_i.

(6)



This modification to how dependencies between an indefinite expression and another c-commanding DP come about has major consequences. Firstly, shifting an NP to a functional noun restricts the domain of the choice function to the elements in the characteristic set of NP that are related to some x_i via the functional variable R. The argument of this choice function is a function that outputs a unique value for each value of the individual variable. This in effect makes the choice function pick from a singleton set (See also (Schwarzschild 2002) for an analysis of indefinites as existential quantifiers which can be implicitly restricted to a singleton set).

How does the free functional variable take its value? The basic idea is that it is like other referential pronouns. Thus, it requires a context that provides a salient function R about which the common ground entails that R outputs a unique value for every given individual variable within its domain, which in turn, is determined by the domain of a higher quantifier that binds this variable. Let us call this requirement *salience presupposition*. Salience implies *existence*. That is, the free functional variable presupposes that there is a discourse referent with which it can be identified. The question is what counts as a salient referent for the functional variable. It seems that the salience of a suitable referent for the functional variable R is highly sensitive to the linguistic information directly given by the sentence in which the indefinite appears. Framing this notion of salience in the discourse representation will have to be left for the future research. In the context of this brief paper, I will treat it as a descriptive fact.

It has been argued that referential pronouns, and by extension free variables, impose a Strong Contextual Felicity (SFC) constraint , which is the requirement that the trigger can be used felicitously only if the implication associated with the trigger is established in the utterance context (Tonhauser et al. 2013, Beaver & von Fintel 2013, and King 2018, among others). SFC constraints cannot be easily accommodated. In the next section, I will demonstrate that the new formalization of Skolemization, together with the SFC requirement on the referent of R and the unavailability of accommodation thereof, derives the Binder Roof Constraint in DE contexts. Why is violation of the Binder Roof Constraint allowed in case of *a certain-type* indefinites? I propose that the difference between the two kinds of indefinites is whether or not (or how easily) the presuppositions of a free functional variable in their scope can be accommodated. I will show that accommodating the existence of a referent for the functional variable R is enough to generate the wide scope reading of an indefinite over an operator that binds into its restrictor. A major advantage of encoding the difference between the two types of indefinites in pragmatic component of functional interpretations at the NP level is that we can maintain a uniform semantics for both.

What accounts for the difference between the two types of indefinites in the availability of the accommodation strategy? It is useful here to recall a general point about presupposition accommodation: "presupposition Accommodation depends on the hearers trusting that the speaker knows whereof she is speaking"(von Fintel 2008). If accommodation is generally dependent on *speaker's knowledge*, then it is not so puzzling that the presence of the NP modifier "*certain*" which in its basic meaning overtly signals speaker's commitment makes accommodation possible. This way of characterizing the difference between the two types of indefinites makes a novel typological prediction that epistemically specific indefinites should ease presupposition accommodation, and thus allow for violations of the Binder Roof Constraint. While further research is necessary, the available cross-linguistic data appear to confirm this prediction.

In the next section, I will illustrate with data that this proposal not only derives the Binder Roof

Constraint but it also provides an explanation of why it does not hold across the board.

4. Deriving the Binder Roof Constraint & Its Violations

To see how this proposal works, let us discuss how the intermediate scope of the indefinite expression *some teacher* in (7-a) is derived.[2] Our analysis assigns the LF in (7-b) to this sentence. This LF contains a free functional variable ʀ. We have stated earlier that the linguistic context in which the indefinite expression appears should provide a salient referent for ʀ. In (7-a), for instance, an ʀ that maps every student x to a teacher z who the student x *read* every book *praised by* z is computable from the composition of the existing relations *read* and *praised-by*.

(7) *Context: Smith and Baker are the teachers, both Sue and Mary (the students) read every book Smith praised, but only Sue read every book Baker praised.*

a. Every student read every book praised by some teacher.

b. $\exists f \forall x$ [Student(**x**) $\rightarrow \forall y$ [book (y) $\wedge$ **praised-by**$_2$ (y,$f(\lambda z.teacher(z) \wedge$ʀ(**x**, z))) $\rightarrow$ **Read**$_1$(**x**, y)]]
The referent of R in the linguistic context: R(x,teacher) $\subseteq$ R(y, teacher) $\circ$ R(x,y)

Our analysis assigns the same LF (7-b) to a corresponding sentence containing "*a certain*", given in (8). The presence of the NP modifier "*certain*" makes the accommodation strategy, which is otherwise unavailable, possible. It is important to note that only the existence presupposition is accommodated. Salience presuppositions cannot be accommodated (Tonhauser et al. 2013, Göbel 2022, among others).[3]

(8) Every student read every book praised by a certain teacher.
R is locally accommodated.

We can now go back to DE contexts where we can examine the Binder Roof constraint. Consider again the sentences (1) and (3), repeated here as (9-a) and (9-b) in the same scenario: Sue wrote two papers SP=$\{S_1,S_2\}$ but only submitted S_1, and Mary wrote two papers MP=$\{M_1,M_2\}$ but only submitted M_2. We saw earlier that without a further constraint, both of these sentences can be assigned an LF which wrongly predicts both (9-a) and (9-b) can be true in this scenario. However, only (9-b) is true in the given scenario.

(9) a. No candidate$_1$ submitted *a* paper they$_1$ had written.

b. No candidate$_1$ submitted *a certain* paper they$_1$ had written.

Recall that the source of this over-generation problem is the existence of a random function that picks S_2 for Sue, and M_1 for Mary. Let us call this function B. Our proposal immediately solves this problem by making random mappings unsuitable to serve as the referent of the free functional variable r. Let us see how. Both (9-a) and (9-b) will have the LF given in (10) under this account.

(10) $\exists f$[No candidate(**x**) λ_1[t$_1$ submitted f [λz.paper(z)$\wedge$ʀ(**x**, z)$\wedge$write(**x**, z)]]]

Our account predicts that if a suitable referent for r is salient, or its existence can be accommodated, then we can get the wide scope reading, otherwise, we only get the narrow scope. The sentence containing *a certain* indefinite in (9-b) is predicted to be true in this scenario, as the existence of a function, B for instance, can be accommodated. The sentence (9-a), on the other hand, is only predicted to be true if B is a salient referent for r in linguistic context. Which functions are salient? The *write*-relation between students and one of their papers is not a function. Under a functional interpretation of *write*, the candidates are mapped to the plural entity consisting of papers they wrote, R=$\{\langle Sue, S_1 \oplus S_2\rangle, \langle Mary, M_1 \oplus M_2\rangle\}$. But the output of the choice function which takes this ʀ as argument does not verify (10). Therefore, the sentence is correctly predicted to be false in the scenario.

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[2] Following Kratzer 1998, Winter 2004, and Schlenker 2006, I take all intermediate readings of indefinites to be functional construals.

[3] In accordance with the contextualist account of Kratzer 2003, this implies that the speaker has a particular function that maps teachers to students in mind.

If the linguistic context provides a suitable referent for R, the sentence becomes acceptable. Assume Sue and Mary disliked the papers that they didn't submit.(11-a) is judged true, as predicted.

(11) a. No candidate$_1$ submitted **a** paper they$_1$ wrote but disliked.
b. $\exists f$[No candidate(**x**) λ_1[t$_1$ submitted f [λz.paper(z)$\wedge$R(**x**, z)$\wedge$write(**x**, z)$\wedge$dislike(**x**, z)]]]

It is important to note that what counts as salience in the linguistic context appears to be solely determined by the information provided by the sentence within which the indefinite appears. For instance, although the antecedent of the conditional in (12) also mentions the function *dislike*, the unacceptability of (12) shows that it is not accessible as the referent of R in the consequent.[4]

(12) # If Mary and Sue each submitted their syntax papers that they liked but not their phonology papers that they disliked and no one else submitted anything, then no student submitted a paper of hers.

Let us work through another example. Consider (13-a) and (13-b), in the following scenario: Smith and Baker are the teachers, both Sue and Mary (the students) read every book Smith praised, but only Sue read every book Baker praised. (13-a) and (13-b) are predicted to be true in this context by previous choice functional accounts, as they are assigned a meaning that roughly says that there's a way of choosing among teachers such that not every student read every book praised by the teacher that is selected for them, namely a function that picks Smith for Sue, and Baker for Mary (the function C). But only (13-b) is judged true. (13-a) is false in this scenario.

(13) a. Not every student read every book *some* teacher had praised.
b. Not every student read every book *a certain* teacher had praised.

Under our approach, both (13-a) and (13-b) are assigned the LF in (14), where the restriction of f is narrowed to only those teachers that have been mapped by R to a student.

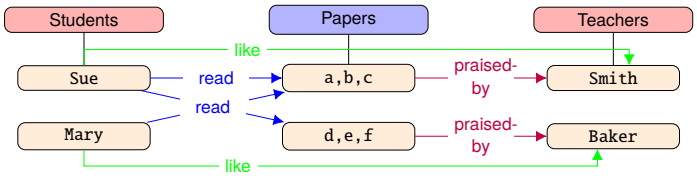
(14) $\exists f \neg\forall$x [Student(**x**) $\rightarrow \forall$y [book (y) $\wedge$ **praised-by**$_2$ (y, f(λ z.teacher(z) $\wedge$R(**x**, z))) $\rightarrow$ **Read**$_1$(**x**, y)]]

The sentence (13-b) is predicted to be true, as the existence of a referent for R can be accommodated. The sentence (13-a), on the other hand, is only predicted to be true if R has a referent in the linguistic context. Computing R(x,teacher) $\subseteq$ R$_{praised-by}$(y, teacher) $\circ$ R$_{read}$(x,y) from the information in the linguistic context, there are two possible functions that can serve as a referent for R:

(15) R$_1$=$\{\langle Sue, Smith\rangle, \langle Mary, Smith\rangle\}$ R$_2$=$\{\langle Sue, Baker\rangle, \langle Mary, Smith\rangle\}$

None of these options verifies (14). Thus, the sentence containing *some* indefinite (13-a) is correctly predicted to be false by this approach. If the linguistic context provides a suitable referent for R, sentences containing *some* indefinites are also predicted to render a functional reading. This prediction seems to be borne out. In the same scenario, further assume that Sue likes Smith and Mary likes Baker. (16-a) is judged true in this context, as predicted.

(16) a. Not every student$_i$ read every book **some** teacher they$_i$ like had praised.
b. $\exists f \neg\forall$x [Student(**x**) $\rightarrow \forall$y [book (y) $\wedge$ **praised-by**$_2$ (y, f(λ z.teacher(z) $\wedge$R(**x**, z)$\wedge$ like(**x**, z))) $\rightarrow$ **Read**$_1$(**x**, y)]]



In sum, I have argued that a modification to the formalization of functional interpretations can re-establish the choice functional account as a serious candidate for a uniform model of the semantics of

[4] I thank Clemens Steiner-Mayr for bringing this to my attention.

indefinites. This proposal derives the Binder Roof Constraint in cases where there is no suitable referent for the functional variable R introduced by Skolemization and the indefinite determiner that has R in its scope does not facilitate accommodation. The difference between the two kinds of indefinites with respect to the Binder Roof Constraint is thus reduced to the (un)availability of accommodation. Since this proposal makes a link between the availability of accommodation strategy and the assertion of speaker's knowledge, it predicts that epistemically specific indefinites are not subject to the Binder Roof Constraint. The next section briefly discusses this prediction.

5. Implications for cross-linguistic variation

Dawson 2020 and Bossi 2023, who respectively investigate properties of indefinites in Tiwa and Kipsigis, suggest that there is a link between the epistemic status of indefinites and their exceptional scope taking properties. They propose different characterizations of such a relation, but both are concerned with the relation between higher order ignorance and exceptional wide scope. The proposal laid out in this paper provides new insight on the relation between the epistemic status of indefinites and their scope properties. The wide scope of epistemically specific indefinites that signify speaker's knowledge is predicted to be unrestricted with no sensitivity to the Binder Roof Constraint. This prediction is borne out for English *a certain* and Russian *koe* (Martí & Ionin 2018). It is important to note that this correlation is only predicted for indefinite determiners that *semantically* encode speaker's knowledge. My proposal is silent about cases where the epistemic specificity arises pragmatically. However, it can shed light on a typological gap observed by Bossi 2023: there seems to be no epistemic indefinite that conveys purely first order ignorance but takes unrestricted exceptional wide scope.

Katzir & Singh 2013 observe that ignorance inferences block presupposition accommodation. They explain that this is because the accommodation suggests that the speaker believes this proposition, a suggestion that conflicts with the ignorance inference. Since under the present account, the accommodation is necessary for unrestricted wide scope readings of indefinites with no sensitivity to the Binder Roof Constraint, we expect indefinite determiners that *semantically* encode ignorance to be subject to the Binder Roof Constraint. Again, This prediction does not extend to cases of pragmatically derived ignorance. More cross-linguistic research that systematically studies scopal and epistemic properties of indefinites is needed to determine the the validity of this typological prediction.

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