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Two Types of Choice-Functional Indefinites: Evidence from Ga (Kwa)

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Abstract There is a longstanding discussion whether wide-scope indefinites denote choice functions that are existentially bound (Matthewson 1999; Reinhart 1997; Winter 1997) or remain free (Kratzer 1998). Data from Ga, an under-researched language spoken in Ghana, show that there are (i) wide-scope indefinites denoting existentially bound skolemized choice functions whose parameter is bound by a higher quantificational NP, (ii) free skolemized choice functions with the speaker or a higher quantificational NP as a parameter, and (iii) narrow scope quantificational indefinites. Thus the data show that both existentially bound and free skolemized choice functions are attested in natural language shedding new light on the semantics of indefinites.

Keywords Indefinites · Choice functions · Ga (Kwa) language

1 Introduction

In the history of formal semantics, indefinites, whose small subset is exemplified in (1), have obtained many different analyses, e.g., Barwise and Cooper (1981), Heim (1982), Heim and Kratzer (1998), Kamp and Reyle (1993), Montague (1973).

(1)   Kofi read **a/some/one** book.

Recently indefinites have been analyzed as denoting choice functions, i.e., functions from sets of individuals that pick a unique individual from any non-empty set in its domain (Kratzer 1998).[1] The main controversy in a choice-functional analysis of indefinites is whether they are existentially bound (Reinhart 1997; Winter 1997) or remain free (Kratzer 1998).[2] In this paper, I argue that both free and existentially bound (skolemized) choice functions are attested in natural language, shedding new light on the semantics of indefinites in a cross-linguistic perspective.

The empirical focus of this paper is put on two indefinite determiners in Ga, i.e., *ko* and *kome*, which show non-homogeneous scopal properties with respect to negation and quantifiers. Based on these properties, I argue that *ko* denotes an existentially bound skolemized choice function whose parameter is bound by a higher quantificational NP, if available, and *kome* denotes a free skolemized choice function, whose parameter can be bound either by the speaker or a higher quantificational NP. The structure of this paper is as follows. In Sect. 2, I provide evidence that *ko* and *kome* are interpreted as indefinites and I illustrate their scopal properties. Subsequently, Sect. 3 presents the analysis of *ko* and *kome* as denoting different kinds of choice functions. Importantly, I also discuss their scopal behavior in downward entailing contexts, which were argued to be problematic for the analysis of indefinites as denoting existentially bound choice functions at the widest scope level (Chierchia 2001, Schwarz 2001, 2011). Section 4 identifies directions for future research and Sect. 5 concludes.

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[1] For a recent non-choice-functional analysis of indefinites, see for example Brasoveanu and Farkas (2011).

[2] For a discussion of problems of both types of analyses, see Chierchia (2001) and Schwarz (2001, 2011).

2 Indefinites in Ga

Ga is an under-researched Ghanaian language spoken in The Greater Accra Region by ca. 745,000 speakers. It is an SVO language with two tones: high and low. All the data stem from the author's original fieldwork in Accra in 2014 and 2016 with four Ga native speakers using the semantic field research methodologies presented in Matthewson (2004). All the language consultants grew up in a Ga speaking community and they speak Ga at home. The language consultants were students at the time of conducting the fieldwork. None of them has a background in linguistics.

2.1 *Ko*, and *Kome* are Indefinites

Before I discuss the scopal properties of *ko*, and *kome*, let me first provide empirical evidence that they are indeed indefinites.[3] Below, I present the results of applying some diagnostics for detecting indefinites, whose design is based on the tests presented in Matthewson (1999).

The results of the diagnostic demonstrated in (2) show that *NP ko* and *NP kome*, as English indefinite NPs, can refer to two different discourse referents in a sentence. By contrast, if they were definite, they would refer to the same entities in both clauses leading to a pragmatically odd structure:[4]

(2) context: Shikatoohe   **ko/kome** yε   Osu...
                   bank   INDF/INDF   be.at   Osu
                   'A bank is in Osu...'
    ...ni shikatoohe   **ko/kome**   yε   Jamestown.
    and bank   INDF/INDF   be.at   Jamestown
    '...and a bank is in Jamestown.'
    #'The bank is in Osu and the bank is in Jamestown.'

Further, it turns out that unlike definite determiners, *ko* and *kome* can be used in contexts in which the discourse referent is not unique, as illustrated in (3):

(3) context: There is a tree outside the window. There are three
        birds on the tree.
    Gbekε   biihii   lε   fεε   na   looflo   **ko/kome**.
    child   boys   DET   ALL   see   bird   INDF/INDF
    'All the boys saw a bird.'
    #'All the boys saw the bird.'

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[3] Note that also bare NPs in Ga can obtain an indefinite interpretation. However, since a precise account of their semantics goes beyond the scope of this paper, I am leaving it for another occasion.

[4] The glosses used in this paper are as follows: INDF = indefinite; DET = determiner; SG = singular; PL = plural; 3 = Third person; PRT = particle; NEG = negation; REL = relativizer; PFV = perfective; PROSP = prospective. An example marked with '#' means that the example was judged to be unacceptable in the given context and I hypothesize that it is for semantic or pragmatic reasons. Examples without any diacritics were judged as acceptable in the given context.

Finally, the test illustrated in (4) is based on the observation that NPs associated with the *wh*-remnant in sluicing constructions cannot be definite [see Matthewson (1999) and references there]. The fact that *ko* and *kome* are acceptable in sluicing constructions suggest that they are indefinites.

(4) John mii-tawo   wolo   **ko/kome**, shi mi-le   tenoniji.
    John PROG-look.for book   INDF/INDF   but 1SG-not.   which
                                                   know
    'John is looking for a book but I do not know which.'
    #'John is looking for the book but I do not know which.'

2.2 *Ko*, *Kome* are Singular Indefinites

Both *ko* and *kome* are singular indefinites. *Kome* derives from *ekome* 'one' and the cardinality one forms part of its meaning. This claim is based on the data presented in (5)–(7), which show that *kome* can only combine with singular count nouns:

(5) SINGULAR COUNT NOUN:
    Q: What did Kofi buy yesterday?
    A: Kofi he   adafitswawolo   kome   nyε.
        Kofi buy   newspaper   INDF   yesterday
        'Kofi bought (one) newspaper yesterday.'

(6) PLURAL COUNT NOUN:
    Q: What did Kofi buy yesterday?
    A: #Kofi he   adafitswawo-ji   kome   nyε.
        Kofi buy   newspaper-PL   INDF   yesterday
        'Kofi bought one newspapers yesterday.'

(7) MASS NOUN:
    Q: What did Lisa buy yesterday?
    A: #Lisa he   fɔ   kome   nyε.
        Lisa buy   oil   INDF   yesterday
        'Lisa bought (one) oil yesterday.'

Also *ko* combines with singular count nouns but not with plural count nouns, as shown below:

(8) SINGULAR COUNT NOUN:
    Q: What did Kofi buy yesterday?
    A: Kofi he   adafitswawolo   ko   nyε.
        Kofi buy   newspaper   INDF   yesterday
        'Kofi bought (one) newspaper yesterday.'

(9) PLURAL COUNT NOUN:
    Q: What did Kofi buy yesterday?
    B: #Kofi he   adafitswawo-ji   kome   nyε.
        Kofi buy   newspaper-PL   INDF   yesterday
        'Kofi bought one newspapers yesterday.'

However, the data with mass nouns are more complicated. It seems that in general *ko* cannot combine with mass nouns. However, if one has in mind a particular type or brand of the given NP, *ko* becomes acceptable. By way of illustration consider (10):

(10) MASS NOUNS:

Q: What did Lisa buy yesterday?

A: #Lisa he   fɔ   ko   nyɛ.
   Lisa   buy oil INDF yesterday
   'Lisa bought (one) oil yesterday.'

B: #Lisa he   abele ko   nyɛ.
   Lisa   buy corn   INDF yesterday
   'Lisa bought (one) corn yesterday.'

In the case of (10-A) the language consultants gave a comment that it is acceptable if one refers to the particular type of oil. The same holds for (10-B). It is fine if one talks about the particular type of corn but not if one talks about corn in general. This issue should be further examined empirically in order to determine whether it is or it is not another dimension, in addition to the differences in the scopal properties of *ko* and *kome* discussed in the next subsection, in which the semantics of both indefinites differ.[5]

2.3 Scopal Properties of *Ko* and *Kome*

Interestingly, *ko*, and *kome* exhibit non-homogeneous scopal properties with respect to various operators, e.g., negation and quantifiers.[6] First, it turns out that whereas *ko* can take both wide and narrow scope with respect to negation, *kome* can only take a wide scope. Consider (11). Since the context specifies that Kofi bought a lot of fish, it clashes with the narrow-scope interpretation which would lead to the meaning that Kofi didn't buy any fish.

(11) WIDE-SCOPE INTERPRETATION

context: Kofi bought a lot of fish, but

E-he-ko   loo   **ko/kome**
3SG-buy-PFV.NEG   fish INDF/INDF
'He didn't buy a certain fish.'

The context in (12), on the other hand, requires a narrow-scope interpretation. Since the context directly specifies that Kofi didn't buy any fish, a wide scope interpretation which says that Kofi didn't buy a certain fish is ruled-out.

(12) NARROW-SCOPE INTERPRETATION

context: Kofi went to the market yesterday. He bought vegetables, shoes, and toys but he didn't buy any fish.

Kofi he-ko   loo   **ko/#kome**.
Kofi buy-PFV.NEG   fish INDF/INDF
'Kofi didn't buy any fish.'

Second, whereas *kome* can obtain both a constant and a covarying interpretation with respect to quantifiers, as suggested by its acceptability in the context of (13) and (14), *ko* can only get a covarying interpretation, as suggested by their acceptability in the context of (14) and its unacceptability in the context of (13). The context in (13) specifies that all women were reading the same book and thus only a constant interpretation of the indefinite NP 'a book' is felicitous in this context. By contrast, the context in (14) states that every woman read a different book and therefore only a covarying interpretation of the indefinite is felicitous in this context.[7]

(13) CONSTANT INTERPRETATION

context: There were four women in the library. It looked really funny because all of them were reading one book.

Yei   lɛ   fɛɛ   kane wolo **#ko/kome**.
women DET every read book INDF/INDF
'Every woman read some book.'

(14) COVARYING INTERPRETATION

context: When I came to the library yesterday, four women were reading a book. Each of them was reading a different book.

Yei   lɛ   fɛɛ   kane wolo **ko/kome**.
women DET every read book INDF/INDF
'Every woman read some book.'

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[5] Another question is whether *ko* and *kome* also differ along other dimensions, such as existence, indifference, ignorance implications, epistemic specificity, etc. To check it, one should examine whether the minimal pairs with *ko* and *kome* which exhibit the same scopal properties have the same semantics and pragmatics. In this paper however I am concentrating on the scopal properties of *ko* and *kome*; their other properties have to await future research. Thank you to the anonymous reviewers for asking about it.

[6] The scopal properties of *kome* are similar to the scopal properties of *a certain* and singular *some* in English (Farkas 2002). However, the more precise comparison between *some*, *certain* and *ko*, *kome* is not possible at this stage of research due to the lack of the conclusive data regarding their scopal interaction with intensional predicates as well as their additional connotations, like a free choice component or an ignorance implication. Importantly, if these additional connotations are indeed attested in Ga, it would be important to examine whether it is possible to derive the scopal properties of *ko* and *kome* from the basic constraints which are responsible for their epistemic connotations, e.g., in line with Farkas (2002). I postpone this issue for future research, concentrating in this paper on scopal properties of *ko* and *kome* with respect to negation and quantifiers. Thank you to the anonymous reviewer who asked about it.

[7] An anonymous reviewer asked whether *ko* is acceptable in the cases, in which a co-varying interpretation is pragmatically odd, as in (i)

(i) Every participant at the ceremony walked up to a big table in the middle of the room an placed an offering on it.

I plan to check it empirically during my next field trip. Thank you for pointing my attention to this example.

In addition, both *ko* and *kome* can obtain an intermediate scope interpretation. By way of illustration the intermediate scope interpretation, consider (15), taken from Reinhart (1997):

(15) Most linguists have looked at every analysis that solves some problem.

Crucially, (15) can obtain three interpretations, i.e., a narrow, wide, and intermediate scope interpretation, depending on the scope of the indefinite NP *some problem*. All three interpretations are listed below:

(16) a. There is some problem, such that most linguists have looked at every analysis that solves that problem. WIDE SCOPE INTERPRETATION

    b. Most linguists have looked at every analysis that solves a problem. NARROW SCOPE INTERPRETATION

    c. For most linguists, there is some problem, such that they have looked at every analysis that solves that problem. INTERMEDIATE SCOPE INTERPRETATION

The intermediate scope interpretation of (15), explicated in (16-c), is the one in which most linguists chose one problem to work on but the choice of the problem varies with the linguist. This interpretation is presented in the context of (17). Crucially, the acceptability of *ko* and *kome* in this context suggests that both of them can obtain the intermediate scope interpretation.

(17) context: Four linguists chose one linguistic problem to work on. Linguist 1 chose the syntax of Ga, linguist 2 chose the syntax of Akan, linguist 3 chose the phonology of Ewe, linguist 4 chose the morphology of Avatime. Linguists 1, 2, and 3, but not 4, read all the analyses solving the respective problem.

Otsiamii	pii	ekw	susumi	saji
linguist	most	have.looked	analysis	analysis
fɛɛ	ni	yeɔ	boa	sane
every	that	help	solve	problem
kome/ko	naaboam.			
INDF/INDF	solve			

'Most linguist have looked at every analysis that solves some problem.'

A summary of the discussed scopal properties of *ko*, and *kome* is presented in Table 1. A formal semantic account of their properties, in turn, is discussed in the next section.

Table 1 Scopal properties of *ko* and *kome*

	Intermediate scope	Negation	Quantifiers
Ko	✓	Wide, narrow	Covarying
Kome	✓	Wide	Constant, covarying

3 Analysis

Based on the data presented in Sect. 2, I argue that both *ko* and *kome* denote skolemized choice functions. The strongest evidence for the analysis of the indefinites as denoting choice functions (Chierchia 2001, Kratzer 1998, Matthewson 1999, Reinhart 1997, Winter 1997) is the availability of intermediate scope readings.[8] The intermediate scope interpretation with *ko* and *kome* indefinites in (17) shows that they can be neither quantificational nor referential. They cannot be quantificational, because quantifiers cannot move out of syntactic islands and therefore the quantificational analysis predicts the unacceptability of *ko* and *kome* in the context of (17), contrary to fact. Moreover, they cannot be referential in (17), because the linguists didn't choose one and the same problem for all of them but they chose different problems to solve. In the next subsection, I will explicate the semantics of *ko* and *kome* as denoting (skolemized) choice functions and I will demonstrate how this analysis accounts for the data presented in Sect. 2.3.

3.1 *Ko*, *Kome* and Skolemized Choice Functions

A choice function (CF) is a function of type $\langle \langle e, t \rangle, e \rangle$ which takes a set as its argument and returns one element from that set:

(18) A **choice function** is a function from sets of individuals that picks a unique individual from any non-empty set in its domain (Kratzer 1998).

There are two competing approaches to choice functions: Whereas Reinhart (1997), Winter (1997) and Matthewson (1999) argue that choice functions are existentially bound, Kratzer (1998) and Matthewson (2001) argue that they remain free. For example, under the analysis of the indefinite determiner *a* as denoting an existentially bound CF, the sentence in (19) obtains the interpretation in (19-a) and under the analysis of *a* as denoting a free CF, it recieves the interpretation in (19-b), where *f* is a variable ranging over choice functions. In the latter, the value of the CF is provided by the context, which usually is the one intended by the speaker:

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[8] For the opposite view, see for example Guerts (2000, 2002).

(19) Kofi read a book.

    a. $\exists f$ (Kofi read f(book))

    $\approx$ There is a way of choosing a book such that Kofi read this book.

    b. Kofi read f(book)

    $\approx$ Kofi read a book chosen in a way known to the speaker.

Choice functions can also be skolemized, i.e., they can take an additional covert pronominal index (also called the parameter or the skolem index). The index, as overt pronouns, can be either interpreted with respect to the assignment function, usually relativized to the speaker, or can be bound by a higher quantificational NP. The former leads to the constant interpretation in (20-a) and the latter triggers the covarying scope interpretation in (20-b):

(20) Every student read a book.

    a. every student read f_1(book)

    $\approx$ I know a way of choosing a book such that every student read the book chosen that way.

    b. every student$_z$ read f_z(book)

    $\approx$ Every student read a book chosen in a way relative to every student.

Analyzing indefinites as denoting skolemized choice functions can account for the intermediate scope interpretation. For example, the intermediate reading of (17) in Kratzer's (1998) approach to CF is as in (21):

(21) for most x[linguist $(x) \rightarrow \forall z$[analysis $(z) \wedge z$ solves f_x(problem) $\rightarrow x$ looked at z]]

    $\approx$ For most linguists, there is a way of choosing a problem such that they have looked at every analysis that solves that problem.

As it has already been mentioned, I propose that both *ko* and *kome* denote skolemized choice functions. The question is whether they are bound or free, and what the possible binders of their parameters are. I argue that the answers for these questions are provided by different scopal properties of *ko* and *kome* presented in Sect. 2.3.

3.1.1 Interaction with Negation

I propose that in a semantic fieldwork situation, interaction with negation is a good test method for determining whether a CF denoted by an indefinite is existentially bound or not. Crucially, a narrow scope interpretation with respect to negation is only possible if a CF denoted by an indefinite is existentially bound. Otherwise, only a wide scope interpretation is available. Consider (22):

(22) Kofi didn't buy any fish.

With an existentially bound CF both a wide scope interpretation, as in (23-a), and a narrow scope interpretation, as in (23-b), is possible, because negation can scope above or below existential closure:[9]

(23) a. $\exists f[\neg$ buy [Kofi,f_1(fish)]] $\approx$ As for the speaker, there is a way of choosing a fish such that Kofi didn't buy it (there is a fish that Kofi didn't buy.)

    b. $\neg \exists f[$ buy [Kofi,f_1(fish)]] $\approx$ As for the speaker, there is no way of choosing a fish such that Kofi bought it (Kofi didn't buy any fish.)

With a free CF, on the other hand, only a wide scope interpretation is possible, because there is no other operator that negation could scope over:[10]

(24) $\neg$ buy [Kofi,f_1(fish)] $\approx$ The speaker knows a way of choosing a fish such that Kofi didn't buy it (there is a fish that Kofi didn't buy.)

Since *ko* can get both a wide and a narrow scope interpretation with respect to negation, I argue that it denotes an existentially bound skolemized CF. By contrast, since *kome* can only get a wide scope interpretation with respect to negation, it denotes a free skolemized choice function.

3.1.2 Interaction with Quantifiers

The interaction with quantifiers, on the other hand, can detect possible parameter (skolem index) binders. If an indefinite has the speaker as its parameter, it gets a constant interpretation. Conversely, if the parameter is bound by a higher quantificational NP, an indefinite gets a covarying interpretation. Consider (25):

(25) Every woman read some book.

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[9] I propose that both *ko* and *kome* denote skolemized CFs. Since there is no binder that could bind the index in (23), its value is provided by the context, i.e., by the assignment function. Even though in the case of (b) the CF is bound by the context, due to the presence of existential closure it does not obtain a wide scope interpretation.

[10] Note that the paraphrases for contextually bound wide scope indefinites are intended to suggest that the speaker knows the way of choosing a relevant NP rather than that the speaker knows the relevant NP. Therefore, they should not be understood as epistemically specific, see Kratzer (2003). Thank you to the anonymous reviewer who asked for clarification.

The representations of (25) given in (26) illustrate what happens when the parameter is bound by the speaker. In both cases, i.e., when the CF is existentially closed or remains free, the indefinite obtains a constant interpretation:

(26) a. $\exists f \forall z[$ woman $(z) \rightarrow$ read $(z, f_1($ book $))]$

≈ As for the speaker, there is a way of choosing a book such that every woman read a book chosen that way.

b. $\forall z[$ woman $(z) \rightarrow$ read $(z, f_1($ book $))]$

≈ The speaker knows a way of choosing a book such that every woman read a book chosen that way

By contrast, if the parameter is bound by a higher quantificational NP, then the indefinite invariably obtains a covarying interpretation.[11]

(27) a. $\exists f \forall z[$ woman $(z) \rightarrow$ read $(z, f_z($ book $))]$

≈ There is a way of choosing a book relative to every woman such that she read a book chosen that way.

b. $\forall z[$ woman $(z) \rightarrow$ read $(z, f_z($ book $))]$

≈ For every woman there is a way of choosing a book such that she read a book chosen that way.

In Sect. 2.3, it was shown that whereas *kome* can get both a constant and a covarying interpretation, *ko* can only get a covarying interpretation. Building on these data and the observations presented in (26) and (27), I argue that while the parameter of *kome* can be bound either by the speaker or a higher quantificational NP, the parameter of *ko* can only be bound by a higher quantificational NP (if available).

Putting all the elements together, I propose that *kome* denotes a free skolemized CF whose pronominal parameter can be bound either by the context or by a wider scope quantificational NP. *Ko*, on the other hand, denotes an existentially bound skolemized CF, whose parameter is bound by a higher quantificational NP (if available).[12]

In the next subsection, I will discuss the main arguments against the choice functional analysis of indefinites (Chierchia 2001, Schwarz 2001, 2011). In particular, I will discuss the empirical predictions of this analysis in downward entailing contexts and show that the indefinites in Ga give rise to the predicted readings.

3.2 *Ko* and *Kome* in Downward Entailing Contexts

Chierchia (2001) and Schwarz (2001, 2011) claim that existentially bound CFs (with the existential closure taking the widest scope, as it is argued for *ko*) over-generates. In particular, Schwarz (2001) showed that whereas the LF in (28) interprets an indefinite as a narrow scope existential quantifier when α is upward entailing, it interprets an indefinite as a narrow scope universal quantifier when α is downward entailing. Importantly, the latter reading turns out to be unattested in English.

(28) $\exists f[\alpha \ \lambda_1[t_1$ submitted $f[$ paper he$_1$ had written $]]]$

a. UPWARD ENTAILING α

Every candidate submitted a paper he had written.

⇒ *a paper* is interpreted as a narrow scope existential quantifier

b. DOWNWARD ENTAILING α

No student submitted a paper he had written.

⇒ *a paper* is interpreted as a narrow scope universal quantifier

For illustration, consider (29), taken from Schwarz (2011):

(29) Every candidate submitted a paper he had written.

(30) a. every candidate $\lambda_1[\exists f \ [t_1$ submitted f [paper he$_1$ had written]]]

b. $\exists f$ [every candidate $\lambda_1[t_1$ submitted f [paper he$_1$ had written]]]

Schwarz (2011, p. 887)

(30-a) conveys the interpretation that for every candidate there is a way of choosing a paper he had written such that he submitted that paper. Importantly, (30-b) can express the same truth conditions. Namely, it conveys the meaning that there is a CF such that every candidate submitted a paper he had written chosen by that CF. This reading is illustrated in the scenario below, taken from Schwarz (2011), in which the capital letters and numbers in the curly brackets represent the papers a candidate wrote. The submitted papers are underlined:

(31) Alan: $\{\underline{A1}, A2, A3\}$

Bob: $\{\underline{B1}, B2\}$

Carl: $\{\underline{C1}, C2, \underline{C3}\}$

Schwarz (2011, p. 887)

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[11] Note that in the case of indefinites denoting an existentially bound CF, it does not matter whether $\exists$ scopes over $\forall$ or vice versa: since in both cases the parameter is bound by the speaker in (25) and by the higher quantificational NP in (26), both give rise to the same truth conditions.

[12] The fact that one needs two types of choice functions, one contextually bound and one existentially bound, together with two different binding mechanisms to account for the data from one language complicates significantly the choice-functional analysis of indefinites. Especially, if one takes into consideration that Kratzer (1998) proposed the analysis of indefinites in terms of contextually bound choice functions in order to simplify the special binding mechanisms which were needed in order to account for the scopal behavior of indefinites under their analysis as existentially bound choice functions. I leave for future research the question how to simplify the analysis I put forward. Thank you to the reviewer for pointing this out to me.

Crucially, the existence of the CF as in (32) ensures that (30-b) comes out true:

(32) Alan: $\{\underline{A1}, A2, A3\} \rightarrow A1$
    Bob: $\{\underline{B1}, B2\} \rightarrow B1$
    Carl: $\{\underline{C1}, C2, \underline{C3}\} \rightarrow C1$

<div align="right">Schwarz (2011, p. 887)</div>

It follows that (30-b) is true just in case every candidate submitted at least one paper he had written.

The situation is dramatically different in downward entailing contexts. Consider (33) and the two LFs in (34):

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

(34) a. no candidate λ_1 [$\exists f$ [t_1 submitted f [paper he$_1$ had written]]]
    b. $\exists f$[no candidate λ_1 [t_1 submitted f [paper he$_1$ had written]]]

<div align="right">Schwarz (2011, p. 887)</div>

In that case (34-a) conveys the interpretation that for no candidate there is a way of choosing a paper he had written such that he submitted that paper, i.e., for no candidate there is a paper he wrote that he submitted. By contrast, (34-b) expresses the much weaker interpretation that there is a way of choosing a paper the candidate had written such that no candidate submitted that paper, i.e., (34-b) is true just in case no candidate submitted every paper he wrote. It follows that whereas (34-a) is false in the scenario discussed above, (34-b) turns out to be true in that scenario, for example due to the existence of the CF presented below:

(35) Alan: $\{\underline{A1}, A2, A3\} \rightarrow A2$
    Bob: $\{\underline{B1}, B2\} \rightarrow B2$
    Carl: $\{\underline{C1}, C2, \underline{C3}\} \rightarrow C2$

<div align="right">Schwarz (2011, p. 887)</div>

Now, Schwarz (2001, 2011) argues that (33) cannot obtain the interpretation in (34-b), i.e., (33) is not true in the scenario of (35), contrary to what is predicted under the analysis of (33) given in (34-b). Therefore, the analysis of English indefinites as denoting CFs which are existentially bound at the widest scope level gives rise to unattested readings. For that reasons, Schwarz (2001, 2011) building on Chierchia (2001) proposed restrictions on the distribution of the existential closure that bound a CF:

(36) a. **Condition A**: a choice function variable and its existential closure cannot be seperated by an operator binding a variable in the indefinite.
    b. **Condition B**: existential closure with non-widest scope is limited to the immediate scope of a quantifier binding a variable in the indefinite (whose function variable existential closure binds).

<div align="right">Schwarz (2011, pp. 888–889)</div>

Crucially, data from Ga suggest that sentences with *ko*, which I argue denote an existentially bound CF at the widest scope level, give rise to the predicted readings which are unattested in English. Thus one does not have to impose any additional restrictions on the distribution of the existential closure in Ga.[13] Consider the context in (37) and a sentence with the indefinites in downward entailing context:

(37) context: There were three students: Mary, Sue, and Joe. All of them wrote letters, but none of them sent all of them.

Nikaselɔ	ko	kɛ	e-wolo	**ko/kome**
student	INDF	and	3SG-letter	INDF/INDF
ni	e-ŋma	lɛ	e-ya-aa.	
REL	3SG-write	DET	3SG-send-NEG	

'No student send a letter (s)he wrote.'

The scenario can be illustrated schematically as below, where the capital letters with numbers are the letters written by students and the underlined ones are the letters that the students sent:[14]

(38) Mary: $\{\underline{M1}, M2, M3\}$
    Sue: $\{\underline{S1}, \underline{S2}, S3\}$
    Joe: $\{\underline{J1}, J2, \underline{J3}\}$

A semi formal representation of (37) with *ko* is given in (39-a) and with *kome* in (39-b):

(39) a. $\exists f$[no student λ_1 [t_1 sent f [letter he$_1$ wrote]]]   KO
    b. no student λ_1 [t_1 sent f_1 [letter he$_1$ wrote]]   KOME

In that case, as predicted, both (39-a) and (39-b) turn out to be true. (39-a) conveys the meaning that there is a way of choosing a letter written by the student in such a way that

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[13] Note that this pose a serious challenge for an analysis of indefinites in a cross-linguistic perspective. Namely, there are distributional restrictions in the analysis of indefinites in English which then have to be suspended in order to account for Ga data. A development of the unified analysis of indefinites is left for future research. Thank you to the anonymous reviewer for pointing my attention to this issue.

[14] The language consultants were presented with the scenario in (38), i.e., they judged the acceptability of (37) precisely in the context of (38).

no student sent a letter chosen that way. It comes out true for example due to the CF presented in (40):

(40) Mary: $\{\underline{M1}, M2, M3\} \rightarrow$ M2
      Sue: $\{\underline{S1}, \underline{S2}, S3\} \rightarrow$ S3
      Joe: $\{\underline{J1}, J2, \underline{J3}\} \rightarrow$ J2

The LF demonstrated in (39-b) also conveys a proper interpretation of the target sentence in (37). It can be paraphrased as: the speaker knows a way of choosing a letter a student wrote in such a way that no candidate sent the letter chosen that way. Since the context provides such a letter, e.g., letter M2 was sent by no candidate, the target sentence in (37) with *kome* was judged as acceptable in the given scenario.[15]

Coming back to Schwarz's (2001, 2011) examples, all of them are such that there is no overlap in the papers written by different candidates, i.e., 'for no two candidates x and y, the set of papers x wrote is also the set of papers y wrote.' Schwarz (2011, p. 895). By contrast, in what follows, I will show that the analysis of *ko* and *kome* can also account for the different scopal behavior of *ko* and *kome* in downward entailing contexts of (41) and (46), in which there is an overlap in the set of books chosen by the students to read. Consider (41):

(41) context: There were three women in the literature course: Mrs Smith, Mrs Müller, and Mrs Laryea. They were supposed to read three books of their choice. Mrs Smith chose 'Anna Karenina,' 'Gone with the wind,' and 'Madame Bovary.' She read 'Anna Karenina' and 'Gone with the Wind' but she didn't read 'Madame Bovary.' Mrs Müller chose 'The Hobbit,' 'Pride and Prejudice,' and 'Madame Bovary.' She read 'The Hobbit' and 'Pride and Prejudice' but she didn't read 'Madame Bovary.' Mrs Laryea chose 'The Lord of the Rings,' 'Anna Karenina,' and 'Madame Bovary.' She read 'The Lord of the Rings' and 'Anna Karenina' but she didn't read 'Madame Bovary.'

Jeee yei lɛ fɛɛ kane wolo **#ko/kome**.
NEG woman.pl DET every read book INDF/INDF
'Not every woman read a book.'

The context of (41) is presented schematically in (42), where the capital letters stand for books' titles and the underlined capital letters for the books read by the respective woman:

(42) Mrs Smith: $\{\underline{AK}, \underline{GW}, MB\}$
      Mrs Müller: $\{\underline{TH}, \underline{PP}, MB\}$
      Mrs Laryea: $\{\underline{LR}, \underline{AK}, MB\}$

The analysis of *ko* as an existentially bound CF with a higher quantificational NP as the parameter can account for the unacceptability of *ko* in the context of (42). The semi-formal representation of the target sentence with *ko* is given in (43).

(43) $\neg \exists f [\text{every woman}_z \text{ read } f_z(\text{book})]$

It says that there is no way of choosing a book such that every woman read a book chosen by 'her CF.' Crucially, it is false in the context of (41), because there is a way of choosing a book such that every woman read a book chosen that way, as illustrated in (44).

(44) Mrs Smith: $\{\underline{AK}, \underline{GW}, MB\} \rightarrow$ AK
      Mrs Müller: $\{\underline{TH}, \underline{PP}, MB\} \rightarrow$ PP
      Mrs Laryea: $\{\underline{LR}, \underline{AK}, MB\} \rightarrow$ LR

Conversely, the target sentence with *kome* is judged to be acceptable in the context of (41). *Kome* denotes a free skolemized CF. When the value of the skolem index of *kome* is relativized to the speaker, it obtains the following representation:

(45) $\neg [\text{every woman read } f_1(\text{book})]$

(45) says that the speaker knows a way of choosing a book such that it is not the case that every woman read this book. This is true in the context of (41), because it is possible to choose a book in the relevant way. For example, 'Madame Bovary' is the book that was not read by every woman (in fact nobody read it). Now, consider (46):

(46) context: The same as before, but this time Mrs Smith didn't read 'Madame Bovary', Mrs Müller didn't read 'Pride and Prejudice', and Mrs Smith didn't read 'Anna Karenina.' They read all other books they chose.

Jeee yei lɛ fɛɛ kane wolo **#ko/kome**.
NEG woman.PL DET every read book INDF/INDF
'Not every woman read a book.'

Again, the context is presented schematically in (47), where the capital letters stand for books' titles and the underlined capital letters for the books read by the respective woman:

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[15] Note, however, that in order to draw definite conclusions regarding the semantics of indefinites in sentences such as (37) more work should be done on the semantics of negative quantifiers. Even though the data I gathered thus far show that the quantifier 'no' comes out as the result of the interaction between the indefinite *ko* and negation attached to a verb, as demonstrated in (i), one cannot entirely exclude the possibility that the sentence in (37) was understood by the language consultants as 'A certain student didn't send a letter (s)he wrote.' The question whether it is really the case should be further investigated.

(i) context: There were three students: Mary, Sue, and Joe. I have recommended to read 'Anna Karenina' but none of them read it.
Nikaselɔ ko kane-ee wolo lɛ ni mi fa lɛ.
student INDF read-NEG book DET REL 1SG recommend DET
'No student read a book I have recommended.'

(47) Mrs Smith: { AK, GW, MB}
      Mrs Müller: { TH, PP, MB}
      Mrs Laryea: { LR, AK, MB}

The same as in the example discussed before, the target sentence with *ko* is unacceptable in the context of (47). Again, it is judged to be wrong because there is a way of choosing a book, relativized to every woman, such that the respective woman read a book chosen by 'her CF,' contrary to what is suggested by the formal representation of the target sentence with *ko*:

(48) $\neg \exists f$[every woman$_z$ read f_z(book)]

Conversely, the target sentence with *kome* is judged to be acceptable, because *kome* invariably takes a wide scope with respect to negation. Consider (49) with the speaker as the parameter:

(49) $\neg$[every woman read f_1(book)]

It can be paraphrased as: the speaker knows a way of choosing a book such that it is not the case that every woman read this book. This is true in the context of (46), because for example 'Anna Karenina' was not read by every woman. Finally, consider the context in (50) and its schematic representation in (51):

(50) context: There were four women in the library. Three of them were reading a book, i.e., the first one was reading 'Pride and Prejudice,' the second 'Gone with the Wind,' and the third 'Anna Karenina.' The fourth woman was writing an article, she was not reading any book.

Jeee	yei	lɛ	fɛɛ	kane	wolo	**ko/kome**.
NEG	woman.PL	DET	every	read	book	INDF/INDF

'Not every woman read a book.'

(51) woman 1: {PP}
      woman 2: {GW}
      woman 3: {AK}
      woman 4: {∅}

Now, the target sentences with both *ko* and *kome* are judged to be acceptable by the Ga native speakers. Consider (52). The interpretation conveyed by the LF in (52), namely that there is no way of choosing a book relative to every woman such that she read a book chosen by 'her CF,' turns out to be true in the context of (51). It is the case because there is no way of choosing a book for woman 4. Therefore the target sentence with *ko* was judged to be acceptable by the language consultants.

(52) $\neg \exists f$[every woman$_z$ read f_z(book)]

Also the interpretation conveyed by (53) is true in the context of (51). (53) expresses the meaning that the speaker knows the way of choosing a book in such a way that not every woman read a book chosen that way. 'Pride and Prejudice' is for example such a book in the context of (51) and therefore the target sentence with *kome* was judged to be acceptable in the context of (51).

(53) $\neg$[every woman read f_1(book)]

The remaining open issue is the question why in downward entailing contexts the language consultants prefer the interpretation of *ko* in which the negation scopes over the existential closure, i.e., they prefer (54-a) over (54-b):

(54)
Jee	yei	lɛ	fɛɛ	kane	woo	**ko**.
NEG	woman.PL	DET	EVERY	read	book	INDF

'Not every woman read a book.'

  a. $\neg \exists f$[every woman$_z$ read f_z(book)] ⇒ preferred interpretation
  b. $\exists f \neg$ [every woman$_z$ read f_z(book)]

Crucially, (54-b) predicts (54) to be acceptable in the context of (41) and (46) and to be unacceptable in the context of (50). The contexts are repeated in a schematic way below in (55), (56) and (57). Again, the capital letters are the book titles chosen by the women and the underlined ones are those that the women actually read. Crucially, (54-b) conveys the interpretation that there is a way of choosing a book in such a way that it is not the case that every woman read a book chosen by 'her CF.' Importantly, it is true in the scenario of (55) and (56), because in both scenarios for every woman there is a book such that she did not read it. However, in both cases the target sentence with *ko* (54) was judged to be unacceptable, suggesting that *ko* was interpreted as in (54-a), which properly models the discussed data, as it was demonstrated above.

(55) Mrs Smith: { AK, GW, MB} → MB
      Mrs Müller: { TH, PP, MB} → MB
      Mrs Laryea: { LR, AK, MB} → MB
(56) Mrs Smith: { AK, GW, MB} → MB
      Mrs Müller: { TH, PP, MB} → PP
      Mrs Laryea: { LR, AK, MB} → AK

In addition, (54-b) predicts (54) to be unacceptable in the scenario of (57). Again, (54-b) can be paraphrased as: there is a way of choosing a book relative to every woman in such a way that it is not the case that every woman read the book chosen by 'her CF.' However, in (57) there is no way of choosing a book for every woman, because the forth woman did not read a book at all.

(57) woman 1:   {<u>PP</u>}
      woman 2:   {<u>GW</u>}
      woman 3:   {<u>AK</u>}
      woman 4:   {∅}

It seems that the interpretation of *ko* as denoting a CF scoping above the negation is systematically blocked in the contexts discussed so far. The question that arises immediately is whether it is for semantic, pragmatic, or methodological reasons. It might be that the interpretation of (54) with the widest scope negation, as in (54-a), is easier to obtain than the interpretation of (54) with the widest scope existentially bound CF, as in (54-b), and for that reason the language consultants gave the judgments along the interpretation of (54) given in (54-a). Definitely more semantic field research must be conducted which ideally would employ different methodologies, including experimental ones, in order to find out a source of the observed effect.

To sum up, in this section I argued that the proposed analysis of *ko* and *kome* as an existentially bound skolemized CF and a free skolemized CF, respectively, give proper results also in downward entailing contexts. It was important to show because downward entailing contexts were argued to be problematic for the analysis of indefinites as denoting CFs. In particular, Chierchia (2001) and Schwarz (2001, 2011) showed that a choice functional analysis of English indefinites predicts very weak truth-conditions and unattested readings in downward entailing contexts. It seems that Ga indefinites give rise precisely to these readings and therefore their analysis in terms of CFs can be sustained.

4 Directions for Future Research

In future research, the scopal properties of *ko* and *kome* with respect to other quantifiers and intensional predicates should be elicited. As for the scopal properties of *ko* and *kome* with respect to *if*-clauses, the relevant data are presented below:[16]

(58) E-baa-ŋɔɔ   Mary   naa   kɛji   onukpa   **ko/kome**   ba.
      3SG-PROSP- Mary   happy2   if   elder   INDF/INDF   come
      happy1

      'Mary will be happy if an elder comes.'

   C1 NARROW SCOPE INTERPRETATION: Mary doesn't know if there are any elders, but...

   ⇒ both *ko* and *kome* are <u>acceptable</u> in this context

   C2: WIDE SCOPE INTERPRETATION : There are bunch of elders in this community. Mary dislikes most of these elders and doesn't want them to come, but there is a particular elder who she likes and wants her to come.

   ⇒ both *ko* and *kome* are <u>unacceptable</u> in this context

It turns out that both *ko* and *kome* can obtain a narrow scope interpretation with respect to *if*-clauses, as demonstrated by their acceptability in the context of (58-C1). However, they cannot obtain a wide scope interpretation with respect to *if*-clauses, as suggested by their unacceptability in the context of (58-C2). Nonetheless, since in order to account for the interaction of the semantics of indefinites with *if*-clauses, systematic field research on the semantics of conditionals needs to be conducted, it is left for future research.

Moreover, it should be examined empirically whether *ko* and *kome* differ along some other dimensions than their scopal properties, especially that their distribution in some cases overlaps, as illustrated in Table 1. It should be verified whether they are semantically and pragmatically identical in these cases. In particular, it should be checked whether they give rise to existence, indifference or ignorance implications, identifiability or non-identifiability requirements, and epistemic specificity.[17] The next step then would be to develop a unified analysis of indefinites in a cross-linguistic perspective.

5 Summary

In this paper, I provide empirical evidence that both existentially bound skolemized choice functions and free skolemized choice functions are attested in natural language. I particular, I analyzed the scopal properties of two indefinites in Ga: *NP ko* and *NP kome*. I propose that whereas *ko* denotes an existentially bound CF that takes a higher quantificational NP as its parameter (if available), *kome* denotes a free skolemized CF that always can take either the speaker or a higher quantificational NP as its parameter. Importantly, the data suggest that *ko* and *kome*, which obtain a choice-functional analysis, give rise to weak truth conditions and readings predicted by the choice functional analysis of indefinites but which are unattested in English. Thus the data from Ga shed new light on the semantics of indefinites and point to a variation in their analysis in a cross-linguistic perspective.

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[16] The test is modeled following the examples in Matthewson (1999).

[17] Thank you to the anonymous reviewer who asked about it.

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