Choice Function and Natural Language Semantics

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Definites vs. indefinites in Functional Relative Clauses

Dora Alexopoulou and Caroline Heycock

In this talk we discuss some aspects of the interpretation of relative clauses and argue that a view of their semantics in terms of functions can capture a number of their properties in a more satisfactory way than analyses based on Quantifier Raising or `reconstruction' (Quantifier Lowering). The epsilon operator allows us to capture the apparently conflicting properties of indefinites in relative clauses and maintain a functional approach for donkey-relatives.

Bianchi 1999 and Bhatt 2000 among others observe that the definiteness of a relative head NP affects quantifier scope. Thus, while `the two patients each doctor will examine' allows a distributive reading, in (2) `two patients each doctor will examine' only the collective reading is available. Such facts have been explained in terms of Kayne's hypothesis that the definite determiner is base-generated externally and that the numeral NP `reconstructs' to its base-position. After reconstruction, `two patients' is within the scope of the universal in (1), but not in (2), where the numeral `two', in the absence of a definite determiner, occupies the external determiner position and cannot therefore appear within the scope of the universal.

We will argue that this analysis faces various problems, not least the fact that it cannot capture the contrast between the definite and indefinite in (3) `the/a patient each doctor will examine', which is parallel to that exhibited by (1) and (2) (with the definite and indefinite head respectively). In both cases it is the bare NP `patient' that reconstructs and both sentences are predicted to allow the same readings (it is also not clear which quantifier should be associated with a bare NP). Further, it cannot capture the binding of the matrix pronoun `him' by `every man' in the (marginal) (4) `the woman every man hugged pinched him', since, the matrix pronoun is not c-commanded by the universal.

We will argue that the contrasts associated with the definiteness of the head can find a more natural explanation under the view that relative clauses, like wh-questions, involve functional dependencies (as proposed in Sharvit 1999). More precisely, the functional approach predicts that, when the relative is headed by an indefinite, the value of the function is undefined. This is so because, for e.g. when (3) is headed by `a patient', there is no unique patient that can be mapped to `each doctor'. The functional reading is thus unavailable. The question arising then is how the indefinite is bound by the universal in standard `donkey-anaphora' sentences such as (5) `every man who has a donkey beats it'. Crucially, if the relation involving an indefinite is not functional in (2&3) why this is not so in (5) (in relation to this see Heim 1990, who stipulates local accommodation of a uniqueness presupposition for `a donkey' in order to `save' the functional/e-type analysis of 5). We will argue that the difference between (2&3) and (5) lies in the interpretation of the indefinite NP in these two types of sentences. Unlike (2&3), the interpretation of the indefinite in (5) does not correspond to that of an existentially quantified NP. Rather, it is best captured by the epsilon operator which seems to convey the functional reading. (Skolemizing the existential quantifier would also provide a functional reading but, unlike the epsilon operator, would force an interpretation in which every man is assigned a unique donkey, which is not what (5) means). Linguistic evidence for this analysis will draw from a comparison with Greek. In Greek, the indefinite in (5) (but not 2) corresponds to a bare singular (rather than a NP with an indefinite determiner as in English). The difference in the interpretation of the corresponding indefinite

will also be argued to be the source of the acceptability contrast between (5) and (4) (under the bound reading for the matrix (e-type) pronoun). (Both examples should be equally good, since they involve the same syntactic configuration).

We will conclude with a comparison between non-identity relative clauses and identity ones (as in (6) `the woman every man hugged was his mother') which have also been argued to involve a functional dependency.

Functional Pronouns in a Pragmatic Semantics

Paul Dekker

In my talk I will first sketch a background in which the results of systems of dynamic semantics are obtained on the basis of a classical, static meaning assignment. The basic and grounding ideas are that (i) surface indefinites are used with referential intentions and (ii) discourse is linearly ordered. The ideas are adapted from (Stalnaker 1998). In the resulting more pragmatic picture it is not so much the anaphoric potential of surface indefinites which is surprising, but the lack of anaphoric potential of indefinites in embedded positions. That is to say, the lack of anaphoric potential attributed to them in most systems of dynamic semantics.

In my talk I will argue that information structure is relevant here, and that indefinites indeed need not be associated with referential intentions when they figure in the background part of an assertion (a negated sentence, the antecedent of a conditional, the restriction of a quantifier). Motivation for this can be found in the typical roles of these constructions in discourse and dialogue, properly conceived of from some game-theoretical perspective. Their local anaphoric potential can then be analyzed, roughly, along the lines of (Gawron 1996; Aloni, Beaver and Clark 1999).

Indefinites in focal positions (consequent of a conditional, nuclear scope of a quantifier, in certain intensional contexts) are then predicted to be associated with referential intentions again, but then of a functional nature. These can be easily accounted for as well by means of a rule of division (Jacobson, 1999). Quite a few examples involving functional readings of terms have been discussed in the literature, and we will show how our pragmatic approach applies to them. Finally we turn to indefinites in so-called intermediate contexts. Here as well, referential and functional readings can be distinguished and we will argue, like (Kratzer 1998), that a more pragmatic approach is called for, and actually can be given.

Generalized Quantifiers and *in situ*-Interpretation

Cornelia Endriss & Christian Ebert

We investigate problems with the interpretation of standard Generalized Quantifiers (GQs) in the Choice Function (CF) approach and propose a refinement to *minimal* CFs, which handles standard GQs correctly. This refined version is then shown to be equivalent to the *Double Scope (DS) approach* (Endriss&Haida 2001) in extensional contexts only. This makes plausible, that the *in situ*-interpretation of the CF approach runs into problems (Geurts 2000), which the DS does not have due to its dislocation of the GQ. To investigate the handling of standard GQs in the CF approach we consider the following example.

(1) If three relatives of mine die, I will inherit a fortune.

The Choice Function representation of the wide scope reading of (1) is

(2) *f. CF(f)* IF **Dist**(*f(3rel)*)(*die*) THEN I will inherit a fortune.

where **Dist** is the distribution operator $\lambda P.\lambda Q.\ x.P(x) \rightarrow Q(x)$. This representation leads to wrong truth conditions if *3rel* denotes the standard generalized quantifier (GQ)

(3) $3rel \equiv \lambda Q.|\ relatives\_of\_mine \cap Q\ | = 3$

because the CF is not committed to choosing only elements of the restrictor set. The proposed solution to this problem is a deviation from the standard GQ semantic (3) towards the following (cf. (Reinhart 1997)):

(4) $3rel' \equiv \lambda Q.\ Q \quad relatives\_of\_mine \quad |Q| = 3$

Substituting (4) for (3) in (2) yields the truth conditionally correct representation, since the CF is forced to select only sets containing exactly three relatives by definition. But if there is the need for a deviation from the standard GQ semantic, why use Choice Functions? Using (4), one can get the same result without the use of Chioce Functions as is shown in the following representation:

(5) *P. 3rel'(P)* IF **Dist**(*P*)(*die*) THEN I will inherit a fortune.

By stipulating 'deviated' GQ semantics such as in (4) Choice Functions become superfluous to derive wide scope interpretations. A more straightforward approach would be to derive these 'deviated' GQ semantics from the standard ones, rather than stipulating them. This can be achieved by constructing the *minimal witness sets* of a standard GQ using the following operator

(6) $\mathbf{M} \equiv \lambda R.\lambda P.\ R(P) \quad \mathbf{min}(P, R)$,

where the **min**-operator is defined as

(7) $\mathbf{min} \equiv \lambda R.\lambda P.\ \neg\ X.\ R(X) \quad X \quad P$

Applying **M** to a standard GQ yields a generalized quantifier that exists of the minimal witness sets of this GQ, e.g. **M**(*3rel*) = *3rel'*. We can now account for the narrow scope reading of (1) by using the standard GQ *3rel* and for the wide scope reading by using the derived GQ **M**(*3rel*) as follows:

(8) IF *3rel(die)* THEN I will inherit a fortune.

(9) *P*. **M**(*3rel*)(*P*) IF **Dist**(*P*)(*die*) THEN I will inherit a fortune.

This mechanism explains narrow scope readings by using the standard GQ semantics. The wide scope readings are derived by dislocating the GQ and minimizing and distributing it via **M** and **Dist** respectively. This mechanism has been elaborated in the *Double Scope* approach (Endriss&Haida 2001). The DS approach has been shown to account for an even broader range of phenomena than the CF approach, e.g. the non-distributive *de re*-readings of strong quantifiers (such as in *Someone believes that every politician is corrupt*), unexpected anaphoric references (such as in *Yesterday, three students were at the party. *He/They had fun.*) and the classification of quantifiers into those, which can take wide scope and those, which cannot.

In correspondence with the dislocation of a GQ and the application of **M**, the minimization can also be incorporated into the CF approach. We propose a refinement of the Choice Function predicate *CF* to $CF_{\min}$, the *minimal Choice Function* predicate:

(10) $CF_{\min}(f) \equiv CF(f)$ X. **min**(f(X), X).

where f is of type $\langle e, t \rangle, t \rangle, \langle e, t \rangle$. That is, we require the CF to choose a minimal witness set from its GQ argument. Using this definition instead of the standard one in (2), the wide scope reading of (1) can be derived by using the standard GQ semantics *3rel.* In order to compare the CF and DS approach, we may derive the following abstract representations for wide scope readings in general, where $\phi[X]$ denotes a formula containing X, e.g. $\phi[X]$ = **Dist**(X)(*die*) → I will inherit a fortune.

(11) $f.\ CF_{\min}(f)$ $\phi[f(G)]$ (CF-min approach)

(12) $P.\ G(P)$ **min**(P, G) $\phi[P]$ (DS approach)

The GQ argument G appears inside ϕ in the CF-min approach (i.e. the GQ remains *in situ*), whereas it does not appear inside ϕ in the DS approach (as the GQ is dislocated). Now consider the interpretation of (11) and (12) in the same model M. If ϕ is an extensional context, the denotations of G in (11) and (12) are identical. In this case, (11) and (12) are equivalent, since the existence of a function, that selects a minimal witness set of G implies the existence of this set and vice versa. However, if ϕ is an intensional context, the denotation of G in (11) might differ from that in (12) as G is interpreted *in situ* – i.e. inside of ϕ – in (11) and outside of ϕ in (12). Thus we conclude that the DS and the CF-min approach yield equivalent representations in extensional contexts and they might differ in intensional ones. This makes plausible, that the DS approach can account for the same wide scope readings as the CF approach without running into the same *in situ* problems (Geurts 2000).

Tanya Reinhart (97): ”Quantifier Scope: How Labour is divided between QR and Choice Functions.”, in: L&P 20, pp. 335-397.

Cornelia Endriss & Andreas Haida (2001): ”The Double Scope of Quantifier Phrases.” Proceedings of NELS31, Washington

Bart Geurts (2000): ”Indefinites and Choice Functions.”, in: Linguistic Inquiry 31, pp. 731-738.

Varieties of Indefinites

Donka F. Farkas

The paper examines some of the considerable morphological variation within the realm of noun phrases one would classify as indefinites within a language as well as cross-linguistically, and make the following points:

(i) Distinguishing between choice-functional and non-choice functional indefinites is less useful than it has been claimed. More specifically, it will be argued in some detail that the beavior of "some" in English is not captured by assuming that it is choice-functional in the singular or plural. (The claim that plural "some" is choice-functional has been made in Chierchia 1998.)

(ii) A more promising line for capturing inter- and intra-linguistic variation is to assume that noun phrases with descriptive content are essentially all choice-functional, the descriptive content providing the set that serves as argument to the choice function, but that variation arises as a result of various languages marking various further constraints on the choice function in question, constraints pertaining to the nature of the function (i.e., whether it is a Skolem function or not), as well as to the nature of its argument.

Choice Functions and the Anaphoric Semantics of Definite NPs

Klaus von Heusinger

Choice functions are commonly used for representing indefinite NPs in LF for reasons of scope behavior, while definite NPs are analyzed according to Russell's classical theory. However, this view is restricted to sentence semantics and, therefore, it assumes static meanings of definite and indefinite NPs. Once we extend our analysis to (small fragments of) discourses, the picture changes dramatically: Indefinite expressions receive a context change potential, while anaphoric definite expressions must be interpreted according to the updated context. This is the approach of dynamic semantics, such as FCS, DRT or DPL. However, in these theories, there is no clear account of the semantics of anaphoric definite NPs, which are often analyzed as Russellian descriptions, i.e. as static terms that do not interact with the context change potential of other expressions.

Lewis (1979, 179) has already illustrated that this view cannot account for the different reference of the two occurrences of the definite NP *the cat* in (1).

(1) "the cat"
Imagine yourself with me as I write these words. In the room is a cat, Bruce, who has been making himself very salient by dashing madly about. He is the only cat in the room, or in sight, or in earshot. I start to speak to you:
The cat is in the carton. **The cat** will never meet our other cat, because our other cat lives in New Zealand. *Our New Zealand cat* lives with the Cresswells. And there he'll stay, because Miriam would be sad if **the cat** went away.

I will argue that anaphoric definite descriptions are crucially involved in the dynamics of context change: First they are dependent on the updated context, and second they themselves update a given context. Context change is reconstructed as the change of a contextual salience structure that can be represented by a choice function. An indefinite NP *a cat* changes these structure in that it assigns its referent to the set of cats as being the most salient one. A definite NP *the cat* refers to that most salient referent and updates the context in the following way: (i) it trivially updates the set of cats with the referent of the definite NP (which is already the most salient one); (ii) it updates also some supersets such that that referent becomes the most salient referent of the supersets. In this way we can account for the salience change of the set of cats from one cat (Bruce) to another cat (Bobby) by the definite expressions *our New Zealand cat.*

Lewis, David 1979. Scorekeeping in a Language Game. In: R. Bäuerle & U. Egli & A. von Stechow (eds.). *Semantics from Different Points of View.* Berlin; Heidelberg; New York: Springer, 172-187.

Tree growth and the construal of indefinites

Ruth Kempson and Masayuki Otsuka

In this talk, we argue that the scope ambiguity of indefinite noun phrases is a phenomenon parallelling that of pronoun construal in having an input lexical specification which only partially determines their interpretation, an underspecification which is resolved during the process of logical form construction. Indefinite noun phrases will be analysed as providing instructions for constructing epsilon terms, with a constraint that the resulting term must take narrower scope than some other term in the structure under construction, the choice of term on which to define such a scope relation being (in English) otherwise free. This analysis is set within the Dynamic Syntax framework of Kempson, Meyer-Viol and Gabbay 2001, in which interpretation is modelled as a process of tree growth leading to a logical form following the left-right sequence of words in a sentence. We shall see that this account enables us to express a range of cross-linguistic and lexically imposed variation in scope potential. Evidence confirming both this specific application of the epsilon calculus, and the more general claim of Kempson et al that the defined process of tree growth constitutes the basis for syntactic explanations of natural language phenomena, is the explanation the account provides for the syntactic puzzle posed by so-called head-internal relative clauses (in Japanese), whose E-type form of interpretation emerges as an immediate consequence of the analysis.

Scope Encoding of Indefinite NPs in Japanese

Kimiko Nakanishi

In this paper, I present novel data on the scope-freezing effect in the sequence of indefinite indirect object (IO) - direct object (DO) in Japanese. I argue that such effect is due to the specificity of the indefinite IO in IO-DO and that this specificity is obligatorily encoded as a variable over choice functions, similar to English *a certain* (Kratzer 1998) and also to St'át'imcets non-polarity indefinite determiners (Matthewson 1999).

In Japanese, IO-DO order has only the surface scope reading IO>DO, whereas DO-IO order is ambiguous between DO>IO and IO>DO readings (ex.1) (Hoji 1985).

(1) a. IO-DO: Taro-ga [sannin-no onna]-ni [futari-no otoko]-o syookaisita.
Taro-NOM [three-GEN woman]-DAT [two-GEN man]-ACC introduced
'(lit.) Taro introduced to three women two men.'
_IO(>Distr.)>DO, *DO(>D)>IO

b. DO-IO: Taro-ga [futari-no otoko]-o [sannin-no onna]-ni syookaisita.
_IO>D>DO, _DO>D>IO

Given that indefinites in Japanese can escape islands, in the examples where ditransitive constructions with the indefinite IO and DO are within *if*-clauses, both objects should be able to freely take logical scope outside of the *if*-clause. Indeed, DO-IO order is ambiguous between DO>IO and IO>DO in terms of choice functions (ex.2). In IO-DO order, however, only the IO>DO reading is available (ex.3).

(2) *If* [S DO IO V], ...
[Nidai-no kuruma]-o [yonin-no kyaku]-ni miseta-ra, Taro-wa boonasu-o mora-eru.
[two-GEN car]-ACC [four-GEN customer]-DAT show-if Taro-TOP bonus-ACC get-can.
'If (Taro) shows two cars to four customers, Taro can get a bonus.'
_IO>*if*>DO: _f [CH(f)_[[_y [CAR(y) __y_=2 _ SHOW(t, y, f (four customers))]] _ GET(t, b)]]
_DO>*if*>IO: _g[CH(g)_[[_x[CUSTOMERS(x)__x_=4_SHOW(t,g(two cars),x)]]_GET(t, b)]]
_IO, DO>*if*: _f _g [CH(f) _ CH(g) _ [SHOW(t, g (two cars), f (four customers)) _ GET(t, b)]]

(3) *If* [S IO DO V], ...
[Yonin-no kyaku]-ni [nidai-no kuruma]-o miseta-ra, Taro-wa boonasu-o mora-eru.
[four-GEN customer]-DAT [two-GEN car]-ACC show-if Taro-TOP bonus-ACC get-can
_IO>*if*>DO, */??DO>*if*>IO, _IO, DO>*if*

I claim that this frozen scope effect is due to the specificity of the indefinite IO in IO-DO. This claim is motivated by similarities between the IO in IO-DO in Japanese and *a certain* in English, which has only a specific interpretation. Following Kratzer (1998) and Matthewson (1999), this specificity is encoded as variables over choice functions existentially-closed at the top: *a certain* and the indefinite IO in IO-DO have only a choice function interpretation. This is illustrated with the interpretation of indefinite NPs under ellipsis.

(4) Mary visited *a certain* store, and Susan did, too. _same store, ??different store

(5) IO-DO: Taro-ga [Penn-no gakusei]-ni Jun-o syookaisita-to kiita kedo, Jiro-mo Ø Jun-o
Taro-NOM [Penn-GEN student]-DAT Jun-ACC introduced-COMP heard while Jiro-too Jun-ACC
syookaisita-rasii.
introduced-seem '(lit.)
While (I) have heard that Taro introduced to a Penn student Jun, it seems that Jiro
introduced (to a Penn student) Jun, too.' _same, ??different

In (4), *a certain* NP and its deleted counterpart are interpreted as the same. In the same vein, the antecedent indefinite IO in IO-DO and the deleted IO in (5) tend to be interpreted as the same, whereas the IO in DO-IO and the DO in both orders do not show such tendency. These readings result if we interpret the specific indefinite IO as introducing a choice function variable existentially-closed at the top, as *a certain* in English, and if we allow for non-specific NPs to be interpreted as generalized quantifiers.

There have been proposed two linguistic forms to encode variables over choice functions: *a certain* in English (Kratzer 1998), which is a lexical encoding, and non-polarity indefinite determiners in St'át'imcets (Matthewson 1999), which is a morphological encoding. In this paper, I show that there exists a syntactic encoding, i.e., the IO in IO-DO in Japanese. Thus, I propose that there are crosslinguistically at least three encodings of variables over choice functions, i.e., lexical, morphological, and syntactic.

References

[1]Hoji, H. 1985. Logical Form constraints and configurational structures in Japanese. Diss. U. of Washington.

[2]Kratzer, A. 1998. Scope or pseudoscope? In *Events and Grammar*.

[3]Matthewson, L. 1999. On the interpretation of wide-scope indefinites. *NLS* 7.

[4]Reinhart, T. 1997. Quantifier scope: how labor is divided between QR and choice functions. *L&P* 20.

A One-Dimensional Choice-Function Approach to 'Association with Focus'

Ingo Reich

As is well known, focus particles like only are sensitive to the focus structure of their syntactic scope in that a difference in the placement of focus results in a difference in truth-conditions. Usually, this phenomenon is referred to as 'association with focus' (AwF). Since only (being a VP-adjunct) is not adjacent to the focus it is associated with, the challenge for the semanticist is to derive this truth-conditional effect in a compositional way.

Roughly speaking, there are two lines of research tackling this problem. The first (one-dimensional) one, starting with Chomsky (1976) and enriched with the notion of 'structured

propositions' in von Stechow (1981), assumes covert movement of the focus (the foci) to the focus sensitive expression it is associated with. The second approach, going back to Rooth (1985), concludes from the fact that AwF behaves island-insensitively, cf. (1), that rather an in situ analysis of focus is called for. To this effect, Rooth stipulates a second dimension of interpretation that, in the background, computes alternatives to the denotation of the complement of only, to which only then gets access. However, as Kratzer (1991) points out, this approach, too, (lacking variable binding) is coerced to assume island-insensitive movement in VP-ellipsis contexts. Therefore, she proposes a representational variant of Rooth's two-dimensional semantics that mimics variable binding in VP-ellipsis contexts (via identity of focus-indices) and thus allows for keeping an in situ analysis. However, as Krifka (1991) showed, two-dimensional alternative semantics in general (being 'unselective' in nature) cannot cope with 'crossed association with focus,' unless (undesirable) island-insensitive movement is allowed for, cf. (2).

To account for the observed island-insensitivity of AwF, I propose in this paper to take exactly the opposite route to Kratzer, i.e., I will show that it is possible and reasonable to combine a one-dimensional structured propositions approach to AwF with an in situ analysis of focus. What could such an analysis look like? As is well known, AwF shares the property of island-insensitivity with indefinites and wh-phrases. Further common features, such as all being related to the notion of 'new' information or indefinites and focus putting identical restrictions on word order in German, suggest that indefinites, wh-phrases, and focus together form a natural class of 'indefinite' or 'weak' phenomena. If this is correct, this should be reflected by a common core in their analysis. Following Reinhart (1994), I assume a choice function approach to the analysis of indefinites and wh-phrases and propose to treat a focus-index as introducing a choice function that gets bound by a coindexed focus-sensitive expression (or rhetorical relation). Concretely, an F-marked constituent like BillF1 is translated as f1(X1), where f1 is a choice function variable and X1 is a variable being mapped to the contextually salient set of alternatives to Bill (including himself). On LF the coindex F1 on only adjoins to VP. The resulting binary branching, then, is translated as a structured proposition consisting of a (minimal) choice-function f from which Bill (being the only value under f) is still recoverable and a certain property of choice-functions, cf. (3). The function f itself will be constructed (observing compositionality) as a definite description. (This is actually the most challenging part.) This interpretational process is easily extended to all conjoinable types. The semantics of focus-sensitive particles, then, is straightforwardly modified so as to apply to choice-functions instead of individuals.

While inheriting the high degree of informativeness of the one-dimensional approach (thus accounting for the Zimmermann example, see von Stechow 1991), this choice-function approach may be considered as a first step towards a natural explanation for the island-insensitivity of AwF in treating focus as 'one of a family of island-insensitive operators' (Rooth 1996:284). In each case, island-insensitivity is a direct consequence of treating the respective phenomenon in terms of (island-insensitive) binding instead of (island-sensitive) movement: a choice function variable is introduced in situ that gets bound by existential closure (in the case of indefinites), a Q-morpheme (wh-phrases), or a focus-sensitive operator (focus). Moreover, as in Kratzer's analysis, VP-ellipsis contexts are quite unproblematic (identity of focus-indices), but, contrary to hers, cases of crossed AwF can be accounted for, too – in a way that avoids non-standard techniques for the interpretation of binary branching, as those proposed in Krifka (1991).

I. Data:

(1) Dr. Jones only rejected [the proposal [that JohnF submitted]]

(2) a. John onlyF1 introduced BillF1 to Mary.
b. He alsoF2 onlyF1 introduced BillF1 to SueF2.

(3) a. only [F1 [John introduced f1(X1) to Sue]]
b. only‘(· f, lf1. John introduced f1(X1) to SueÒ),
where f: { X1 } → De, f(X1) = Bill.

II. References:

Chomsky, Noam (1976). ‘Conditions on Rules of Grammar’. Linguistic Analysis 2. 303-350.

Kratzer, Angelika (1991). ‘The Representation of Focus’. In: A. von Stechow and D. Wunderlich, eds. Semantics. An International Handbook of Contemporary Research. Berlin: de Gruyter. 825-834.

Krifka, Manfred (1991). ‘A Compositional Semantics for Multiple Focus Constructions’. In: Proceedings of SALT I. 127-158.

Reinhart, Tanya (1994). Wh-in-situ in the Framework of the Minimalist Program. OTS Working Papers. Utrecht: Utrecht University.

Rooth, Mats (1985). Association with Focus. Ph.D. thesis. University of Massachusetts, Amherst.

Rooth, Mats (1996). ‘Focus’. In: S. Lappin, ed. The Handbook of Contemporary Semantic Theory. Oxford: Blackwell. 271-297.

Stechow, Arnim von (1981). ‘Topic, Focus, and Local Relevance’. In: W. Klein and W. Levelt, eds. Crossing the Boundaries in Linguistics. Dordrecht: Reidel.

Stechow, Arnim von (1991). ‘Current Issues in the Theory of Focus’. In: A. von Stechow and D. Wunderlich, eds. Semantics. An International Handbook of Contemporary Research. Berlin: de Gruyter. 804-825.

Choice Functions: From Definite Descriptions to Conditionals

Philipp Schlenker

We suggest that the Choice Function analysis of definite descriptions can and should be extended to if-clauses, and that the proposed analysis gives a formal account of striking observed in Lewis 1973 between Definite Descriptions and If-clauses.

1. Lewis 1973 observed that patterns of non-monotonicity with conditionals can be replicated with definite descriptions (‘Lewis’s Generalization’). Standard patterns of monotonic reasoning fail in both cases, which is surprising if if-clauses are analyzed as restricted universal quantifiers over worlds, and if definite descriptions are analyzed either in Russellian or in

Strawsonian terms. (In the following examples '**ιx**' is interpreted as: 'the' or as 'if', depending on the case; p and q are predicates of individuals or predicates of worlds):

(1) Failure of Strengthening of the Antecedent: **[ιx:p] [q]** does not entail **[ιx:p&p'] [q]**
a. If this match were struck, it would light, but if this match had been soaked in water overnight and it were struck, it wouldn't light [modified from Stalnaker 1968)
b. The pig is grunting, but the pig with floppy ears is not grunting [Lewis 1973]
c. The students are rather satisfied, but some ~~students~~ in Beijing are not
d. #Every student is rather satisfied, but some ~~student~~ in Beijing isn't [clearer contrast if ~~student~~ is elided]

(2) Failure of Transitivity; [**[ιx: p] [q]** and **[ιx: q] [r]**] does not entail: **[ιx: p] [r]**
a. If B. wins the election, S. will retire to private life. If S. dies tomorrow, B. will win the election ≠> If S. dies tomorrow, S. will retire to private life.
b. The students are vocal. The undergraduates in Beijing are students.
≠> The undergraduates in Beijing are vocal.

2. In the case of definite descriptions, Lewis's idea was that 'the pig' refers to the *most salient* pig in the domain of discourse. Since the most salient pig is not necessarily the most salient pig *with floppy ears*, the lack of monotonicity followed. Von Heusinger and Egli have formalized this intuition in terms of Choice Functions; in a contex c, $f([[pig]]^c)$ selects the most salient pig in c. With respect to if-clauses, Stalnaker had originally modelled their non-monotonic behavior in terms of a notational variant of Choice functions, his 'selection functions', with 'salience' replaced by 'similarity between worlds'. In effect, 'if p' was analyzed as: 'the closest world satisfying p'. But Lewis himself did *not* follow this path, and used a sphere-based system instead (see the definition of his truth-conditions in the following table). We suggest that this was incorrect, and that a Choice function analysis is superior, and can be extended to address some of Lewis's criticisms if if-clauses are analyzed as *plural* definite descriptions of possible worlds. Thus we argue that 'if p' should be analyzed as: 'the closest/most salient world**s** satisfying p'. The resulting system is intermediate between Stalnaker's and Lewis's (it is equivalent to Lewis's system together *with* the 'Limit Assumption', but without what Lewis calls 'Stalnaker's Assumption')

3. This system has several advantages.

(a) Against Lewis: Lewis worried that Stalnaker's system, or an extension of it, would fail to account for the following sentence:

(3) If this line were longer than it is, it would be less than 2"

If worlds are ordered by similarity and if the similarity measure is the difference between the length of the line in the world in question and its length in the actual world, there must be an infinite sequence of worlds each of which is more similar to the actual world than the previous member of the sequence (this is because measures of lengths are dense). Thus in this case there is no 'most similar' world or worlds, which appears to invalidate both Stalnaker's system and our proposed extension. However: (i) it is highly unclear that measures of similarity are ever as fine-grained as Lewis assumes in this example. Furthermore, (ii) Lewis's own sphere-based system makes incorrect predictions in this case (a point already noted in McCawley 1993). This is because he predicts that if the line is actually 1", each of the following statements should necessarily be true, contrary to fact: 'If this line were longer than it is, it would be less than 2"', 'If this line were longer than it is, it would be less than 11/4"', 'If this line were longer than it is, it would be less than 11/8", etc. It is better in this case to assume that the similarity measure is not so fine-grained, which allows us to preserve the Choice function analysis.

(b) Against Stalnaker: [b1] Stalnaker had to assume that a single 'closest world' can always be selected, an implausible assumption with debatable consequences ('if p, q or if not-p, q',

the 'conditional excluded middle', is a tautology in his system, since the value of 'if p' is a single world). By assuming that 'if p' is analyzed in terms of a choice function which selects a *plurality* of worlds ('the closest world**s'**), we can relax the implausible assumption and avoid its consequence ('if p, q or if not-p, q' isn't a tautology; it could be that some the worlds in $[[\text{if p}]]^c = f(p, c)\ (\ [[p]]^c\ )$ satisfy q, while others satify not-q). [b2] Our system has the additional advantage of extending straightforwardly to generalized quantification, such as: 'Necessarily/possibly/most probably if p, q'. This wasn't the case on Stalnaker's analysis, since there the value of 'if p' was a single world. As soon as pluralities of worlds are considered, the problem can be solved in the same way as it is for definite descriptions ('All/some/most of the students are happy).

Stalnaker's System	**Choice Functions selecting a plurality of worlds**	**Lewis's System**
Selection Function, **one** world **$[[\text{if } \varphi]] = f(i, \varphi)$ W** **= j** *the closest p-world is a q-world*	Selection Function, **several** worlds **$[[\text{if } \varphi]] = f(i, \varphi)$ W** **= $\{j_1, j_2, j_3, \ldots\}$** *the closest p-world**s** **are** q-world**s***	**No** Selection Function. Spheres
"If φ, ψ" is true at world i iff either (1) No φ-world exists, or (2) f(i, φ) [[ψ]]	"If φ, ψ" is true at world i iff either (1) No φ-world exists, or (2) f(i, φ) [[ψ]]	"If φ, ψ" is true at word i (according to the system of spheres $), iff either (1) No φ-world belongs to any sphere S in $$_i$, or (2) Some sphere S in $$_i$ does contain at least one φ-world, and φ ψ holds at every world in S
Conditional excluded middle j [[ψ]] j [[¬ψ]]	**No conditional excluded middle** It may be that neither $\{j_1, j_2, j_3, \ldots\}$ [[ψ]] nor $\{j_1, j_2, j_3, \ldots\}$ [[¬ψ]]	**No conditional excluded middle**
Limit Assumption satisfied => cannot handle infinite sequence of worlds each closer than the prev	**Limit Assumption satisfied** => cannot handle infinite sequence of worlds each closer than the previous one	**Limit Assumption not satisfied** => **can** handle infinite sequence of worlds each closer than the prev
<u>No</u> extension to Gen. Quant. (a single world cannot restrict a GQ)	**Easy extension to Gen. Quant.** (a plural description **can** restrict a GQ)	**?**

On Skolem functions and wide scope indefinites

Yoad Winter

Choice functions (CFs) are often used for obtaining wide scope readings of indefinites while leaving the indefinite in situ. Some works observed that when the restriction of the indefinite contains a locally free pronoun, its simple treatment using CFs leads to undesired truth conditions. For instance, an analysis as in (2) for sentence (1) is inappropriate, because two

children who happen to know the same set of women are expected by analysis (2) to have a common woman liked by both of them. This claim is contrary to intuition.

(1) Every child likes a woman he knows.
(2) exists f [CF(f) & for-all y [child(y) -> like(y,f(women y knows))]]

The treatment in (2) seems to violate May's "scope principle", according to which a noun phrase cannot take scope over a binder of a pronoun it contains. A solution to this problem is to use Skolem functions (SFs) as a natural generalization of CFs. Definition: A Skolem Function of arity n (SKn) is a function that maps any tuple <a1,a2,...,a_n, X> in a product A1 x A2...x An x Pow(A)-{} to an element of X.

Sentences like (1) can now be treated correctly using an SK of arity 1:

(2') exists g [SK1(g) & for-all y [child(y) -> like(y,g(y,women y knows))]]

Two different children can now be mapped by g to two different women even when they happen to know exactly the same women. Obviously - CFs are SKs of arity 0.

In this talk I will make two claims:
1. That the general SK mechanism is not only required to prevent undesired effects with CFs. Certain sentences with indefinites and anaphora violate May's principle but are correctly analyzed using SKs.
2. That the arity of a Skolem function should be identical to (or at least, not smaller than) the number of (locally) free variables in the restriction of the indefinite it applies to. This restriction is easy to implement under Jacobson's functional treatment of anaphora.

Proof terms for the existential quantifier

Wilfried Meyer-Viol

In this talk I will discuss various proof terms that have been proposed for the existential quantifier. Standardly, and familiar from the Curry Howard Calculus, a proof term for $\exists x \varphi(x)$ (a, p) where a is a constant and p is a proof of $\varphi(a)$. This object has been developed in the intuitionistic calculus and straightforwardly extends to substructural Logics. An alternative family of proof terms has been suggested by Ruy de Queiroz and Dov Gabbay within the framework of Gabbay's Labelled Deductive Systems.
This framework allows for structurally very rich proof terms intended to to supply terms also for classical predicate logic. A third class of terms is under development by me and derives from the treatment of existential quantification in the epsilon calculus. Standardly epsilon terms are interpreted by choice functions and these are typically geared towards classical logic. I will outline a theory of proof-objects for formulas with epsilon terms in which the "proof: proposition" pairs are extended with "construction:object" pairs where the interpretation 'proposition P is true if it has a proof' has the analogon 'object O' exists (in the domain) if it has a construction.

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