Different as a restriction on Skolem Functions

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Summary: We propose to analyse *different* in sentences like *every child watched a different movie* by employing a certain kind of Skolemized Choice Function to analyse indefintes and letting *different* restrict these functions in certain ways. The internal reading of different (each child can be assigned a movie that it watched without assigning any movie twice) restricts the function so as to map each child to a movie that is not in the set of movies it maps the other children to. The external reading is analysed by restricting the function so as to map each child to a movie that is not in the set of contextually salient movies. Leaving the lexical entry of *different* underspecified regarding the choice of the set (movies the other children are mapped to vs. salient movies) then provides a unified account of both readings. The account is also able to deal with multiple possible antecedents of *different* as in *every girl thinks that every boy watched a different movie* more succesfully than previous accounts by Brasoveanu (2011) and Bumford and Barker (2013).

1 Introduction

The adjective *different* can have what Carlson (1987) calls the *external* and *internal* readings, exemplified in (2a) and (2b), respectively.

(1) Every child watched a different movie.

(2) a. Every child watched a movie that was different from the salient movies.
b. Every child watched a movie that was different from the movies the other children watched.

I shall here only concern myself with internal readings in cases where they have an *every*-phrase as antecedent. Following Beck (2000) I assume that *different* in sentences like *two children sang different songs* should receive a separate treatment.

(2a) is external in that what the movies are supposed to be different from must be determined by the extrasentential context. The reading in (2b) is internal because, in some sense, the sentence itself provides what it states the movie watched by every child to be different from, namely those watched by the other children.

We propose to analyse the internal reading by adopting an analysis of indefinites in terms of Skolemized Choice Functions and letting *different* require these functions to be injective. (1) thus basically states that there is a function f that maps every child to a movie which the child has watched and which is distinct from those it maps the other children to. This will be expressed as $f(M[ovie])(x) \notin I$, where I is the set of objects that f assigns to arguments distinct from x. Taking S to be the set of salient movies, replacing I with S then yields the external reading. Leaving the lexical entry of *different* underspecified with regard to the choice between I and S thus provides us with a unified treatment of the external and internal readings.

Before we introduce our analysis we shall briefly discuss the previous accounts by Brasoveanu (2011) and Bumford and Barker (2013). It will be seen that these cannot fully explain the phenomena that we can account for.

2 Previous Accounts

2.1 Brasoveanu (2011)

Brasoveanu (2011) offers a unified treatment of the external and internal reading of *different*. His account of the internal reading relies on a dynamic semantic system and the assumption that quantifiers like *every* and *each* employ an operator *Dist* to distibute their scopal content over the atoms of their restrictor sets. This operator also opens up a second information state in addition to the primary one to which the meaning of most other expressions solely contributes. This information state makes available during the update with *Dist* for each element x of the restrictor the result of the corresponding update for all elements of the restrictor distinct from x. In this context, *different* can then require the non-identity of the movies which have been introduced in the two distinct information states. By allowing *different* to relate to previously introduced movies instead of those introduced in the course of the update, the external reading is also explained. In effect, Brasoveanu derives (3) as the meaning of the internal reading of (1).

(3) It is possible to assig a movie to each child such that, for any two children, the children are assigned distinct movies and each watched the movie he or she is assigned.

This is the meaning we shall also derive, but differently from Brasoveanu, we shall make the assignment of children to movies more explicit in the form of a Skolem function. This will solve the problem with multiple antecedents discussed in the following section.

2.2 Bumford & Barker

Bumford and Barker (2013) (B&B) correctly point out that Brasoveanu's account encounters difficulties where a sentence contains multiple possible antecedents for *different*. Of particular relevance for the argument are examples like (4).

(4) Every girl thinks that every boy recited a different poem by his mother.

This sentence has a reading under which there is, for each girl, a poem that was written by the common mother of the boys which she believes every boy to have recited. In (4), B&B argue, the scope order needs to be $\forall_{girl} > think > \forall_{boy} > \exists_{poem}$ because $\forall_{boy}$ is confined to the *that*-clause and binds a variable in the restrictor of $\exists_{poem}$. This makes it impossible for *different* to pick $\forall_{girl}$ as its antecedent because only the scopally lowest operator can act as an antecedent under Brasoveanu's account.

The solution that B&B propose has every *each*- and *every*-phrase introduce an additional stack[1] which in a manner roughly paralleling Brasoveanu's analysis is supposed to mediate the needed information. But what B&B's account actually derives as the meaning of (4) is approximately what is shown in (5).

(5) $\forall x, y(x \neq y \wedge x, y \in G \rightarrow x, y \in TH(\lambda w.\forall z(z \in B \rightarrow \exists uv(u \neq v \wedge u, v \in P(z) \wedge R(z, u) \wedge R(z, v)))))$

But this simply ascribes to every girl the belief that every boy read at least two different poems, which is not even close to any possible reading of (4). To arrive at the intended reading, the indefinite would somehow need to take scope outside of the *that*-clause. This means that either $\forall_{girl}$ must also be able to take scope outside of this clause or there is a mismatch between scope order and binding, with $\forall_{girl}$ somehow binding a variable in the restrictor of a quantifier that has wider scope than $\forall_{girl}$ itself. Taking the latter of these routes would result in a considerable loss of ground in comparison with Brasoveanu, as it should then be possible again to let the *different*-phrase take scope in such a way that the intended antecedent is scopally closest. The first route would require $\forall_{boy}$ to be able to systematically take scope outside of its *that* clause.

While both approaches would solve the undergeneration problem, the overgeneration of predicting (5) as a possible reading would remain and need to be solved separately.

3 An Alternative Account: A Restriction on Skolem Functions

Our account of the phenomenon will rest on an analysis of indefinites by means of Centered Partial Skolemised Choice Functions. Consider first Partial Skolemised Choice Functions: such a function takes a set S as its first argument (the *set argument*) and any number of entities as further arguments (the *entity arguments*) and ultimately returns a member of S. The variables representing these functions are bound by existential quantifiers which can freely choose where to take scope. *Every student read a book* thus receives the following possible analyses with a wide-scope reading (6a) and the equivalent narrow-scope readings (6b), where 'scope' is modelled by the use of a bound entity argument, and (6c), which is a true scope variant.[2]

(6) a. $\exists f(PSCF(f) \wedge \forall x(S(x) \rightarrow R(x, f(B))))$
b. $\exists f(PSCF(f) \wedge \forall x(S(x) \rightarrow R(x, f(B)(x))))$
c. $\forall x(S(x) \rightarrow \exists f(PSCF(f) \wedge R(x, f(B))))$

Since we will need partial functions, $f(B)(x)$, for instance might be undefined for certain values of x. This will lead to undefinedness of $R(x, f(B)(x))$ and of all expressions it is a part of, except for the existential quantifier $\exists f$: if ϕ is not true for any value of f, $\exists f \phi$ will be false.

From PSCFs we get to Centered PSCFs by further requiring the functions to be *centered*.

Definition 1 (Centered PSCF) *A PSCF f is* centered *iff there is a partial function c such that for any S and any vector of entities $\vec{x}$:*[3] $\uparrow c(\vec{x})$ *if* $\uparrow f(S)(\vec{x})$ *and, if both are defined,* $f(S)(\vec{x}) = c(\vec{x})$. *Call c the* center *of f, $Ct(f)$.*

[1] Stacks (basically, partial variable assignments) are also employed by Brasoveanu, but the plural info states he works with are sets of stacks, not single stacks. As a consequence B&B have to assume, unlike Brasoveanu, that the indefinite article means "exactly one". (B&B do not explicitly make this assumption, but if it is rejected, (1) is predicted to be true if 100 children each watched the same two movies, an unwelcome result.)

[2] While having two different analyses of the narrow scope reading introduces some redundancy, the consequences of function quantifiers taking scope will be seen to be welcome in section (4.2).

[3] While the examples given here employ only a single or no entity argument, the option of having more of them is left open; furthermore, $\vec{x}$ may also refer to an empty vector, so the definition also covers unskolemised choice functions.

If a $PSCF$ is centered, the set argument no more plays any role in determining its final result apart from specifying a set it needs to be contained in.[4] Centering solves the problems with choice-functional analyses of sentences like *every girl gave a flower to a boy she fancied* discussed by Geurts (2000): with non-centered PSCFs, a reading would be predicted that is true only if all girls that fancied the same boys also gave the flowers to the same boys. This kind of dependence/covariance with the set of fancied boys does not seem to be warranted and is eliminated by centering the PSCFs in that no variation of their values with the set argument is permitted at all. What is predicted is a thus wide scope reading for the indefinite according to which there is a boy whom all girls fancy and gave a flower to; I do not see any clear evidence that this reading is unavailable. The narrow-scope reading can be represented by assigning $\exists f$ narrow scope or by representing the dependence via entity arguments to the function. We can now assign to a sentence like *every child watched a different movie* the following representation

(7) $\exists f \forall x(C(x) \to W(x, f(M)(x)) \wedge \neg Im^{-}(f)(x)(Ct(f)(x)))$

where Im^{-} is defined as follows.

Definition 2 (Except-for-Image) $Im^{-}(f)(x) = \lambda z.\exists y : x \neq y \wedge \uparrow Ct(f)(y) = z$

So what (7) says is that there is some function f such that, for every girl x, $f(B)(x)$ is a book she read and there are no set and no individual distinct from x applied to which $Ct(f)$ is defined and has the same value. In particular thus, no girl is assigned the same book as x. This is the intended reading.

4 *Different* with Multiple Possible Antecedents

4.1 Extensional Contexts

(8) has at least the readings in (9).

(8) Every actor owes every loan shark a different sum.

(9) a. For every actor it holds: for every loan shark there is a different sum which the actor owes him.

b. For every loan shark it holds: for every actor there is different sum which he owes the loan shark.

These are straightforwardly represented as in (10)

(10) a. $\forall x(A(x) \to \exists f \forall y(L(y) \to O(x, y, f(S)(y)) \wedge$
$\neg Im^{-}(f)(y)(Ct(f)(y))))$

b. $\forall y(L(y) \to \exists f \forall x(A(x) \to O(x, y, f(S)(x)) \wedge$
$\neg Im^{-}(f)(x)(Ct(f)(x))))$

Table 1a shows a model of 10a and table 1b shows one of 10b.
More readings could be derived; e.g., $\exists f$ might take wide scope and f could then take one or both of the bound variables as arguments. All of these readings imply at least one of the readings in (10), which makes it difficult to tease them apart from these readings and prove or refute their autonomous existence.

4.2 Intensional Contexts

(11a) can be analysed as shown in (11b).

(11) a. Every girl believes that John read a different book.

b. $\exists f \forall x(G(x) \to BL(x, {}^{\wedge}R(j, f(B)(x)))$
$\neg Im^{-}(f)(x)(Ct(f)(x)))$

[4] It is an immediate consequence that $f(S)(x)$ and $f(S')(x)$ cannot both be defined if S and S' are disjoint; partiality is thus essential for centering to be possible at all.

owe	Matt	Ben
Crook	2000	2000
Lowlife	3000	4000

(a) A model of 10a

owe	Matt	Ben
Crook	2000	3000
Lowlife	2000	4000

(b) A model of 10b

bel. that saw	Mary	Sue
Pete	Jaws	Jaws
Rudy	Heat	Hook

(c) Verifies a reading of 13

bel. that saw	Mary	Sue
Pete	Jaws	Heat
Rudy	Jaws	Hook

(d) Does not verify a reading of 13

Table 1: Illustrative Models

And we can also provide an analysis of (4) as in (12).

(12) $\exists f \forall x (G(x) \rightarrow BL(x, {}^\wedge\forall y(B(y) \rightarrow R(y, f(P(y))(x)))) \wedge$
$\neg Im^{-}(f)(x)(Ct(f)(x)))$

For sentences like (13)

(13) Every girl thinks that every boy watched a different movie.

our theory lets us expect that we should find the scope order corresponding to (10a) but not that corresponding to (10b), as this would require embedded *every boy* to take wider scope than *every girl*. The prediction seems to be borne out: while table (1c) verifies the reading of (13) that corresponds to (10a), table (1d), which would verify a reading corresponding to (10b), does not in fact seem to verify any reading of (13) at all.

5 Accounting for the External Reading

Replacing $Im^{-}(f)(x)$ with $Sal(P)$ – the set of salient P – we can now also model the external reading of *different*.

(14) The teacher had recommended "Pulp Fiction" and "The Boondock Saints", but every child watched a different movie.

By whatever analysis of salience one prefers, one should get

$$Sal(M) = \{pulp\ fiction, the\ boondock\ saints\}$$

So (15), which is true in the given context if every child watched a movie that is neither Pulp Fiction nor The Boondock Saints, clearly expresses the desired truth conditions.

(15) $\exists f \forall x (C(x) \rightarrow W(x, f(M)(x)) \wedge \neg Sal(M)(Ct(f)(x)))$

References

Beck, Sigrid. 2000. The semantics of 'different': Comparison operator and relational adjective. *Linguistics and Philosophy* 23:101–139.

Brasoveanu, Adrian. 2011. Sentence-internal 'different' as quantifier-internal anaphora. *Linguistics and Philosophy* 34:93–168.

Bumford, Dylan, and Chris Barker. 2013. Association with distributivity and the problem of multiple antecedents for singular 'different'. *Linguistics and Philosophy* 36:355–369.

Carlson, Greg N. 1987. 'Same' and 'different': Some consequences for syntax and semantics. *Linguistics and Philosophy* 10:547–556.

Geurts, Bart. 2000. Indefinites and Choice Functions. *Linguistic Inquiry* 31:731–738. URL `https://muse.jhu.edu/article/20032`.