SOMETHING ELSE

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Abstract. The target of this paper is a compositional analysis of locutions like "somebody else" and "nobody else," as they may occur in an example like "Who gave what to whom? ..., and nobody anything to anybody else." Upon our account "else" is a modal predicate which holds of any individual which is not (yet) known to satisfy a contextually specified attribute.

The target of this paper is a compositional analysis of locutions like "somebody else" and "nobody else," as they may occur in an example like the following:

(1) Who gave what to whom? John a book to Mary, Jane a funny hat to some hippie, somebody else all her recordings of "Friends" to Denise, and nobody anything to anybody else.

Before we can actually come to an analysis, however, we first need to come up with a suitable interpretation of indefinite noun phrases. In section 1 we present a system of Predicate Logic with Anaphora (*PLA*), which, although it obviously stands in the tradition of systems of discourse representation and dynamic semantics, makes a most minimal and fully conservative extension of classical first order systems. In the second section we define topically restricted quantification. This is a formalization and generalization of Westerståhl's contextually restricted quantification, and at the same time a minimal reformulation of the type of topically restricted quantification developed by (Gawron 1996; Aloni et al. 1999). (A topic here can be the students who visited the party yesterday, but also the question who gave what to whom.) In section three we show how topical restriction can be used to give a fully general account of constituent answerhood.

Section 4 presents an interpretation of "else" from which a proper interpretation of in particular "somebody else" and "nobody else" can be derived in a compositional fashion. Upon our account "else" is a predicate which holds of any individual which is not (yet) known to satisfy a contextually specified attribute. The account is inspired by the exhaustivity operator from (Zeevat 1994), which says, at some point in a discourse, that apart from the answers given to a question, there are no other true answers. We present a deconstruction of Zeevat's exhaustivity operator, and show that combining "nobody" with the resulting "else," we get the required exhaustification effects, whereas the combination of "else" with "somebody" comes to mean that somebody else than those specified satisfies the contextually given attribute.

1. A Simple Satisfaction Semantics

The system of *PLA* has grown out of the tradition of discourse representation and dynamic interpretation but it tries to deviate from a classical semantics only minimally (cf., Dekker

2002). It is mainly inspired by (Stalnaker 1998) and sets out to formally develop the idea that indefinite noun phrases can be used with referential intentions, and that anaphoric pronouns can be coreferential with these indefinites by picking up individuals which may satisfy these intentions. As we will see in due course, these minimal deviations from a totally classical semantics are not key to the issues discussed in this paper, but yet they are relevant.

The language of *PLA* is like that of first order predicate logic except for the fact that it also contains a category of pronouns $P = \{\mathrm{p}_1, \mathrm{p}_2, \ldots\}$. For ease of exposition, we focus on a minimal language which is built up from variables, names, pronouns, $=$ and n-ary relation expressions, by means of negation $\neg$, existential quantification $\exists x$ and conjunction $\wedge$. As is usual, we use existentially quantified expressions to model indefinite noun phrases. Conditional sentences can be modeled using implication $\rightarrow$, defined by $(\phi \rightarrow \psi) \equiv \neg(\phi \wedge \neg\psi)$.

The semantic of *PLA* is spelled out as a satisfaction relation $\models$, which may hold between an ordinary first order model M, an ordinary variable assignment, and a sequence of individuals e on the one hand and a formula ϕ on the other. The sequences of individuals e are the possible referents of terms (indefinite and pronominal) in ϕ. Besides the use of these possible witnesses, the only deviation from a classical semantics is that we also take into account what is referred to as $n(\phi)$, the number of (surface) existentials in ϕ. It is defined as follows:

- $n(Rt_1 \ldots t_m) = 0 \qquad n(\exists x\phi) = n(\phi) + 1$
  $n(\neg\phi) = 0 \qquad n(\phi \wedge \psi) = n(\phi) + n(\psi)$

Satisfaction is defined as follows:

Definition 1 (Satisfaction in PLA)

- $[t]_{M,g,e} = M(c)$ if $t \equiv c \qquad [t]_{M,g,e} = g(x)$ if $t \equiv x \qquad [t]_{M,g,e} = e_i$ if $t \equiv \mathrm{p}_i$
- $M, g, e \models Rt_1 \ldots t_m$ iff $\langle [t_1]_{M,g,e}, \ldots, [t_m]_{M,g,e} \rangle \in M(R)$
  $M, g, e \models \neg\phi$ iff $M, g, ce \models \phi$ for no $c \in D^{n(\phi)}$
  $M, g, ce \models \phi \wedge \psi$ iff $M, g, e \models \phi$ and $M, g, ce \models \psi$, with $c \in D^{n(\psi)}$
  $M, g, de \models \exists x\phi$ iff $M, g[x/d], e \models \phi$ for $d \in D$
- $M, g, e \models \downarrow\phi$ iff $\exists c \in D^{n(\phi)}$: $M, g, ce \models \phi$

In *PLA* the so-called 'dynamics of interpretation' is located entirely in the dynamics of conjunction, which simply models the fact that if a conjunction is actually used, the first conjunct literally precedes the second. That is, the first conjunct is evaluated before the second conjunct has come up with its possible witnesses and the second after the first has done so. Thus, if a sequence e satisfies the referential intentions of (a use of) ϕ, and if an extension ce of e, where c satisfies the referential intentions of indefinites in a subsequent conjunct ψ, then the whole sequence ce also satisfies the conjunction of ϕ and ψ.

Before we turn to the two key features of *PLA*, the reader may observe that if we leave out pronouns and (existentially) quantify out witnesses, the semantics of *PLA* is totally standard. For ease of understanding the sequel, this possibility should be kept in mind.

It is interesting to see out how close indefinites and pronouns are in *PLA*. For, for instance:

Observation 1 (Indefinites and Pronouns)

- $M, g, e \models \exists x Fx$ iff $M, g, e \models F\mathrm{p}_1$
  $M, g, e \models \exists x \exists y Rxy$ iff $M, g, e \models R\mathrm{p}_1\mathrm{p}_2$

The difference between the two types of terms (indefinites and pronouns) resides entirely in the way they are used in processing conjunctions. Indefinites there can be seen to introduce 'new' referents, whereas pronouns refer back to 'old' ones. (Besides, indefinites are existentially quantified away under a negation, whereas pronouns, of course, are not. Just in order to be able to properly make this distinction, we have employed the number $n(\phi)$.)

PLA captures the basic results of discourse representation theory and dynamic semantics as can be seen by checking the following equivalences:

Observation 2 (Anaphoric Relations)

- $\exists x(Dx \wedge \exists y(Py \wedge Fxy)) \wedge L\mathrm{p}_1\mathrm{p}_2 \Leftrightarrow \exists x(Dx \wedge \exists y(Py \wedge Fxy \wedge Lxy))$
- $\exists x(Fx \wedge \exists y(Dy \wedge Oxy)) \rightarrow B\mathrm{p}_1\mathrm{p}_2 \Leftrightarrow \forall x(Fx \rightarrow \forall y((Dy \wedge Oxy) \rightarrow Bxy))$

Indeed, these formal equivalences corelate to the intuitive equivalence of the following examples, with our apologies for the worn-out second one:

(2) A diver found a pearl but she lost it again.
A diver lost a pearl she just found.

(3) If a farmer owns a donkey he beats it.
Every farmer beats every donkey he owns.

We will not go into the ins and outs of indefinites and anaphora here though, as these are not relevant to the main issues of this paper. For discussion and further extensions we refer to the paper mentioned above. The main point to observe here is that we have a solid grip on the witnesses which can be associated with certain terms. Besides, we must refer to (Dekker 2002) for derived notions of content, update and support. All these notions are easily defined in terms of *PLA*-satisfaction, and they can be defined independently.

2. Topically Restricted Quantification

In this section we introduce topics and topically restricted quantification. We give a most minimal, and we think most perspicuous reformulation of the rather involved notion put forward in (Gawron 1996; Aloni et al. 1999). We employ topics as the meanings of questions, where questions are formed, as is fairly usual, by putting a question marked sequence of variables for a formula. Thus, $?\vec{x}\phi$ is a question, where $\vec{x}$ is a (possibly empty) sequence of variables. If $\vec{x}$ is a sequence of i variables, we say that $q(?\vec{x}\phi) = i$. If $q(?\psi) = 0$, then $?\psi$ is a polar question.

In most semantic theories of questions, and in a lot of work on information structure, so-called abstracts are used to model or derive the meanings of questions or topics. We also use such entities as topics here. Just to keep matters simple, we stick to an extensional set up, in which topics are sets of sequences of individuals, so that in case of a polar issue it can only be either $\{\langle\rangle\} = \{\lambda\}$ or $\{\ \} = \emptyset$, which are the truth values 1 and 0, respectively. Formally, the definition runs as follows:

Definition 2 (Topics) • $[\![?\vec{x}\phi]\!]_{M,g,e} = \{c \in D^{q(?\vec{x}\phi)} \mid M, g[\vec{x}/c], e \models \downarrow\phi\}$
(where $g[\vec{x}/c] = g[x_1/c_1]\ldots[x_n/c_n]$)

It is easily observed that:

Observation 3 (*Wh*-phrases and Indefinites)

- $[\![?\vec{x}\phi]\!]_{M,g,e} = \{c \in D^{q(?\vec{x}\phi)} \mid M, g, ce \models \exists\vec{x}\downarrow\phi\}$

Thus, also *Wh*-phrases are very much like indefinites and again the two types of terms differ with respect to the different roles they play in discourse.

Having defined our abstracts, we can now turn to the issue of topically restricted quantification. What we offer will here is a generalization of the notion of contextually restricted quantification presented in (Westerståhl 1984), since it may concern sequences of quantifiers which are restricted by sets of sequences of individuals, as in (Gawron 1996; Aloni et al. 1999). At the same time, it is a vast simplification of the last, because topical information is not hung upon variables which are distributed over various 'information states,' but it is, rather, presented per se.

For the sake of simplicity, we assume that quantifiers respond to one topic only, and that they simultaneously address all arguments of a topic. That is, we will define $M, g, e \models_\alpha \exists\vec{x}\phi$, where α is an n-place topic restricting the values of $\vec{x} = x_1 \ldots x_n$ in ϕ. We restrict our attention to quantificational restrictions to single topics because this puts us in a better position to carefully define and study the interaction between quantifier and restrictor. Of course, in a more general model of dialogue we have to account for the process of "raising and resolving issues," to lend a term of (Hulstijn 2000). For that purpose we would have to introduce (possibly hierarchical) stacks of topics as in, e.g., (Büring 1999; Roberts 1995). However, for the purposes of this paper this is not necessary, and it would lead us astray from the main focus.

Topically restricted quantification is defined as follows:

Definition 3 (Topically Restricted Quantification)

- $M, g, ce \models_\alpha \exists\vec{x}\phi$ iff $c \in \alpha$ and $M, g[\vec{x}/c], e \models_\alpha \phi$

The definition of $\exists\vec{x}$ is like that of $\exists x$ but for the fact that witnesses for $\vec{x}$ must satisfy α. The following observations show topical restriction at work:

Observation 4 (Topical Restriction)

- $M, g, e \models_{?\vec{x}\phi} \exists\vec{y}\psi$ iff $M, g, e \models_{?\vec{x}\phi} \exists\vec{y}(\downarrow[\vec{y}/\vec{x}]\phi \wedge \psi)$
  $M, g, e \models_{?\vec{x}\phi} \forall\vec{y}\psi$ iff $M, g, e \models_{?\vec{x}\phi} \forall\vec{y}(\downarrow[\vec{y}/\vec{x}]\phi \rightarrow \psi)$

(Here, and in what follows, we will often use $[\![?\vec{x}\phi]\!]_{M,g,e}$ and $?\vec{x}\phi$ interchangably, whenever this is not likely to give rise to confusion.) Here is an example of how things work out. When we are discussing who were at the party, you may say:

(4) Some girl was absolutely fabulous, and all boys went mad.
$M, g, de \models_{?xPx} \exists\vec{x}(Gx_1 \wedge AFx_1) \wedge \forall\vec{y}(By_1 \rightarrow WMy_1)$ iff
$M, g, de \models \exists x((Px \wedge Gx) \wedge AFx) \wedge \forall y((Py \wedge By) \rightarrow WMy)$

So, "some girl" comes to mean "some girl who was at the party" and "all boys" "all boys who were at the party." It is important to note that this is not the general pattern though. If we are still discussing who were at the party, consider the following example with "only," assuming it denotes the superset relation:

(5) Only students drank beer.
$M, g, e \models_{?xPx} \forall\vec{x}(Sx_1 \leftarrow DBx_1)$ iff $M, g, e \models \forall x(Sx \leftarrow (Px \wedge DBx))$

"Only students" does *not*, unconditionally, come to mean "only students who were at the party. In the given context the whole sentence says, rather, that among those who were at the party, only students drank beer, as it should be. Similarly, and as has been observed in (Jäger 1996):

(6) Which Athenians are wise? Only Socrates is wise.
$M, g, e \models_{?x(Ax \wedge Wx)} \forall\vec{x}(x_1 = s \leftarrow Wx_1)$ iff $M, g, e \models \forall x(x = s \leftarrow (Ax \wedge Wx))$

In response to the given question, "Only Socrates is wise." does not say that Socrates is the only wise person in the universe (a 'blasphemy' according to Jäger), but, rather, that Socrates is the only wise Athenian.

A lot can, and has to, be added to the analysis of "which"-phrases and to the analysis of "only", but we will not do so here. Here we want to use topical restriction to contribute to a proper notion of answerhood.

In response to a single constituent topic, simple constituent answers like "John," "Not John," and "some girl" may count as (partial) answers:

(7) Who will come? John. / Not Mary. / An undergraduate.
$M, g, de \models_{?xCx} \exists\vec{x}(x_1 = j)$ iff $M, g, de \models \exists x(Cx \wedge (x = j))$ /
$M, g, e \models_{?xCx} \neg\exists\vec{x}(x_1 = m)$ iff $M, g, e \models \neg\exists x(Cx \wedge (x = m))$ /
$M, g, de \models_{?xCx} \exists\vec{x}Ux_1$ iff $M, g, de \models \exists x(Cx \wedge Ux)$

However, topical restriction and consituent answerhood are not the same. For instance, topical restriction of "All girls" affects the domain of the (universal) quantifier, as we saw above. When, however, "All girls." figures as a constituent answer to the question who will come, topical restriction of that quantifier does not make any sense. Topical restriction does play a role in constituent answerhood though, but, as we will see in the next section, it has to be applied in the right fashion.

3. Quantified Constituent Answers

Before we can give a suitable interpretation of quantified constituent answers, we of course have to introduce generalized quantifiers in the *PLA*-framework in the first place. All by itself, this is a routine enterprise, which, however, is complicated somewhat because we want to preserve the special treatment of indefinites. If it is acknowledged that all of the complications have to do with our treatment of indefinites and pronouns, however, it is easily established that, apart from that, our treatment is fully standard.

We extend *PLA* with first order abstraction and application, and with generalized quantifiers D (or determiners). For the sake of simplicity, we assume that there is only (polyadic) abstraction on formulas, and that abstracts are always applied to sequences of arguments sufficient to produce a formula again. Determiners are taken to denote the familiar relations $[\![D]\!]_{M,g,e}$ between pairs of sets of individuals. Determiners $\mathbf{D}$ will also be applied to sets, so that $\mathbf{D}(P)$ is that quantifier $\mathbf{T} = \{Q \mid \langle P, Q\rangle \in \mathbf{D}\}$. In order to treat multiple constituent answers, we will also use (keenian) compositions $T_1 \circ T_2$ of quantifiers (with T_1 an ordinary type $\langle 1\rangle$ quantifier, and T_2 of arbitrary type $\langle n\rangle$, i.e., a composition of n type $\langle 1\rangle$ quantifiers (cf. Keenan 1992).

A special determiner is $SOME$, the interpretation of which requires an associated witness: $[\![SOME]\!]_{M,g,de} = \{\langle P, Q\rangle \mid d \in (P \cap Q)\}$. We also use proper names $NAME_c$

which are true of a set iff it contains the value of the associated individual constant c: $[\![NAME_c]\!]_{M,g,de} = \{Q \mid [c]_{M,g,e} = d \in Q\}$. (Notice that it is not quite appropriate to treat proper names as indefinites, but for ease of exposition we skip the details necessary to improve upon things.) Furthermore, we have to extend the function $n(\bullet)$ to the new expressions in our language. In what follows D is short for determiner, T for quantifier, and π and ρ are set denoting expressions:

- $n(\phi) = n(\lambda\vec{x}\ \phi) = n((\lambda\vec{x}\ \phi)(t_1 \dots t_n))$
  $n(NAME) = 1$, $n(D) = 1$ if $D \equiv SOME$ and $n(D) = 0$ otherwise
  $n(D(\pi)) = 0$ if $n(D) = 0$ and $n(D(\pi)) = n(D) + n(\pi)$ otherwise
  $n(T(\rho)) = 0$ if $n(T) = 0$ and $n(T(\rho)) = n(T) + n(\rho)$ otherwise
  $n(T_1 \circ T_2) = 0$ if $n(T_1) = 0$ and $n(T_1 \circ T_2) = n(T_1) + n(T_2)$ otherwise

If $\vec{x}$ is a sequence of n variables, we let $l(\vec{x}) = n$. The interpretation of the new expressions is defined in the following way:

Definition 4 (Generalized Quantifiers in PLA)

- $[\![\lambda\vec{x}\ \phi]\!]_{M,g,e} = \{\vec{d} \in D^{l(\vec{x})} \mid M, g[\vec{x}/\vec{d}], e \models \phi\}$
  $M, g, e \models \beta(t_1 \dots t_n)$ iff $\langle [t_1]_{M,g,e}, \dots, [t_n]_{M,g,e}\rangle \in [\![\beta]\!]_{M,g,e}$

- $[\![D(\pi)]\!]_{M,g,e} = [\![D]\!]_{M,g,e}([\![\downarrow\pi]\!]_{M,g,e})$ if $n(D) = 0$
  $[\![D(\pi)]\!]_{M,g,dce} = [\![D]\!]_{M,g,de}([\![\pi]\!]_{M,g,ce})$ otherwise, with $c \in D^{n(\pi)}$
  $[\![T_1 \circ T_2]\!]_{M,g,e} = [\![T_1]\!]_{M,g,e} \circ [\![\downarrow T_2]\!]_{M,g,e}$ if $n(T_1) = 0$
  $[\![T_1 \circ T_2]\!]_{M,g,dace} = [\![T_1]\!]_{M,g,dce} \circ [\![T_2]\!]_{M,g,ace}$, otherwise and with $dc \in D^{n(T_1)}$ and $a \in D^{n(T_2)}$
  $M, g, e \models T(\rho)$ iff $[\![\downarrow\rho]\!]_{M,g,e} \in [\![T]\!]_{M,g,e}$ if $n(T) = 0$
  $M, g, dace \models T(\rho)$ iff $[\![\rho]\!]_{M,g,ace} \in [\![T]\!]_{M,g,dce}$ otherwise, and with $dc \in D^{n(T)}$ and $a \in D^{n(\rho)}$

with, for α a set denoting expression, $[\![\downarrow\alpha]\!]_{M,g,e} = \{b \mid \exists c \in D^{n(\alpha)}\colon\ b \in [\![\alpha]\!]_{M,g,ce}\}$

It is easily verified that all of this is standard apart from the use of $n(\bullet)$, of $\downarrow$, and of sequences of witnesses. Proper names and indefinites still behave like they did before:

Observation 5 (Indefinites and names)

- $JOHN(\lambda x\psi) \Leftrightarrow \exists x(x = j \wedge \psi)$
  $SOME(\lambda x\phi)(\lambda x\psi) \Leftrightarrow \exists x(\phi \wedge \psi)$

Now we have got our quantifiers on board, we can give a fully general definition of a (quantified) constituent answer:

Definition 5 (Constituent Answers in PLA)

- $ANS(T_1 \dots T_n) \equiv (T_1 \circ \dots \circ T_n)(\lambda\vec{y} \downarrow\exists\vec{x} \bigwedge_{1\leq i\leq n}(x_i = y_i))$ (with $l(\vec{y}) = n$)

The interpretation of ANS is relatively straightforward. If a sequence of n quantifiers answers an n-place question, we take the composition of the quantifiers and we feed it the property or relation questioned by means of topical restriction in their nuclear scope. For observe that, if there is no other context dependence in the sequence of quantifiers:

Observation 6 (Topically Restricted Constituent Answers)

- $M, g, e \models_{?\vec{x}\phi} ANS(T_1 \ldots T_n)$ iff $M, g, e \models (T_1 \circ \ldots \circ T_n)(\lambda\vec{x}\phi)$

Let us illustrate this observation with a couple of examples:

(8) Who will come? John. / A boy. / Every student. / Only undergraduates.
$M, g, de \models_{?xCx} ANS(JOHN)$ iff $M, g, de \models \exists x((x = j) \wedge Cx)$
$M, g, de \models_{?xCx} ANS(SOME(B))$ iff $M, g, de \models \exists x(Bx \wedge Cx)$
$M, g, e \models_{?xCx} ANS(ALL(S))$ iff $M, g, e \models \forall x(Sx \rightarrow Cx)$
$M, g, e \models_{?xCx} ANS(ONLY(U))$ iff $M, g, e \models \forall z(Uz \leftarrow Cz)$

(9) Who gave what to whom? Mary a picture to a boy. / Every boy no CD to any girl.
$M, g, mbde \models_{?xyzGxyz} ANS(MARY \circ SOME(P) \circ SOME(B))$ iff
$M, g, mbde \models \exists x((x = m) \wedge \exists y(Py \wedge \exists z(Bz \wedge Gxyz)))$
$M, g, e \models_{?xyzGxyz} ANS(ALL(B) \circ NO(CD) \circ SOME(G))$ iff
$M, g, e \models \forall x(Bx \rightarrow \neg\exists y(CDy \wedge \exists z(Gz \wedge Gxyz)))$

These examples may serve to show that, indeed, topical restriction, when properly used, is the right tool to deal with constituent answerhood and I think I have not seen any more transparent analyses in the literature.

4. Something Else

Finally the time has come for us to focus on the main subject of this paper, the interpretation of "else." Like we said the one we have in mind is inspired by (Zeevat 1994)'s exhaustivity operator. After a list of (partial) answers to some question Zeevat's exhaustifier says that all possible answers to the question which are not asserted yet are not true. This exhaustification can be naturally expressed by "And nobody else." But, of course, we may as well say, "And somebody else." and this we take to be good motivation to deconstruct Zeevat's analysis in terms of independently defined notions of "else," "nobody," and "somebody." Just to keep the analysis most general, we give *ELSE* the following cross-categorial interpretation:

Definition 6 (ELSE) • $ELSE \equiv \lambda\vec{y}\ \Diamond\forall\vec{x}(\vec{x} \neq \vec{y})$

The $\Diamond$ here is an ordinary modal operator which refers to the current state of discourse, as it has been established publicly. (So we interpret $\Diamond$ as an ordinary modality here, which of course changes its meaning over time; alternatively we could have explained it away using Veltman's epistemic modality by turning our satisfaction semantics into a content related update semantics. See (Dekker 2002) for the details of this.) The embedded inequality $\vec{x} \neq \vec{y}$ is, simply, the negation of the conjunction of $x_i = y_i$ for $1 \leq i \leq n$. Relative to a topic α, *ELSE*, thus, holds of any n-tuple of individuals which, in the current state of the discourse, is not known (asserted, claimed, ...) to belong to α.

In case of a single constituent issue like, for instance, who where at the party, *ELSE* holds of any individual which, in the current state of discourse, is not asserted or implied to have been there:

Observation 7 (One Constituent Else)

- $M, g, e \models_{?xPx} ELSEy$ iff $M, g, e \models \Diamond\neg Py$

Combining *ELSE* with *SOME* and *NO* shows we get the desired results for "Somebody else." and "Nobody else." as constituent answers. The constituent answer interpretation of "Somebody else." turns out to be the following:

Observation 8 (Somebody Else)

- $ANS(SOME(ELSE)) \Leftrightarrow \exists y(\Diamond\forall\vec{x}(x_1 \neq y) \wedge \exists\vec{x}(x_1 = y))$

(10) Who will come? John, an undergraduate, and somebody else.
$M, g, duje \models_{?xCx} \exists\vec{x}(x_1 = j) \wedge \exists\vec{x}Ux_1 \wedge \exists z(\Diamond\forall\vec{x}(x_1 \neq z) \wedge \exists\vec{x}(x_1 = z))$ iff
$M, g, duje \models \exists x((x = j) \wedge Cx) \wedge \exists y(Uy \wedge Cy) \wedge \exists z((\mathrm{p}_1 \neq z \neq \mathrm{p}_2) \wedge Cy)$

This example may also serve to show why we started out with a system like *PLA* in the first place, even though this invoked all the complications with introducing quantifiers. For it is only because indefinites are associated with witnesses that "Somebody else." here means, among others, "Somebody else than that student." This will be even more interesting when we turn to "Nobody else.":

Observation 9 (Nobody Else)

- $ANS(NO(ELSE)) \Leftrightarrow \neg\exists y(\Diamond\forall\vec{x}(x_1 \neq y) \wedge \exists\vec{x}(x_1 = y))$

(11) Who will come? An undergraduate and nobody else.
$M, g, ue \models_{?xCx} \exists\vec{x}Ux_1 \wedge \neg\exists z(\Diamond\forall\vec{x}(x_1 \neq z) \wedge \exists\vec{x}(x_1 = z))$ iff
$M, g, ue \models \exists y(Uy \wedge Cy) \wedge \forall z((\mathrm{p}_1 \neq z) \rightarrow \neg Cz)$

"Nobody else." here means "Nobody else besides the mentioned student." Indeed, if we had not assumed that indefinites are associated with witnesses, then example (11) would have turned out to be inconsistent, as the reader may verify.

Before we turn to the polyadic uses of "else" one further comments is in order here. We have silently assumed that a rigid interpretation of proper names here. Let us first observe that we can easily drop this assumption if we also allow variables to range over conceptual covers as in (Aloni 2001). Besides, our "else" is sensitive to the agents' knowledge about and conception of the domain of quantification. To make the reader appreciate this point, note that we render the following answer consistent:

(12) Who will come? John, all undergraduates, and somebody else.
But maybe that is an undergraduate as well.

For it may not be common knowledge who exactly the undergraduates are. For the same reason, if we don't know exactly who the undergraduates are, and if John is known not to be identical to Jane, the following inference is valid:

(13) Who will come? John, all undergraduates, and nobody else.
So if Jane comes she must be an undergraduate.

So far we have focused on "else" in response to single constituent issues. In response to multi-constituent issues "else" can be used in two ways. In the following observation we assume that the first use of "else" associates with the first position of a question and the second use with the second position:

Observation 10 (Nobody Else ∘ Anybody Else)

- $ANS(NO(ELSE_1) \circ SOME(ELSE_2)) \Leftrightarrow$
$\neg\exists y(\Diamond\forall\vec{x}(x_1 \neq y) \wedge \exists z(\Diamond\forall\vec{x}(x_2 \neq z) \wedge \exists\vec{x}((x_1 = y) \wedge (x_2 = z))))$

Relative to the question "Which boy saw which girl?" this means that no boy other than those mentioned saw a girl different from those mentioned:

(14) John Mary, Pete Gretha and nobody else anybody else.

$M, g, pgjme \models_{?xy\ Bx \wedge Gy \wedge Sxy}$ (14) iff

$M, g, e \models (Bj \wedge Gm \wedge Sjm) \wedge (Bp \wedge Gg \wedge Spg) \wedge$
$\neg\exists x \exists y((j \neq x \neq p) \wedge (m \neq y \neq g) \wedge (Bx \wedge Gy \wedge Sxy))$

The quasi-exhaustifying answer says that if you go beyond the set consisting of John and Peter, then you will not find any boy who saw any girl beyond the set consisting of Mary and Gretha. This is appropriate. But notice that this is not a truly exhaustifying answer because it is consistent to add, e.g.:

(15) But Bart saw Mary, too, and Pete also saw Evelyn.

Bart is indeed somebody else$_1$, but the girl he saw was not anybody else$_2$. Similarly for Evelyn, somebody else$_2$, who was seen by Pete, not anybody else$_1$. It is for a truly exhaustifying answer that we need polyadic else. Consider the polyadic constituent answer "(Nobody anybody) else.":

Observation 11 (Nobody ∘ Anybody Else)

- $ANS((NO \circ SOME)(ELSE)) \Leftrightarrow \neg\exists y \exists z(\Diamond\forall\vec{x}(x_1x_2 \neq yz) \wedge \exists\vec{x}(x_1x_2 = yz))$

We find:

(16) John Mary, Pete Gretha and nobody anybody else.

$M, g, pgjme \models_{?xy\ Bx \wedge Gy \wedge Sxy}$ (16) iff

$M, g, e \models \forall x \forall y((Bx \wedge Gy \wedge Sxy) \leftrightarrow ((x = j \wedge y = m) \vee (x = p \wedge y = g)))$

Upon the analysis given, "else," in combination with "no," may serve to express that a list of (multiple) constituent answers indeed exhausts the interpretation of a given (multiple) constituent question, this in an entirely compositional fashion.

5. Conclusion

We have gone quite a way to arrive at a compositional analysis of "else." We have started out from an independently motivated satisfaction semantics *PLA*, we have added a traditional notion of a topic, we have added generalized quantifiers, and we then have given a single notion of constituent answerhood. Armed with these tools, we have formulated a single, polyadic, interpretation of "else" which has been shown to behave as required in constructions like "Somebody else," "Nobody else," and "Nobody somebody else." To conclude this paper, we want to simply mention two further subjects that suggest itself, and add a final observation.

First, of course a system of interpretation like the one given here calls for a extension which accounts for the earlier mentioned process of raising and resolving issues. But *that* is a boring and routine exercise once we have a good idea of the intricate interaction between topical restriction and constituent answerhood. Actually giving an update reformulation, and actually using stacks, is an 'off the shelve' enterprise. Second, much more interesting it is to look indeed at the interaction between "else" and the knowledge of the participants of the domain of quantification. Unfortunately we must leave that for another occasion. We want to end, finally, with an inspiring observation. Since both *ANS* and *ELSE* are defined as n-place predicates, they have zero-place instances. Interestingly, these correspond to affirm ("Yes.") and deny ("No.") respectively. For:

Observation 12 (Zero-Constituent ANS and ELSE)

- $ANS_0 \;\Leftrightarrow \lambda \downarrow\exists\top \;\Leftrightarrow \exists\top$
  $ELSE_0 \Leftrightarrow \lambda \Diamond\forall\bot \Leftrightarrow \neg\exists\top$

(17) Is it raining? Yes.
$M, g, e \models_{?p} ANS$ iff $M, g, e \models_{?p} \exists\top$ iff $\lambda \in [\![?p]\!]_{M,g,e}$ iff $M, g, e \models p$

(18) Is it raining? No.
$M, g, e \models_{?p} ELSE$ iff $M, g, e \models_{?p} \neg\exists\top$ iff $\lambda \notin [\![?p]\!]_{M,g,e}$ iff $M, g, e \not\models p$

The proper treatment of "Yes" and "No" has been a matter of struggle and debate in the literature. Here they just fall into place as the simplest borderline case—as it should be.

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