Reducing order-insensitivity in pronouns to accommodation

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I. Introduction: As noted in Heim (1990) and references therein, pronouns anteceded by definites (class R, see (1)) sytematically differ from pronouns anteceded by indefinites (class I, see (2)). For instance, class R allows the anaphora to preceed its antecedent. Class I does not, yielding the familiar cross-over effects (Chierchia, 1995; Engdahl, 1988).

(1) a. The person who interviewed her$_1$ said [the candidate]$_1$ was a good fit.
b. The fool who burnt it$_1$ mocked the wise man who saved [his paycheck]$_1$.

(2) a. # Her$_1$ mother likes some boy or other$_1$.
b. # It$_1$ kicked every farmer who owns a donkey$_1$.

In frameworks with built-in order-sensitivity, such as Dynamic Semantics (Groenendijk & Stokhof, 1991), accounting for the free pronoun-antecedent orderings of class R is challenging. Crossing dependencies even suggest that no amount of reordering at LF can create a structure where all pronouns are correctly ordered with respect to their antecedents, as required for proper interpretation in Dynamic Semantics.

(3) The$_1$ man who loved her$_2$ kissed the$_2$ woman who wrote to him$_1$. (Karttunen, 1971)

Our goal is to rescue an order-sensitive grammar for anaphoras from these puzzles. We do so by denying that Class R involves real antecedent-pronoun relations. Rather, we propose a formalization of Heim (1982)'s system whereby definites are anaphors with descriptive content, whose referent can be accommodated. The system predicts the possibility and licensing conditions of paycheck pronouns Jacobson (2000) and crossing dependencies.

II. Set-up: To deal with functional anaphoras (e.g. paycheck), we make use of complex indices (Sudo, 2014, and references within), such as 7(2). Simple indices are interpreted standardly (e.g. $[\![\text{pro}_2]\!]^g = g(2)$) and complex indices are interpreted as in (4).

(4) $[\![\text{pro}_{7(2)}]\!]^g = g(7)[g(2)]$

Following our assumptions, we treat definite descriptions as indices with a presupposed descriptive content, as in (5).

(5) $[\![\text{the}_i\ \alpha]\!]^g = g(i)$ (**presupposition:** $g(i) \in [\![\alpha]\!]^g$)

III. Accommodation: Since definites are anaphoric, the referents of novel first-mention definites must be accommodated. Following Heim (1982), the accomodation procedure is governed by the following principle.

> **Unique accomodation** If current g fails to meet the conditions on context imposed by a sentence S, replace g with g' where g' is the minimal extension of g that satisfies these conditions. If no such unique minimal extension exists, the accommodation cannot take place.

Minimal extensions are defined in a way that suits both individual and functional referents.

(6) a. **Order:** $g \prec g'$ iff $\mathbf{dom}(g) \subset \mathbf{dom}(g')$ and for all indices i:
- if $g(i)$ is an individual, $g(i) = g'(i)$
- if $g(i)$ is a function, $\mathbf{dom}(g(i)) \subset \mathbf{dom}(g'(i))$ and $g(i)$ and $g'(i)$ coincide where both are defined.

b. **Minimal extension:** g' is a minimal extension of g satisfying C if there is no $g'' \neq g'$ satisfying C such that $g'' \prec g'$.

The unique minimal extension principle will be satisfied in (7) if and only if there exists a unique chancellor, amounting to the standard Fregean presuppositions of the definite.

(7) [The$_3$ emperor of Japan] came (**pres.**: $3 \in \mathbf{dom}(g)$ and $g(3)$ is an emperor of Japan)
   a. **initial context:** $g = [1 \to \text{Sue}]$
   unique minimal extension: $g' = [1 \to \text{Sue}, 3 \to \text{Akihito}]$

For (subordinated) paycheck sentences like (8), our notion of minimal extension for functions will ensure that there will be only one minimal extension of the initial context iff each cat played with just one toy. In that case, the function in (9) is accomodated as the value of $g(3)$.

(8) a. Every cat λ_2. bit [the$_{3(2)}$ toy that it$_2$ played with].
   b. Most of them λ_1. licked it$_{3(1)}$ as well.

(9) $\mathbf{dom}(g(3)) = [\![\text{cat}]\!]$
$\forall x \in [\![\text{cat}]\!], g(3)(x) = \iota y : x$ is a toy that x played with

In the case of cross-dependencies like (10), a unique minimal extension exists iff if there is one man-woman pair such that the man loves the woman and the woman wrote to the man; this presupposition matches the predictions of Keenan (1972).

(10) a. The$_1$ man who loved her$_2$ kissed the$_2$ woman who wrote to him$_1$.
   b. **presupposition:** $1,2 \in \mathbf{dom}(g)$ and [$g(1)$ is a man] and [$g(1)$ loves $g(2)$] and [$g(2)$ is a woman] and [$g(2)$ wrote to $g(1)$]

IV. The role of focus: This account seems to fail to extend to other paycheck dependencies where the pronoun's binder (i.e. *Albert*) is not a subset of the antecedent's binder (i.e. *Josh*). Indeed, the minimal accomodation of *his paycheck* yields a function mapping Josh to his paycheck and undefined elsewhere. Such function cannot map Albert to his paycheck in (11b).

(11) a. Josh$_F$ λ_1 got his$_{3(1)}$ paycheck $\sim \mathscr{C}$. b. Albert$_F$ λ_2 got it$_{3(2)}$ (too)$_F \sim \mathscr{C}$
   c. $[\![\alpha \sim \mathscr{C}]\!]^g$ defined iff $[\![\alpha]\!]^g \in \mathscr{C}$ and $\mathscr{C} \subset [\![\alpha]\!]^g_{\text{focus}}$; denotes $[\![\alpha]\!]$ when defined.

This issue can be solved building on Keshet (2011)'s observation that paycheck sentences such as (11) are only felicitous in contrastive focal constructions. Following him, we assume that parallelism is enforced by $\sim$ operators. Our account departs from Keshet (2011) in that our denotation for $\sim$ is standard (see (11), Rooth (1985)) and does not modify the assignment function.

(12) a. $[\![(11)]\!]^g_{\text{focus}} = \{\lambda w : g(3)(y) \text{ is a paycheck of } y.\ y \text{ got } g(3)(y) \mid y \in D_e\} =: F_1$
$[\![(11)]\!]^g_{\text{focus}} = \{\lambda w.\ y \text{ got } g(3)(y) \mid y \in D_e\} =: F_2$
   b. **Presuppostions:** $\mathscr{C} \subset F_1$ and $\mathscr{C} \subset F_2$ and $(\lambda w.$ Albert bought $g(3)(y)) \in \mathscr{C}$ and $(\lambda w.$ Josh bought $g(3)(y)[g(3)(y)$ is a paycheck of $y]) \in \mathscr{C}$

By (12b), $\mathscr{C}$ is a set of the form $\{\lambda w : g(3)(y) \text{ is a paycheck of } y.\ y \text{ got } g(3)(y) \mid y \in E\}$, where $E \subset D_e$. A minimal extension of the initial context can be found iff each member of E has a unique paycheck. The accommodated value for $g(3)$ is the function mapping every element of E to their paycheck (undefined elsewhere). The condition in (12b) implies that E contains Albert and Josh. Therefore, the function $g(3)$ will be defined for these individuals, eliminating the problem posed by non-subordinated paycheck sentences.

V. Conclusion: The account we proposed reduces backward anaphora to cases of referent accomodation. This allows for a grammar for anaphora that is uniformly left-to-right, as proposed in Dynamic Semantics. The resulting system has the added advantage of accounting for paycheck pronouns and crossing dependencies, which have proven difficult for dynamic approaches (Elbourne, 2005).