Donkey Sentences

The problem of 'donkey sentences' occupies a prominent place in the logical analysis of natural language sentences. The purpose of logical analysis in the study of language is to assign to sentences a structure suitable for logical calculus (i.e., the formally defined preservation of truth through a series of sentences). Such structure assignments usually take the form of a 'translation' of sentence structures into propositions in some accepted variety of predicate calculus (see *Predicate Calculus*) or quantification theory (see *Quantification, Collective and Distributive*).

Modern predicate calculus or quantification theory, insofar as it remains purely extensional, is such that a term in a proposition that has a truth-value in some world W must either be an expression referring to an individual (or set of individuals) that really exists when W really exists, or else be a bound variable. Modern predicate calculus leaves no other choice. (A propositional language is 'extensional' just in case it allows in all cases for substitution of co-extensional constituents *salva veritate*.) Russell (1905; see *Russell, Bertrand*) proposed his theory of descriptions precisely in order to get rid of the logical problems arising as a result of natural language expressions that have the appearance of referring expressions but fail to refer (as in his famous example 'The present king of France is bald'). It now appears that the very same problem still rears its head: there are natural language sentences whose logical analysis is considered to result in purely extensional propositions but which can be true or false in W even though they contain one or more terms that neither refer to an existing individual nor allow for an analysis as bound variable. Natural language thus seems to resist analysis in terms of modern predicate calculus or quantification theory.

It was the British philosopher Peter Thomas Geach (see *Geach, Peter Thomas*) who first adumbrated this problem, without, however, getting it into sharp focus. He deals with it for the first time in his book *Reference and Generality* (1962), in the context of the question of how to translate pronouns into a properly regimented logical language. In dealing with this problem he typically uses as examples sentences containing mention of a donkey. Hence the name donkey sentences. If, he says (1962: 116–18), the subject expressions in sentences like (1) and (2):

Any man who owns a donkey beats it. (1)

Some man who owns a donkey does not beat it. (2)

are taken to be structural constituents in logical analysis, the pronoun *it* 'is deprived of an antecedent.' A solution, he says (p. 118), might be found in rewording these sentences as, respectively (3) and (4):

Any man, if he owns a donkey, beats it. (3)

Some man owns a donkey and he does not beat it. (4)

where *it* allows for a translation as a bound variable. But now there is a translation problem, since 'now the ostensible complex term has upon analysis quite disappeared.' (Apparently, Geach sets greater store by the structural properties of natural language sentences than Russell did.) The problem crops up again on pp. 128–30, again in the context of logical translation. Here he gives the sentences (5)–(7):

If any man owns a donkey, he beats it. (5)

If Smith owns a donkey, he beats it. (6)

Either Smith does not own a donkey or he beats it. (7)

Again, a solution would seem to require a thorough restructuring of the problematic sentences, creating the artificial predicate 'either-does-not-own-or-beats any donkey,' whose subject can then be *any man* or *Smith*. All this, however, is still more or less beating about the bush.

The real problem comes to a head in the example sentences (6) and (7) just given. Both these sentences should translate as strictly extensional propositions (they contain no nonextensional elements). In the standard logical analysis of the truth-functions *if* and *or* they come out as true if Smith owns no donkey. Now, *it* cannot be translated as a referring expression (*the donkey*) as it lacks a referent. It should therefore be translatable as a bound variable. But then, too, there are severe and probably insurmountable problems.

One obvious thought (Geach 1962: 17) is to apply an extended analysis to (6) and (7), which would then be rephrased as (8) and (9), respectively:

If Smith owns a donkey, he owns a donkey and beats it. (8)

Either Smith does not own a donkey or he owns a donkey and beats it. (9)

In *Logic Matters* (1972: 115–27) Geach argues that a sentence of the form *Smith owns a donkey and he beats it* should not be translated as a conjunction of two propositions, i.e., as the form $A \wedge B$, but rather as, using restricted quantification, $(\exists x)$ donkey $[\text{Own}(\text{Smith}, x) \wedge \text{Beat}(\text{Smith}, x)]$, i.e., as a quantified construction, with *it* translated as a bound variable. This, however, cannot be a solution, as this analysis makes (8) and (9) true if Smith owns two donkeys and beats only one of them, whereas (6) and (7), in their normal interpretation, must be considered false in such a case (Geach 1962: 117–8). Examples (8) and (9) are thus not equivalent with (6) and (7). Moreover, as was pointed out in Seuren (1977), the analysis itself as proposed in

Geach (1972) lacks generality in view of such cases as (10):

> It's a good thing that Smith owns a donkey, but it's a bad (10)
> thing that he beats it.

where treatment of *it* as a bound variable leads to insurmountable scope problems. This particular approach should therefore be considered unsuccessful.

Another obvious thought is to translate *a donkey* in (6) and (7) as a universally quantified constituent, leading to, respectively (11) and (12):

$$\forall x[Donkey(x) \wedge Own(Smith, x) \rightarrow Beat(Smith, x)]. \tag{11}$$

$$\forall x[Donkey(x) \rightarrow [\neg Own(Smith, x) \vee Beat(Smith, x)]]. \tag{12}$$

This, however, is ad hoc and thus inevitably leads to a lack of generality in the translation procedure, as appears from cases like (13) and (14), which, again, lead to insurmountable scope problems under this analysis:

> If it's a good thing that Smith owns a donkey, it's a bad (13)
> thing that he beats it.

> Either Smith no longer owns a donkey or he still (14)
> beats it.

It thus seems that, even if radical restructuring is allowed in logical translations, there is a hard core of extensional sentences, such as (6) and (7), that resist semantically equivalent translation into any accepted variety of modern predicate calculus. These sentences contain definite expressions, preferably pronouns, which are neither referring expressions nor bound variables.

It must be noted, in this connection, that the grammatical behavior of these pronouns is that of anaphoric pronouns (see *Anaphora*): referring expressions anaphorically linked up with an antecedent, and not that of bound variable pronouns (or of reflexive pronouns, which are not at issue here). These two categories differ, among other things, in that the former allow for substitution by a lexical noun phrase, whereas the latter do not. Thus, *it* in (15), (16), and (17) can be replaced by, for example, *the animal*, without any change in meaning, but *it* in (18) does not allow for such substitution (15)–(18):

> Smith owns a donkey and he beats it/the animal. (15)

> If Smith owns a donkey he beats it/the animal. (16)

> Either Smith does not own a donkey or he beats it/the animal. (17)

> Every donkey owned by Smith fears that Smith will (18)
> beat it /*the animal.

The difference is that *it* in (18) functions as a bound variable, whereas in (15)–(17) it does not.

The problematic pronouns thus behave like referring expressions even though they cannot be, and their analysis as bound variables meets with systematic failure. Kamp (1981) recognized the fundamental nature of this problem and proposed a radical departure from standard notions and techniques of semantic interpretation. He defends an analysis whereby the donkey pronouns and other definite expressions in extensional sentences do not 'refer' directly to real entities in the world at hand, but instead 'denote' mental representations of possibly real world entities. In this theory, known as discourse representation theory (see *Discourse Representation Theory*), the mechanism of reference is mediated by a cognitive system of mental representations, whose relation to any actual world is a matter of

independent concern. The insertion of this halfway station of mental representations creates some extra room for a semantic account of donkey sentences. Even so, however, it must be recognized that standard logical analyses are inadequate for natural language. What logic will do better justice to the facts of language is therefore still an open question. Groenendijk and Stokhof (1991) is an attempt at answering it.

See also: Anaphora; Formal Semantics; Discourse Representation Theory; Discourse Semantics; Reference, Philosophical Issues concerning.

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P. A. M. Seuren