HOW TO GET THROUGH WITHOUT DAVIDSON'S TREATMENT OF ADVERBS

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1. Intuitive deductions with adverbial constructions

Certain adverbial constructions seem to create difficulties. There are intuitive deductions concerning adverbs and prepositional phrases, which are not easily translatable into the formal language of first-order logic; at least the ways of translating them are open to discussion. Thus from:

Brutus stabbed Caesar violently (1)

or from:

Brutus stabbed Caesar with a (given) knife (2)

or from:

Brutus stabbed Caesar violently with a knife (3)

we deduce intuitively:

Brutus stabbed Caesar. (4)

Is there a (more of less) general tratment to express and to justify this type of deductions in first-order logic?

Such a treatment exists since a long time and, in my opinion, it works quite well *under normal conditions*. In section 2, we will see its application to elementary cases and compare it, in section 3, with Davidson's treatment, also for more complex cases. However, not all adverbial constructions have the same function in a sentence, conditions are not always "normal". For certain special cases, e.g. concerning propositional attitudes, the standard treatment can still be applied, if we are dispossed to enlarge our universe of discourse to what has been called an "intensional universe". This will be seen in section 4, where Davidson's events are compared whit the eventualities of the intensional universes. I do not pretend that, whit this, all adverbial constructions are covered; but at least we can examine the related problems by trying to classify the adverbial constructions. Section 5 presents such a classification and shows how far we can go, in each case, with the standard treatment.

Frequently, in this paper, comparisons are made with Davidson's treatment; the so-called "predicate modifier theory" and special modal systems, which go beyond first-order logic, will not be considered.

THEORIA - Segunda Época - Vol. VIII
1993, Nº 19, 127-133

2. The standard treatment

Let us see how the example of the intuitive deduction will be handled in the standard treatment. For the implication which goes from (3) to (4), we take "stabbing" as a four-place predicate and interpret (4) as including implicitly "in some way" and "with something". This gives (with *S* for stabbing, *b* for Brutus, etc.):

$$Sbcvk \qquad (3')$$

implies:

$$(\mathrm{E}x)(\mathrm{E}y)Sbcxy \qquad (4')$$

The same treatment applies to (1') ("$(\mathrm{E}y)Sbcvy$") and to (2') ("$(\mathrm{E}x)Sbcxk$" or, if we have "with *some* knife", "$(\mathrm{E}z)(\mathrm{E}x)(Kz \wedge Sbcxz)$").

In general, *from a logical point of view*, a sentence is not analysed alone, but together with other sentences which constitute a given context (e.g. a supposed deduction). According to this context, "stabbing" may be two-place or three-place or... The number of argument places must be sufficiently large to allow a throughgoing analysis, but economical reasons (in Occam's sense) will limit it to those places which are instructive in the given context.

If sentences like (4) were interpreted as Brutus's stabbing Caesar *with nothing at all*, we could not deduce (4) from (3) or from (2).

3. Davidson's treatment

For Davidson (see [3] in the bibliography) the mentioned example is treated quite differently. He considers that predicates are ostensibly n-place ("stabbing" would be two-place) and transforms them into predicates with n+1 argument places, where the additional place is occupied by an individual term which corresponds to "events". Adverbs and prepositional phrases should then be taken as expressing properties and relations concerning these events. Thus we get:

$$(\mathrm{E}d)(Sbcd \wedge Vd)^1 \qquad (1'')$$

"There is an event *d* which is the stabbing by Brutus of Caesar and *d* is violent" and:

$$(\mathrm{E}d)(Sbcd \wedge (\mathrm{E}z)(Kz \wedge Wzd)$$
$$(2'')$$

"... and *d* is done with some knife *z*" and:

$$(\mathrm{E}d)(Sbcd \wedge Vd \wedge (\mathrm{E}z)(Kz \wedge Wzd)) \qquad (3'')$$

which each implies by first-order logic:

$$(\mathrm{E}d)Sbcd \qquad (4'')$$

One could criticize Davidson for the introduction of events, which may be violent or with a knife, etc. I will not do this, because violent events and a violent way (the treatment proposed in this paper) are open to the same criticism. In both cases, the universe of discourse will contain not only really existing individuals (whatever "really existing" means).

My criticism is that Davidson's treatment is unnecessarily complicated and does not cover a number of cases which should be covered by a general theory. Some examples will show this.

The first case is a certain form of negation. Setting aside the artificial "Brutus violently did not stab Caesar", we can have the quite natural:

Brutus resentfully did not go to the party (5)

In the treatment presented here we get without problems:

$-Gbpr^2$ (5')

while Davidson would refuse to form a d corresponding to $-G$.

Another case is a conjunction of the type (see [12]):

Shem hit shaun (at the moment m_1) violently with a shillelagh and not violently with a cudgel. (6)

This sentence corresponds to a physical possibility (Shem has two hands) and seems linguistically quite acceptable. If we formalize it according to Davidson's treatment, at least if no special devices are introduced, we have a single event d which is violent and not violent, i.e. we get a contradiction. In the treatment presented here we have, without problems, (with W for ways, V for what is violent, S for shillelaghs, s for Shem, a for Shaun, etc.):

$$(\mathrm{E}x)(\mathrm{E}y)(Wx \wedge Vx \wedge Sy \wedge Hsam_1\, xy) \wedge (\mathrm{E}z)(\mathrm{E}u)(Wz \wedge \sim Vz \wedge Cu \wedge Hsam_1\, zu) \quad (6')$$

4. Intention and intension

Davidson excludes explicitly from his treatment the adverbs that impute intention (like "intentionally" in "Brutus intentionally did not stab Caesar") and that are, thus, more or less related to propositional attitudes and to epistemic logic.

However we can treat this type of adverbs (without the apparatus of modal systems which go beyond first-order logic) by using intensional universes (see [5] and [8]). These universes of discourse have been developed in order to analyse epistemic problems in first-order logic, i.e. they are not *ad hoc* constructions introduced for the treatmentof adverbs. The intensional universes have more than one individual for each individual of the usual universes. More precisely, if *according to a given context* two individual expressions are considered as having different intensions, then the corresponding individuals will be treated as being different. All of them could be included in the enlarged universes. We may have:

Caesar (c) $\neq$ the first lover of Cleopatra (l)

although in the usual universes both are supposed to be identical (we might introduce an additional two-place predicate "$=_e$"and write "$c =_e l$"). In spite of the distinction between $=$ (the identity of the intensional universes) and $=_e$ (the "extensional" identity of the usual universes), the treatment of the enlarged universes is entirely extensional and does not need to go outside the applied first-order system. Brutus might stab intentionally c without having intention to stab l;

there is no contradiction, because *c* and *I* are now different individuals of the given intensional universe.

Approaching the territory of epistemic logic, we need something eventlike but much more flexible than Davidson's events. The individuals of this special type have been called "situations" (oppsed to them would be the "antisituations") in [5] and "eventualities" in [8]. In spite of the fact that both, Davidson's events (*d*) and the eventualities (*e*), are additional elements of the universes of discourse, there are fundamental differences between the two types of individuals:

use

The *events* are basically used to analyse the role played by certain adverbial constructions in sentences (and some aspects of causal relations); no general application to epistemic logic is developed. The *eventualities* are not used to analyse the adverbial constructions under normal conditions; they are principally used for knowledge sentences, belief sentences, etc.

identity

According to *Davidson*, "$d_1 = d_2$" means that d_1 and d_2 share all causes and effects. For the *eventualities*, "$e_1 = e_2$" (the individual expressions "e_1" and "e_2" have the same intension) means that, according to the given context, e_1 and e_2 satisfy the same epistemic and non-epistemic predicates. Thus if, e.g. somebody knows e_1 he must know e_2 also; *one* exception would be sufficient to get "$e_1 \neq e_2$". A couple of reasonable candidates for "$e_1 = e_2$" may be Brutus's stabbing of Caesar (e_1) and Caesar's being stabbed by Brutus (e_2).

flexibility

There are no *events* corresponding to the not stabbing or to combinations of entirely disconnected events. There is exactly one *eventuality* corresponding to every formal sentence (simple or complex with negations, conjunctions, etc.).

In the following we will consider only the sentences (excluding the other well formed expressions, but see [8])and state explicitly the relation between sentences and "eventuality declarations" (the individual expressions which denote eventualities). For each sentence "A" we will have the eventuality declaration "e{A}". If the sentence is true, the eventuality denoted by "e{A}" will be considered as a situation ("*S*"; we can also say that it is a fact or that it has taken place). If the sentence is false, the eventuality will be treated as an antisituation. All this could be expressed by premises like:

$A \equiv Se\{A\}$.

If the left side of the equivalence is true, the right side is true also, if the left side is false, we have the same result for the right side[3]. Thus "Brutus stabbed Caesar" is equivalent to "The eventuality that Brutus stabbed Caesar (e{A}) is a situation" or "Brutus's stabbing of Caesar has taken place".

Contrarily to Davidson's events, an eventuality (of any degree of complexity) is something unique; even if Brutus hit Caesar three times in order to get the desired result, the triple hitting will be an unique eventuality: e{Brutus hit Caesar three times}.

The use of eventualities in connection with adverbs and prepositional phrases needs some comments. Frequently the nominalized verb form ("stabbing") is simply a paraphrase of the standard form, so that "Brutus's stabbing of Caesar was done with a knife"[4] should be treated as "Brutus stabbed Caesar with a knife". There are, however, some cases in which the applications of the eventualities may allow interesting distinctions. Let us consider an example given by Davidson:

Henry gracefully ate all the crisps. (7)

This sentence is ambiguous and could be red as (7a) "For all crisps, Henry ate each of them gracefully" and as (7b) "Henry'scrisp-eating was an overall graceful action (even if not *every* crisp was eaten gracefully)" The following translations to the formal language give the shades of the two readings ("*A*" three-places for eating and "*G*" one-place for being graceful):

$(x)(Cx \supset Ahxg)$ (7a')

$Ge\{(x)(Cx \supset (Ey)Ahxy)\}$. (7b')

In (7b') the third argument place of *A* is simply filled with "in some way".

5. The classification of the adverbial constructions

In order to give a survey of the related problems, we will try to classify the adverbs (and the propositional phrases) *from a logical point of view*. We have at least the following categories:

(I) *Pseudo-adverbs*. They do not operate really as adverbs but as attributes (generally of the subject).

(II) *Argument place-adverbs*, i.e. adverbs which ocuppy argument places in first level language (they represent the standard form). Examples: (1), (2), (3), (6), (7a).

(III) *Eventuality predicates*, i.e. adverbs which are treated, in formal language, as predicates of eventuality. Example: (7b).

(IV) *Meta-adverbs*. They are argument place adverbs in metalanguage, i.e. they occupy argument places in metasentences, which speak *about* something linguistic. We might still maintain a first-*order* treatment, but we are not any longer in the first *level*.

It is not easy to find adverbs which belong exclusively to the category (I), but there is a great number of cases which are ambiguous between (I) and (II). Thus in the sentence (5):

Brutus resentfully did not go to the party

"resentfully" may be interpreted as (a) "being a resentful individual" or as (b) "in a resentful attitude". The symbolization according to (b) is (5'), while (5a) could be translated as:

$Rb \wedge (Ex)\text{-}Gbpx$[5] (5a')

Another example is Austins's:

He clumsily trod on the snail (8)

where again "clumsily" may be (a) "being a clumsy individual" or (b) "in a clumsy attitude"[6]:

$Ch \wedge (Ex)Thsx$ (8a')
$Thsc.$ (8b')

Besides (7b), there are many other examples for the point (III); they occur frequently (but not always) with adverbs like "unfortunately" ("Unfortunately he did..."), "surely", "doubtlessly", "naturally", etc. Sometimes they are called "sentence adverbs", a term that seems to me more adequate for meta-adverbs in a higher level of language.

As a category (IV), there are cases where even the original sentence is explicitly in metalanguage, like:

Henry declared gracefully "The crisps are fine" (9)

which gives, with "s_c" for the sentence about the crisps:

Dhs_cg (9')

Apart from cases that are not very instructive (we can have adverbs of the categories (I), (II) and (III) in any higher level of language), many typical cases belong only *apparently* to first-level language, e.g. with modal terms like "necessarily", possibly", etc. in the sense of "it is necessarily true tht", "it is possibly true that", etc.[7] Examples:

Necessarily Henry ate all the crisps (10)
Possibly Brutus killed Caesar (11)

which gice (with "T" two-place for being true, "s_a" for the sentence about eating and "s_k" for the sentence about killing):

Ts_an (10')
Ts_kp (11')

With all this, the preceding analysis gives some indications which show that the standard treatment, improved and extented, works in first-order logic with only a minimum of complications.

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NOTES

1 I use here "*d*" for Davidson's variable limited to events (and not "*e*" which be used in the following pages for eventualities).

2 (5'), more explicitly written "*(-G)bpr*", is a well formed expression of first-order logic (with λ-operator). It is equivalent to "*~Gbpr*" ("It is not the case that Brutus resentfully went to the party"); but equivalence (mutual implication) does not mean that two equivalent formal expressions are translations of the same sentence in natural language. A third form of negation, not equivalent to the preceding ones, might appear as "Brutus not resentfully went to the party", where "in a not resentful attitude" could be symbolized by "*n*":

Bbpn

Giving more details (with "A" for attitudes and "R" for what is resentful) we may have:

$(\mathrm{E}x)(Ax \wedge \sim Rx \wedge Gbpx)$

[3] With "A ≡ B" we would have only "*Se*{A} ≡ *Se*{B}", but not "e{A} = e{B}".

[4] The translation as:

$(\mathrm{E}x)(Kx \wedge De\{Sbc\}x)$

with the two-place predicate "doing" ("*D*") is always possible, but in most cases the standard form should be preferred.

[5] "*G*" has been treated as a three-place predicate, in order to compare (5') and (5a'); (5a') alone would be better treated (with "*G*" two-place) as:

$Rb \wedge \text{-}Gbp.$

[6] This treatment does not follow exactly Austin's analysis.

[7] For more details on modal terms and their interpretations in first-order logic, see [11], [7] and [9].

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