The structure of criterion predicates

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Abstract

Instrumental *by* adjuncts have remained ill-understood. So have criterion predicates, one of the types of predicates that can be modified by instrumental *by* adjuncts. There is also no consensus on the proper analysis of manner-neutral causative predicates, the other major type of predicates that can be modified by instrumental *by* adjuncts. I propose an analysis of the *by* locution where both criterion predicates and manner-neutral causatives involve reference to an indefinite predicate and where the function of the instrumental *by* adjunct is to fill that predicate with content by unification. In this way, long-standing intuitions can be accounted for while well-known problems are solved; in particular, the thesis that the *by* locution offers two descriptions of one event is vindicated without predicting a symmetry between the two descriptions.

1. Introduction

A number of verbal predicates have an intuitively rather abstract meaning; they may specify some higher-order, typically modal, property of an action but they remain tacit on what is actually going on. Here are some examples:

(1) a. *obey doctor's orders*, *do me a favour*, *transgress Holy Law*, *give way*, *respond*, *start the nest*, *badger the bureaucracy*, *take revenge on the remote father*

b. *create a fiction*, *ruin my reputation*, *surprise the nation*, *waste fuel*, *help the campaign of Senator John Kerry*, *undermine the war on terrorism*

The items in (1b) are **causative predicates**, more precisely such that do not specify the way in which the change of state is brought about; Kearns (2003) calls them causative upshot predicates. I call them manner-neutral causatives. The predicates in (1a) are not causative. Ryle (1949: 125–147) classifies them as achievements; Kearns (2003: 599) refers to them as **criterion predicates**:

> The key notion here is that there is some conventional criterion an action must meet in order to qualify as an event of the criterion-matching kind.

While criterion predicates specify conventional (normative) or intentional criteria, they are unspecific about the physical criteria an action must meet. Usually, there is a need for more information on how the action is performed. If you ask me to do you a favour, I will want to know what it is. If you tell me that you are obeying doctor's orders, you are probably alluding to a familiar action. Very often, the context will, in various ways, fill in the picture. Much the same is true of manner-neutral causatives.

One way of specifying more concrete criteria is to modify the VP with an adjunct; a clause or a PP. In English, the natural choice is a *by* adjunct with a present participle complement, as in (2)–(5).

(2) The City retaliated by electing its own mayor.

(3) Mowgli kept a promise by killing Shere Khan.

(4) By sending rain, Yahweh had usurped the function of Baal.

(5) It tries to escape by moving as fast as possible away from the predator.

This extends to manner-neutral causatives, as in (6)–(9).

(6) By calling and dancing, he entices a female to his bower.

(7) Yahweh saved the Israelites by opening the Sea of Reeds.

(8) Yahweh made Adam by scooping up some clay and breathing on it.

(9) In Germany they portrayed the Plague as a maid travelling through the air like a blue flame, killing her victims by raising an arm.

(I will subsume criterion predicates and manner-neutral causatives under the term **abstract predicate**.) There is a strong intuition that in each case, the merge of the *by* phrase and the phrase it modifies denotes one set of events, and that somehow, the *by* phrase predicate fills a slot in the abstract predicate. My intent is to account for these intuitions through a formal analysis of the abstract predicate, the instrumental adjunct, and the way they are composed.

The rest of the paper is structured as follows. In Section 2, I review the recent work of Kearns (2003) on abstract predicates and argue that it is incomplete, both as it stands and as a basis for an analysis of the *by* locution. Section 3 provides a critical survey of work on the *by* locution (Bennett 1994) and on *by* adjuncts in connection with causative predicates (Dowty 1979). In Section 4, I develop my own analysis based on unification in recent DRT. In Section 5, I discuss the limits to the *by* locution, arguing that they can be stretched through causative or criterial interpretations of predicates that are not strictly causative or criterion predicates. Section 6 offers conclusions.

2. Kearns 2003 and the Anscombe thesis

According to Kearns (2003), criterion predicates do not refer to basic actions or events but to actions or events that depend on basic actions or events, to **parasite events** depending on **host events** (p. 600).

> What is … parasitic about criterion predicates, … , is that the eventualities described cannot simply come about, but must be realized in the occurrence of some event which is describable in different terms. (Kearns 2003: 627)

In the actual analysis, there is only one event involved, but there is a (usually rather vacuous) host and a parasite description of that event. The latter, the criterial component of the predicate, is an "individual-level predicate on events", as indicated in paraphrases like those in (10) (p. 628):

(10) a. Jones broke the law.
b. 'Jones did something, and what he did was illegal'
c. $\exists$ e (do(j, e) & illegal(e))

This analysis is questionable for two reasons. First, it is hardly reasonable to ascribe properties like legality to events. Generally, it would seem that what must meet conventional criteria are event types – predicates – and not event tokens.[1] Note that cases like (11a) and (12a) turn out to be trivial – contradictory or tautologous – on an analogous analysis, as demonstrated in (11c) and (12c). Obviously, one and the same event e can only occur once.

(11) a. Joan made a common mistake.
b. 'Joan did something, and what she did was a common mistake'
c. $\exists$ e (do(j, e) & mistake(e) & common(e))

(12) a. Joan did something noone had ever done before.
b. 'Joan did something, and what she did noone had ever done'
c. $\exists$ e (do(j, e) & noone had ever done e before)

In fact, there is another possible formalisation in the style of the c. formulae, equally in accordance with the b. paraphrases, avoiding these problems:

(10) d. $\exists$ e $\exists$ P (P(j, e) & illegal(P))

(11) d. $\exists$ e $\exists$ P (P(j, e) & mistake(P) & common(P))

(12) d. $\exists$ e $\exists$ P (P(j, e) & noone had ever done P before)

This is close to what I will propose in Section 4.

Second, this analysis is questionable because it fails to form a sound basis for an analysis of the *by* locution. Kearns does not offer an explicit analysis of the *by* locution. In fact, she assumes that criterion predicates, as opposed to causative predicates, occur more naturally with *in -ing* adjuncts (p. 629). It may be that *in* adjuncts of the type illustrated in (13) and (14) preferably modify criterion predicates. But cases of such predicates with *by* adjuncts abound in corpora, and Kearns herself discusses (p. 599) a case in which "a soldier obeys an order by fixing his bayonet".

(13) In naming him, Putin ended a guessing game that had begun to overshadow a predictable presidential election two weeks from now that is seen as a sure thing for Putin.

(14) In naming him, Putin avoided creating an alternative center of power or a rival for the political spotlight.

In any case, it is clear that Kearns considers *in* or *by* adjuncts to offer **host** descriptions, potentially specifying the proforma "do" predicate in formulae like (10c) above. One can thus conjecture that (15a) may analyse as (15c).

(15) a. Jones broke the law by hunting.
b. 'Jones hunted, and his hunting was illegal'
c. $\exists$ e (hunt(j, e) & illegal(e))

This corresponds to what has been referred to in the philosophical literature as the "Anscombe thesis" in its very simplest form.

The Anscombe thesis (according to Bennett 1994)

If someone ϕs by πing, and F is the act which makes it the case that she ϕs, and P is the act which makes it the case that she πs, then F is P.

In other words, the modified predicate and the *by* adjunct describe one event in two ways. To be sure, there is a strong intuitive basis for this assumption. However, as spelt out in (15c) or any formula where the host and the parasite are parallel predicates and where the latter is a first-order predicate on events, it causes two (closely related) problems.

First, it predicts that the construction is closed under weakening, which it is arguably not:

(16) a. He broke the Jungle Law by hunting at the pool in a drought $\nRightarrow$
He broke the Jungle Law by hunting at the pool $\nRightarrow$
He broke the Jungle Law by hunting

b. $\exists$ e (hunt(j, e) & illegal(e) & atthepool(e) & inadrought(e)) $\Rightarrow$
$\exists$ e (hunt(j, e) & illegal(e) & atthepool(e)) $\Rightarrow$
$\exists$ e (hunt(j, e) & illegal(e))

Second, as pointed out, i.a., by Bennett (1994), the Anscombe thesis is liable to predict a **symmetry** between the *by* adjunct and the modified predicate:

(16) c. He broke the Jungle Law by hunting. $\nRightarrow$
d. ?He hunted by breaking the Jungle Law.

3. Second-order predicates decomposed

In this section, I discuss two approaches to the semantics of the *by* adjunct which avoid the two problems noted above by treating what the *by* adjunct adjoins to as a composite expression containing an existential quantification over things such as those expressed in the *by* adjunct. This is a significant step forward. What these approaches do not provide is a compositional analysis.

3.1. Bennett 1994 and the "namely" analysis

According to Bennett (1994), the asymmetry of the *by* construction falsifies the Anscombe thesis that we have two descriptions of one and the same event. His analysis differs from the one sketched in the last section in two ways:

1. At the relevant level of analysis, the *by* complement does not denote a set of events; in fact, it denotes a (true) proposition (a fact).

2. At the relevant level of analysis, the phrase modified by the *by* phrase denotes a second-order entity; in fact, a set of true propositions (facts).

(I will argue that 1. is inessential while 2. is essential.) Bennett paraphrases (17a) as (17b). A formalisation in the style of the formula in (10c) or (15c) (ignoring tense) could yield (17c):

(17) a. Jones broke a promise – by – coming home late.
b. Some fact about his behavior conflicted with a promise he had made earlier – namely the fact that – he came home late.
c. comehomelate(he) & promise(^not(comehomelate(he)))(he)

Without violating the spirit of this analysis, one could reintroduce events to represent the verb phrase *break a promise by being late* as (17d) (simplified):

(17) d. $\lambda x \lambda e\,(\text{late}(x)(e) \wedge$
$\exists e_1\,(\text{promise}(\hat{}\neg \exists e_2\,(\text{late}(x)(e_2)))(x)(e_1)))$

As a representation of the modified VP, this is intuitively not far off the mark, and it seems to avoid the two problems noted above: The construction is not predicted to be closed under weakening or to be symmetric. The reason is that the "parasite", the criterial component, is not at the same level as the "host"; it is one level up and has an argument place for the host. In principle, this pattern generalises to manner-neutral causative predicates, but this is yet to be a **semantic** analysis – it is not clear how the meaning of the modified VP comes from the meaning of its two daughters through the "namely" operation. Indeed, it is not easy to develop a compositional analysis along these lines.

3.2. Dowty 1979 and the *by* postulate

Dowty (1979: 227–229) treats *by* adjuncts as modifying causative VPs. He first considers ascribing a causative element to *by*, but rejects this because it seems to result in a double causation.[2] It may be added that such a move is also problematic in connection with criterion predicates, for which the result does not seem to involve any element of causation. What Dowty proposes, instead of a translation of the preposition, is a meaning postulate:

$$\forall p \forall P \forall Q \forall x \Box [\mathbf{by}\prime(P)(\hat{y}[Q\{y\}\,\text{CAUSE}\,\check{}p])(x) \rightarrow [P\{x\}\,\text{CAUSE}\,\check{}p]]$$

This ensures that if John awakened Mary by shaking her, then his shaking her awakened her – a welcome result. Dowty did not use events, but in principle, the *by* postulate could be reformulated in terms of events. And in principle, it generalises to criterion predicates (on an appropriate decomposition).

But of course, the postulate does not amount to a compositional analysis. It does not specify the meaning of the *by* phrase, and in particular, it does not say what, if any, predicates the *by* phrase cannot meaningfully modify. If the *by* phrase combines with a predicate not of the form $(\hat{y}[Q\{y\}\,\text{CAUSE}\,\check{}p])$, the meaning postulate does not apply, so it is unable to predict negative facts like those in (18).

(18) ??Fred { tied his necktie / combed his hair / buttoned his shirt / polished his nails / put on his top hat } by ...

The scope of such negative facts may be debatable; Dowty himself (p. 229) mentions the case in which John "hammers the metal flat by pounding it with a pipe wrench". The boundary between abstract and concrete predicates is fuzzy and flexible, but the cases in (18) are evidence that there are predicates that are definitely too "concrete" to be modified by *by* phrases. I will return to this topic in Section 5.

One way to build a compositional analysis is to give the abstract predicate a separate argument place for a *by* phrase predicate (simplified):

"Awaken Mary": $\lambda\, P\, \lambda\, e\, [\, \exists\, e_1$ Cause(Become(awake(m))(e_1))(P(e))]

"Keep a promise": $\lambda\, P\, \lambda\, e\, [\, P(e) \wedge$ Promise(P)(Agent(e))]

But this is hardly plausible considering the cases where the abstract predicate occurs "on its own", without being modified by anything more specific. It would seem, therefore, that one must look farther afield for a compositional analysis preserving the ideas of Bennett and Dowty.

4. The analysis

The discussion in the last two sections has suggested that abstract predicates should not be described (only) as predicates of events but (also) as predicates of predicates of events, that is, as second-order predicates of events, and that when modified by a *by* phrase, they are predicated of the *by* phrase predicate. More precisely, there is reason to assume the following hypothesis:

Hypothesis

If someone ϕs by πing, then ϕ says that she does a ψ such that ... (for instance, ψ is something promised, or her doing ψ causes something), and ψ is π.

To develop this hypothesis into a viable analysis, I will first show how one can make formal sense of it in a version of Discourse Representation Theory. Next, I will show how the problem of composing the representations can be overcome through the notion of unification used in recent DRT. I illustrate various combinations of predicates and show how negative facts can follow from a failure of unification. On the resulting analysis,

- Bennett's and Dowty's ideas are rendered in a compositional version

- the Anscombe thesis is vindicated: There are two descriptions of one event
- the symmetry problem is solved: There is symmetry at event token level but asymmetry at event type level
- a propositional notion of causation is vindicated.

4.1. The desideratum

I will assume that the result of *by* adjunction denotes a set of events: $\lambda e[\dots]$, and that the *by* phrase predicate is predicated of those events; if the *by* phrase is *by reversing*, we have $\lambda e[\dots \mathit{reverse}(e)\dots]$. Considering a sentence like (19a), I will assume that the *by* phrase adjoins at the level of the VP, cf. (19b), and that the Agent relation comes into play at a later stage (cf. Kratzer 1996).

(19) a. Neither would give way by reversing.
b. give way by reversing
c. $\lambda e[\dots \mathit{reverse}(e)\dots]$

On top of this VP, three functional heads round off the sentence:

- Voice: (e.g.) $\lambda x \lambda e\ \mathrm{Agent}(x)(e)$
(a function from objects to sets of events)
- Aspect: (e.g.) $\lambda P \lambda t \exists e\ P(e) \wedge \mathrm{Perfective}(e)(t)$
(a function from sets of events to sets of times)
- Tense: (e.g.) $\mathrm{Past}(t_0)(t_1)$
(a time)

These three functions will be disregarded in the following.

What remains in the skeletal representation of the result of *by* adjunction $\lambda e[\dots P(e)\dots]$, where P is the *by* phrase predicate, is a representation of the modified abstract predicate that involves P, and this requires decomposition. When, as in (19a–c), the modified abstract predicate is a criterion predicate, decomposition is especially difficult. Let us begin with a causative predicate, for which we have some experience with decomposition. Consider (20a–c):

(20) a. She maddened me by dancing.
b. madden me by dancing
c. $\lambda e[\dots \mathit{dance}(e)\dots]$

According to an event-based notion of causation which has become customary over the last years (cf. e.g. Pylkkänen 2002), one would expect (20c) to take the more specific form of (20d):

(20) d. $\lambda e[\exists e_1 \text{ Become}(\textit{mad}(i))(e_1) \wedge \textit{dance}(e) \wedge \text{Cause}(e_1)(e)]$

But this is a representation of the causative predicate (*madden*) which does not involve *dance*, the *by* phrase predicate, and it is difficult to see how the symmetry problem can be overcome on such an analysis. There is, however, an alternative decomposition, more in line with Dowty's work (1976, 1979), where causation is not a relation between events but between propositions (although intensions are notationally disregarded below):

(20) e. $\lambda e[\exists e_1 \text{ Become}(\textit{mad}(i))(e_1) \wedge \textit{dance}(e) \wedge$
$\text{Cause}(\text{Become}(\textit{mad}(i))(e_1))(\textit{dance}(e))]$

Here, it is clear that the abstract predicate involves the *by* phrase predicate – *dance* occurs twice in the representation.

To be sure, it is debatable whether this is the best formulation of causative verb causation, but in any case, a counterfactual analysis of causation (Lewis 1973) is more natural on the basis of a formulation where, as here, the causing event type enters into the causation relation than on the basis of one where only the causing event token enters into it.

Turning to criterion predicates with *by* adjuncts, a similar pattern emerges: To the extent that a decomposition is feasible, it will involve the *by* adjunct. Take the predicate *give way* from (19a). This seems to entail doing something another party insists upon, although it does not follow from objective norms. Let us assume that a decomposition along these lines is theoretically possible (although rather indeterminate). Then *give way by reversing* seems to be the same plus the condition that reversing is that something. On the assumption that something similar holds of all criterion predicates, we can focus on one case where a decomposition is not merely possible but relatively practical, *keep a promise* (still, (21c) is a simplification):

(21) a. She kept a promise by dancing.
b. keep a promise by dancing
c. $\lambda e[\exists e_1 \textit{ Promise}(\textit{dance}(\text{pro}))(\text{Agent}(e))(e_1) \wedge \textit{dance}(e)]$

In order to prepare the ground for a compositional analysis – how to arrive at representations like (20e) and (21c) – it is useful to cast the representations in a Discourse Representation Structure format ((20b)=(22a), (21b)=(23a)):

(22) a. madden me by dancing

b. λe
$$\boxed{\begin{array}{l} e_1 \\ \textit{dance}(e) \\ \text{Become}(\textit{mad}(i))(e_1) \\ \text{Cause}(\text{Become}(\textit{mad}(i))(e_1))(\textit{dance}(e)) \end{array}}$$

(23) a. keep a promise by dancing

b. λe
$$\boxed{\begin{array}{l} e_1 \;\; Q \\ \textit{dance}(e) \\ \textit{dance} \subseteq Q \\ \textit{Promise}(Q(\text{pro}))(\text{Agent}(e))(e_1) \end{array}}$$

So far, so good – but the problem is that it is far from obvious how to derive these structures in a compositional manner. We can go some way towards identifying the contribution of the abstract predicate and that of the adjunct through formulations corresponding one-to-one to the above hypothesis; "if someone ϕs by πing, then ϕ says that she does a ψ such that … and ψ is π":

(22) c. λe
$$\boxed{\begin{array}{l} e_1 \;\; P \\ P(e) \\ \text{Become}(\textit{mad}(i))(e_1) \\ \text{Cause}(\text{Become}(\textit{mad}(i))(e_1))(P(e)) \\ \qquad\qquad \boxed{P = \textit{dance}} \end{array}}$$

(23) c. λe
$$\boxed{\begin{array}{l} e_1 \;\; P \;\; Q \\ P(e) \\ P \subseteq Q \\ \textit{Promise}(Q(\text{pro}))(\text{Agent}(e))(e_1) \\ \qquad\qquad \boxed{P = \textit{dance}} \end{array}}$$

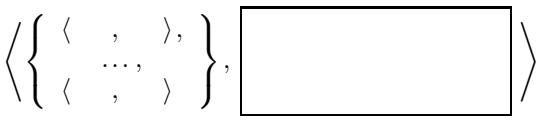
This serves to isolate the problem: The sole contribution of the *by* adjunct seems to consist in the condition $P = \textit{dance}$; but if the contribution of the modified predicate is everything but that condition, it is difficult to see how the *by* phrase can have access to the P event type discourse referent – as long as we maintain traditional ways of composition.

4.2. Composition by unification: Stores and binding conditions

> There are a variety of ways of composing, …
>
> *Duke Ellington*

Recent work in DRT (e.g. Bende-Farkas and Kamp 2001, Kamp 2001) uses unification rather than functional application as a method of composition. So far, this method has mainly been used for the representation of semantic incorporation (see below); I will argue that abstract predicate modification represents another case for which it can make a positive difference. First, it is necessary to describe the novel features in general terms.

A preliminary representation of a node consists of a **store** and a **content**. A store consists of triples: A variable, constraints, and a binding condition. Here I will assume just pairs: A variable and a binding condition, $\langle \quad , \quad \rangle$. A content is a DRS:



When two nodes meet, the unification of store variables of the same type is driven by the binding conditions, and the two content DRSs are then merged. The binding conditions that a store variable may be subject to include:

definite (BC_{def}), **indefinite** (BC_{indef}), and **quantificational** (BC_{Q}).

A quantificational store variable must find an indefinite store variable to bind. Bende-Farkas and Kamp (2001) use this to account for Definiteness Effects in semantic incorporation (cf. Bende-Farkas 1999 and Farkas and de Swart 2003); for instance, *there be* in English comes with a quantificational variable, and if the matching variable from the sister NP is quantificational or definite, unification will fail and the merge will be incoherent.

Indefinite store variables, on the other hand, do not need to be bound, although they easily are; if they are not, they eventually enter the content DRS as normal (indefinite) discourse referents.

I will use three binding conditions,

- λ for 'classical' abstraction,
- indefinite, and
- constant as a subsort of BC_{Q},

and I will assume that the *by* phrase introduces a constant predicate variable while the abstract predicate introduces another, indefinite predicate variable. When the two phrases meet, the former will bind the latter. If the *by* phrase meets a "concrete" predicate not introducing an indefinite predicate variable, the unification fails and the composition terminates. If the abstract predicate does not meet a *by* phrase (or a similar modifier), the indefinite predicate variable enters the content DRS as an ordinary discourse referent.

4.3. Examples

Let us first look at preliminary representations of two abstract predicates, one causative and one criterial. (Note that these representations abstract away from intensions, and that they represent oversimplifications in other respects as well. Recall that I follow Kratzer 1996 in assuming the Agent relation to come into play at a later stage; more on agentivity below.)

(24) a. madden me

b. $\left\langle \left\{ \begin{array}{l} \langle e, \lambda \rangle, \\ \langle P, \underline{\text{indefinite}} \rangle \end{array} \right\}, \boxed{\begin{array}{l} e_1 \\ P(e) \\ \text{Bec}(\mathit{mad}(i))(e_1) \\ \text{Cause}(\text{Bec}(\mathit{mad}(i))(e_1))(P(e)) \end{array}} \right\rangle$

(25) a. keep a promise

b. $\left\langle \left\{ \begin{array}{l} \langle e, \lambda \rangle, \\ \langle P, \underline{\text{indefinite}} \rangle \end{array} \right\}, \boxed{\begin{array}{l} f \;\; Q \\ P(e) \\ P \subseteq Q \\ \mathit{Promise}(Q(\text{pro}))(\text{Agent}(e))(f) \end{array}} \right\rangle$

Next, let us see what a representation of a simple *by* adjunct might look like. I will assume that the function of the preposition is purely identificational: Essentially, it takes a predicate and returns a store-content pair introducing a constant predicate variable with the content identifying this as the predicate:

(26) a. by dancing

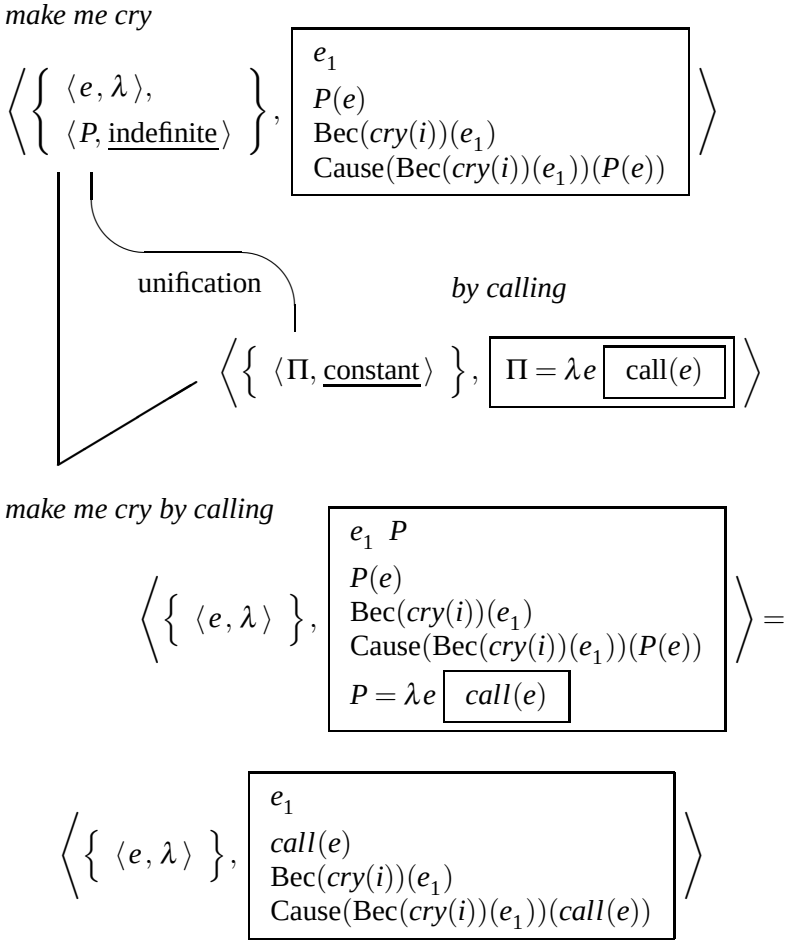
b. $\left\langle \left\{ \langle \Pi, \underline{\text{constant}} \rangle \right\}, \boxed{\Pi = \lambda e \boxed{\mathit{dance}(e)}} \right\rangle$

When a *by* phrase like this modifies an abstract predicate such as (24a) or (25a), the variable Π from the former binds the variable *P* from the latter, the latter being substituted for the former and entering the universe of the merged content DRS. Below are some illustrations of this, as well as illustrations of cases in which there is no *P* store variable or no Π store variable is provided.

4.3.1. Simplex cases

When a manner-neutral causative predicate is modified by a *by* adjunct, (24c) depicts how the *by* phrase predicate identifies the manner by unification:

(24) c. *make me cry*



Note that although the *by* adjunct is only ascribed an identificational meaning (and in particular, not a causative meaning), it is fully possible to represent what seems to be the negation of this meaning, as in (27a); unification occurs but the bound variable is claimed to be different from the constant predicate.

(27) a. sadden me (but) not by dancing (but … by singing)

b. $\left\langle \left\{ \langle e, \lambda \rangle \right\}, \boxed{\begin{array}{l} e_1 \;\; P \\ P(e) \\ \text{Bec}(sad(i))(e_1) \\ \text{Cause}(\text{Bec}(sad(i))(e_1))(P(e)) \\ P \neq \lambda e \boxed{dance(e)} \end{array}} \right\rangle$

Note, also, that when an agent is eventually connected to the modified VP, via the relation $\text{Agent}(x)(e)$ (Kratzer 1996), it is the causing event, described by the modifier, that is assigned agentivity; the caused event may well be unintentional. This is as it should be.

It is an interesting question whether the empty grammatical subject of the *by* phrase is always an external argument, essentially an agent; as it stands, the analysis presupposes that it is. As the *by* phrase is not represented with a PRO subject, a theme trace variable cannot be bound by anything. This predicts, in particular, that there should be no passives in *by* adjuncts, and passives are indeed very rare; when they cannot be interpreted as covert actives, along the lines of (28b), they seem rather marginal, cf. (29):

(28) a. By being defeated, you have ruined everything.
b. By letting yourselves be defeated, you have ruined everything.

(29) ?The mullah lost his honour by being lifted off the floor.

On the other hand, if desired, it would be possible, only more complicated, to supply the representation of the *by* phrase with a PRO subject, controlled by an agent DP or by a raised theme argument binding a theme trace variable in the modified VP; in the latter case, PRO could bind a theme trace variable in the *by* phrase. Whether this is desirable is primarily an empirical question. As long as subjects seem to be agents, I will assume that they are.

The composition of criterion predicates like (25a) and *by* adjuncts like (26a) will parallel the composition of causative predicates like (24a) and *by* adjuncts as shown in (24c) above. So will, in principle, the composition of criterion predicates and more complex *by* adjuncts, as shown in (30) below.

4.3.2. Complex cases

(30) *keep a promise*

$$\left\langle \left\{ \begin{array}{l} \langle e, \lambda \rangle, \\ \langle P, \underline{\text{indefinite}} \rangle \end{array} \right\}, \boxed{\begin{array}{l} f \;\; Q \\ P(e) \\ P \subseteq Q \\ \textit{Promise}(Q(\text{pro}))(\text{Agent}(e))(f) \end{array}} \right\rangle$$

unification *by killing Shere Khan*

$$\left\langle \left\{ \langle \Pi, \underline{\text{constant}} \rangle \right\}, \Pi = \lambda e \boxed{\begin{array}{l} Q \;\; e_1 \\ Q(e) \\ \dagger(s)(e_1) \\ \text{Cause}(\dagger(s)(e_1))(Q(e)) \end{array}} \right\rangle$$

keep a promise by killing Shere Khan

$$\left\langle \left\{ \langle e, \lambda \rangle \right\}, \boxed{\begin{array}{l} f \;\; P \;\; Q_1 \\ \textit{Promise}(Q_1(\text{pro}))(\text{Agent}(e))(f) \\ P \subseteq Q_1 \\ P(e) \\ \qquad P = \lambda e_1 \boxed{\begin{array}{l} Q \;\; e_2 \\ Q(e_1) \\ \dagger(s)(e_2) \\ \text{Cause}(\dagger(s)(e_2))(Q(e_1)) \end{array}} \end{array}} \right\rangle =$$

$$\lambda e \boxed{\begin{array}{l} Q \;\; e_2 \;\; f \;\; Q_1 \\ \textit{Promise}(Q_1(\text{pro}))(\text{Agent}(e))(f) \\ \text{Cause}(\dagger(s)(e_2))(Q(e)) \\ \dagger(s)(e_2) \\ Q(e) \\ \qquad \left(\lambda e_1 \boxed{\begin{array}{l} Q \;\; e_2 \\ Q(e_1) \\ \dagger(s)(e_2) \\ \text{Cause}(\dagger(s)(e_2))(Q(e_1)) \end{array}} \right) \subseteq Q_1 \end{array}}$$

(30) illustrates the modification of a criterion predicate through a *by* adjunct whose predicate is itself complex, here a manner-neutral causative predicate (whose indefinite predicate store variable is entered into the content DRS). The bottom structure says that to keep a promise by killing Shere Khan is to do something causing the death of Shere Khan such that doing something causing the death of Shere Khan entails something that has been promised.

To be sure, the exact form of the representations is open to modifications. This is particularly true of the decomposition of the concept *keep a promise*, where modal and temporal parameters, while relevant, are not made explicit. The event of keeping a promise must succeed the event of making a promise, and the indefinite predicate referent *P* may stand for a predicate in intension. The essential thing is the unification of that referent, made accessible as a store variable, and the predicate Π from the representation of the *by* phrase.

Note that when a manner-neutral causative predicate *by* phrase modifies another manner-neutral causative predicate, there is an asymmetry between the two: With reference to (7), repeated here as (31a), to save the Israelites by opening the Sea is not to do something causing both the Sea to become open and the Israelites to become safe but to do something causing the Sea to become open such that that doing something causing the Sea to become open causes the Israelites to become safe, – as illustrated in (31b):

(31) a. Yahweh saved the Israelites by opening the Sea of Reeds.

b. *save the Israelites by opening the Sea*:

$$\lambda e \left[\begin{array}{l} Q \quad e_1 \quad e_2 \\ Q(e) \qquad \mathrm{Bec}(\mathit{safe}(i))(e_1) \quad \mathrm{Bec}(\mathit{open}(s))(e_2) \\ \mathrm{Cause}(\mathrm{Bec}(\mathit{open}(s))(e_2))(Q(e)) \\ \mathrm{Cause}(\mathrm{Bec}(\mathit{safe}(i))(e_1)) \left(\left[\begin{array}{l} Q \quad e_2 \\ Q(e) \\ \mathrm{Bec}(\mathit{open}(s))(e_2) \\ \mathrm{Cause}(\mathrm{Bec}(\mathit{open}(s))(e_2))(Q(e)) \end{array}\right] \right) \end{array}\right]$$

Note, finally, that the modification-by-unification mechanism is recursive; there is no difficulty in representing the appropriate meaning of, say, (32):[3]

(32) Mowgli kept a promise by killing Shere Khan by stampeding buffalo through a ravine.

4.3.3. Concrete parasites

If composition by unification is to succeed when a predicate is merged with a *by* adjunct, the predicate must provide an indefinite predicate store variable. Not all predicates do. I will argue later, in Section 5, that this is not a sharp, absolute distinction and that predicates can be quite flexible in this regard; but some are simply too concrete or manner-specific to be interpreted as providing an indefinite predicate variable playing a part in their interpretation. These predicates supply the negative facts about *by* phrase modification.

(18) ??Fred { tied his necktie / combed his hair / buttoned his shirt / polished his nails / put on his top hat } by ...

(33) illustrates the failure of composition by unification for the event type *spew all over a man and a woman* and the *by* phrase *by getting blind drunk on seven gins and umpteen pints* (inspired by *Saturday night and Sunday morning* by Alan Sillitoe), a combination which would not be implausible were the *by* phrase to convey a causal relation on its own:

(33) *spew all over a man and a woman*

$$\left\langle \left\{ \langle e, \lambda \rangle \right\}, \boxed{\textit{spew}\ldots(e)} \right\rangle$$

by getting blind drunk on seven gins and umpteen pints

$$\left\langle \left\{ \langle \Pi, \underline{\text{constant}} \rangle \right\}, \boxed{P = \lambda e \boxed{\textit{get}\ldots(e)}} \right\rangle$$

***fail*.**

Unification fails because the constant binding condition for Π, a subsort of Q for Quantificational, necessitates the binding of a variable with an indefinite binding condition in the store of the sister. Here there is none to be found, or even accommodated.

Note the parallel to presupposition failure as failure of anaphora binding; store elements with binding conditions of the Quantificational sort can be viewed as intrasentential presuppositions-as-anaphora.

4.3.4. Lone parasites

The *by* adjunct requires a predicate providing an indefinite predicate variable, but not vice versa: A causative or a criterion predicate can very well occur on its own, without any sort of modifier, because the indefinite predicate store variable is transferred to the content DRS as a normal discourse referent if nothing happens. It does not need to be bound; if it is not, it stays indefinite, as in these examples:

(34) a. He did me a favor.

(35) a. You have done a great deed.

(36) a. The boy insulted me in your bar.

This is not to say that it stays indefinite in a broader context. In isolation, the sentence may be represented with an indefinite predicate discourse referent:

$$\begin{array}{|l|}\hline e \quad t \quad P \\ e \subseteq t \qquad t < n \qquad\qquad P(e) \\ \text{Agent}(e)(you) \\ \qquad\quad great(P) \\ \hline\end{array}$$

But this P can serve as a source or a target for intersentential unification, so that the final representation of the discourse includes conditions of the form $P = \lambda e \ldots$ and $e = \ldots$, or equivalently, much as if there were a *by* adjunct. This seems particularly common with criterion predicates, as shown below:

(34) b. "You want to tell me what this is about?"
"He did me a favor. I want to say thanks. That's all it is."
"It must have been quite a favor," I said. "Do you mind if I ask what he did?"
"He showed me a kindness when I was down on my luck."

(35) b. You have saved the world from the evil witch. [. . .]
You have done a great deed.

(36) b. The boy insulted me in your bar. He told me to shut up.

The establishment of such binding relations is based on pragmatic reasoning and accompanied by discourse relations. In (35b), P succeeds its unifier, and we may speak of **abstraction**, while in (36b), we may speak of **elaboration** (Asher and Lascarides 2003: 204–207, Behrens and Fabricius-Hansen 2002).

5. The scope of abstractness

Sometimes, a *by* phrase adjoins to a predicate which does not seem to be an abstract predicate, either a criterion or a manner-neutral causative predicate; typically, then, the *by* phrase seems to convey a causal relation on its own. Such cases are, of course, a threat to the analysis proposed in the last section. My defense will be to argue that on closer inspection, predicates which do not appear to be abstract really are, at least under the given circumstances; that is, predicates that may not be intrinsically causative or criterial can, under the influence of certain factors, be interpreted as causative or criterial, one of these factors being a merge with a *by* phrase. There is independent support for this, and at a general level, there is reason to embrace the idea that criteriality and causativity are not fixed and lexical but flexible and contextual categories.

Let us first consider some activity predicates modified by *by* phrases.

(37) Snakes move by throwing their bodies into backward-moving waves.

(38) They feed by filtering food particles from the water.

(39) It swims by flexing its body from side to side.

(40) The majority of their people live by farming.

It is not unreasonable to assume that the predicates *move*, *feed*, *swim*, *live* are used here in a slightly derived, abstract sense:

- to *move* or *swim* in the relevant sense is to propel oneself (through water)
- to *feed* in the relevant sense is to obtain food in the genetically encoded way
- to *live* in the relevant sense is to sustain life; to satisfy one's "basic needs"

Thus interpreted, the apparently intransitive activity (or even stative) verbs are in actual fact transitive and causative accomplishments (though temporally, they remain atelic due to iterativity or to the fact that a change of state is not brought about but prevented (cf. Dowty 1979: 124)). As such, they introduce indefinite predicate variables for the causing activity. The verb *feed* features an additional criterion that the indefinite predicate must satisfy, as suggested by the formulation "in the genetically encoded way".

Let us next consider some achievement predicates modified by *by* phrases. Much the same story can be told about them:

(41) They find prey by detecting minute vibrations from a distance away.

(42) . . . , a project to reach India not by following the coastline of Africa . . . but rather by plunging boldly into the unknown Western ocean.

(43) He was forced to forfeit the medal he had won by cheating.

(44) He claimed that he had escaped by crossing the Congo.

In fact, a relevant story has already been told about such cases: To account for "progressive achievements", Rothstein (2004: 45–50, 136–139) proposes that achievement predicates have a double nature: They can be coerced, or shifted, to activities culminating in achievements, that is, to accomplishments:

$$\begin{aligned}&\text{SHIFT}(\text{VP}_{\text{punctual}})\text{: } \lambda e.(\text{BECOME})(e) \rightarrow \\ &\lambda e.\exists e_1 e_2\,[e =^{\text{S}} (e_1 \sqcup e_2) \wedge (\text{DO}(\alpha)(e_1) \wedge (\text{BECOME}(\text{VP}))(e_2) \wedge \text{Cul}(e) = e_2\,]\end{aligned}$$

The dummy predicate DO corresponds to the indefinite predicate variable P in the representations of abstract predicates in the last section. To find prey, to escape, to reach India, or to win the medal in the broader, accomplishment sense is to do something culminating in finding prey, reaching India, winning the medal, or escaping in the narrower, achievement sense.

If, following Dowty (1979: 183), we take the presence of a causal event to be the most salient distinction between achievements and accomplishments, we can represent, e.g., *escape* in the shifted sense, *escape*$^{+}$, as:

$$\left\langle \left\{ \begin{array}{l} \langle e\,, \lambda\,\rangle, \\ \langle P, \underline{\text{indefinite}}\rangle \end{array} \right\}, \boxed{\begin{array}{l} e_1 \\ P(e) \\ \textit{escape}(\text{Agent}(e))(e_1) \\ \text{Cause}(\textit{escape}(\text{Agent}(e))(e_1))(P(e)) \end{array}} \right\rangle$$

Rothstein's shifting operation is supposed to be triggered by progressive aspect; *by* adjunction now emerges as another factor triggering accomplishment readings of apparent achievements.

It should be accentuated that assuming criteriality and causativity to be elastic notions is in no way a costly concession. On the contrary, it is what we should expect. It would be surprising if the class of abstract predicates were closed and solely lexically determined. Elasticity is welcome because it reflects the basically relative (functional, pragmatic) nature of abstractness. In this light, it is not surprising that the limits to the *by* locution are fuzzy. They are, we may say, just as fuzzy as they ought to be.

6. Conclusions

It seems, then, that the key to a better understanding of the *by* locution is a better understanding of the things it modifies, namely, abstract predicates, and vice versa. The need to overcome the "symmetry problem" forces a reassessment of criterion predicates and manner-neutral causatives as predications not merely over events but over sets of events. Conversely, once it is appreciated that predicates with a *by* adjunct involve a second, indeterminate predicate, it becomes clearer what the contribution of the *by* adjunct should consist in: The determination of that second predicate.

This does not proceed on its own, however. A lexical decomposition where the indeterminate "second predicate" is visible remains useless as long as this second predicate is inaccessible for determination through the *by* adjunct. Some innovative method of composition is called for, and in fact available: Recent work in DRT supplements (or supplants) β reduction by unification. Constituent representations are bipartite, and discourse referents figuring in the content section are entered as variables in the store section along with (constraints and) so-called Binding Conditions that drive the unification. The *by* phrase can thus be translated as a structure where the embedded predicate is represented by a store variable with a condition ensuring its unification with the store variable for the "second predicate".[4]

This can be carried out in recent DRT; it can presumably be modelled in another framework as well. However, *by* phrase or other intrasentential modification of abstract predicates is part of a larger picture encompassing intersentential forms of unification between (in)determinate predicate referents. Here, DRT will make a positive difference, inasmuch as even the representations of full root sentences are in this framework only preliminary, open to linkings and bindings driven by more or less "pragmatic" presuppositions. Ahead lies a better understanding of a discourse relation like **elaboration**.

There are negative facts about *by* phrase modification, and they can be accounted for; but the limits to the locution are not that sharp. This reflects the vagueness and context sensitivity of the boundary between the abstract and the concrete. A predicate appearing concrete in one perspective may appear abstract in another. It may be assumed that an instrumental adjunct can itself effect such a shift in perspective.

The Anscombe thesis is vindicated: Just one action is indeed performed if one signals by waving one's arm. This thesis seemed to run afoul of the symmetry problem as long as predicates like *signal* were not taken apart; once there is asymmetry at event type level, however, symmetry at event token level ceases to be a problem. An appealing intuition is thus proven viable.

Notes

1. There is an interesting parallel to the notion of **telicity**: Krifka (1998) argues, contra, e.g., Rothstein (2004), that telicity cannot be a property of event tokens but must be a property of event types.
2. In fact, one may be tempted to such a move by considering predicates, activities or achievements, that are neither clear causative nor clear criterion predicates; cf. Section 5.
3. That is, there is no theoretical problem; in practice, however, such a representation will easily become very complex.
4. It may be debatable in how strict a sense this scheme adheres to compositionality; if it is ultimately judged to transcend one's preferred compositionality notion, it is at least in good company with recent work on incorporation and related matters arguing the need for moderately innovative methods of composition; cf. e.g. Farkas and de Swart 2003.

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