

Under-specification and contextual variability of abstract prepositions: a case study

Alda MARI

CNRS / ENST – INFRES

46, rue Barrault

75013 Paris, France

mari@enst.fr

Abstract

In this paper we discuss some philosophical questions related to the treatment of abstract and underspecified prepositions. We consider three issues in particular: (i) the relation between sense and meanings, (ii) the privileged status of abstract meanings in the spectrum of contextual instantiations of basic senses, and finally (iii) the difference between prediction and inference. The discussion will be based on the study of *avec* (*with*) and the analysis of its abstract meaning of *comitativity* in particular. A model for *avec* semantic variability will also be suggested.

1 Introduction

Through the study of the preposition *avec* we discuss some major questions related to the analysis and model of abstract prepositions.

Avec is traditionally (Spang-Hanssen, 1963) considered as a *mixed* preposition. On one side, its contextual behavior is very heterogeneous: contrary to the *colored* prepositions (e.g. spatial), it seems difficult to construct a unique sense from which all the meanings are derived; nevertheless, contrary to the *uncolored* prepositions such as *de* (*of*) or *à* (*to*) in French, *avec* seems to point to an identifiable set of constraints. It is our aim to investigate whether this set exists and to determine its status. This requires an answer to the following questions:

1. How can the contextual variability of polysemous prepositions be mastered ?
2. Does a privileged sense exist in the spectrum of this variability ?
3. What is the relation between sense and meanings ?

4. What criteria have to be filled by a model ?

We discuss the first of these questions in section 2 where we present the theoretical contention around the notion of polysemy of grammatical items and prepositions in particular, against which we will have to evaluate the results of our study. The second question will be illustrated in section 3 where we present the main meanings of *avec* and focus on *comitativity*, which, being more abstract than the others, seems to point directly to the underspecified set of constraints defining *avec* in general. In section 4 we briefly introduce a model inspired from Channel Theory (Barwise and Seligman, 1997) and we test it on the problematic data related to the meaning of *comitativity*. In section 5 we come back to the two remaining questions: we present a model for the whole semantic domain of *avec* by introducing the distinction among notions and values and discuss the inferential power of our model.

Following Pinkal's distinction between *sense* and *meaning* (Pinkal, 1985, Poesio, 1996), we consider that senses tell us under which circumstances in the world the sentence is true or false, and that meanings assigned to an expression behaves as functions from contexts to senses.

2 Polysemy and contextual variability

The notion of polysemy implies that (i) a word has many different meanings and that (ii) these meanings are in a certain way related to one another. A major issue is then to explain the phrase "in a certain way". By virtue of what principles are they related? Is it by virtue of a

unique sense that, together with a rule system allows to generate all of them, or simply by virtue of *family resemblances* ?

More fundamentally, the notion of polysemy poses the major question of the relation between language and thought. It is not only a matter of discovering whether a unique sense exists, but also to determine whether this sense is cognitively grounded, or in other terms, whether it is pre-linguistic or perception based.

Cognitive linguists such as Wierzbicka (1996) claim that all meanings are derived from a cognitive primitive-based dictionary by a cognitive grammar. Under her account, language is grounded in thought and polysemy is a consequence of the instantiation of thought into language, the cognitive dictionary being the glue of all the meanings of a polysemous word.

Wittgenstein (1953/1961) introduces in his *Philosophical Investigations* (§68) a radically different point of view. He argues that it is clearly impossible to define words by abstract meanings on the account of pure observation. Provocative, this affirmation poses the problem of the existence of rules and opens a series of other questions: do definitions of polysemous word exist? And what do these definitions look like? Is it possible for an abstract definition to coexist with local values not caught by this definition? What is their status then?

According to these antithetic philosophical positions, prepositions have undergone different treatments. Jackendoff (1987), Wierzbicka (1996) and Brøndal (1950) consider that they instantiate primitive atomic notions and that their meanings can be metaphorically and metonymically calculated; some other authors such as Cadiot (1997) consider instead that prepositions denote different properties on a variable spectrum that cannot be reduced to an atomic sense.

These positions are more often grounded in philosophical considerations rather than in empirical observations. Our approach is fundamentally inductive and is focused on the meaning of *comitativity* which seems to trace a privileged way to the abstract notion of *avec*.

3 The privileged status of *comitativity*

Let us first consider a classification of *avec* meanings.

Syntax:	Semantics
NP ₁ <i>avec</i> NP ₂	<i>Part-Whole</i> : Un homme avec un chapeau / A man with a hat
NP ₁ (VP <i>avec</i> NP ₂)	<i>Reciprocity</i> : Jean habite avec Anne / John lives with Ann
NP ₁ VP <i>avec</i> NP ₂	<i>Instrumental</i> : Jean enfonce les clous avec un marteau / John pushes nails with a hammer
	<i>Comitativity</i> : Jean marche avec Anne / John is walking with Ann
	<i>Manner</i> : Jean accueille Anne avec la joie au cœur / John welcomes Ann joyfully
NP ₁ VP <i>avec</i> N	<i>Manner</i> : Jean accueille Anne avec joie / John welcomes Ann with joy
NP ₁ VP <i>avec</i> NP ₂ S	<i>Influence</i> : On a fait tout le voyage avec Pierre qui râlait sans arrêt / We did the entire trip with Peter who couldn't stop complaining
<i>Avec</i> NP ₂ , S	<i>Thematic</i> : Avec ce mauvais temps, il vaut mieux rester chez soi / By this bad weather, it is better to stay at home

Table 1. Classification of *avec* meanings.

The meaning of *comitativity*, as argued by Cadiot (1997), stays in the middle of the spectrum of the semantic domain of the preposition *avec*: it is less constrained than the meaning of *reciprocity* and more specific than the meaning *thematic*. Compared to *instrumental* and *manner*, it is characterized by a notion of symmetry as will be discussed at length in the next section. Its privileged status clearly emerges from the definition given for the first time by Guillaume (1919/1975) and adopted by Cadiot (*ibid.*) in a recent study. Guillaume (*ibid.*: 279) defines the *comitativity* as follows¹: “the preposition *avec* is an abstract image of parallelism: it expresses the relation holding between two entities that exist or act together, accomplish the same movements and follow the same directions. This image presupposes a certain equality ... which is easily realized when the preposition links two nouns”. Cadiot (*ibid.*: 153) adds to this the notion of interaction: “*avec* creates ... the conditions for an optimal interaction between two entities of the reality”.

It is important to note that these definitions also apply to *avec* in general: according to these authors, they fit the meaning of *comitativity* and are modified into the other contextual possibilities enumerated in Table 1.

¹ The translations are of the author of this paper.

Three key notions emerge as fundamental from these citations: *parallelism*, *interaction* and finally *association*, which is strictly related to the first two. In the following section we show that the intuition grounding these definitions is correct, but that it is precisely the sense of association that needs an explanation: to define *avec* means to clearly formulate the constraints which need to be satisfied for two or more entities to be said "associated". We admit that the meaning of *comitativity* has a privileged status and focus on it.

3.1 Cadiot's account of *comitativity* and problematic data

On a phenomenological level, Cadiot (1997) analyzes the typical example of *comitativity* in (1), by a condition on symmetry (2) which implies a coordination (3):

- (1) Pierre marche avec Marie / Peter walks with Mary
- (2) a. If NP₁ VP *avec* NP₂ then, NP₂ VP *avec* NP₁
 b. If "Pierre marche avec Marie", then "Marie marche avec Pierre"
- (3) a. If NP₁ VP *avec* NP₂, then NP₁ VP *et* NP₂ GV
 b. If "Pierre marche avec Marie", then "Pierre marche" and "Marie marche"

These conditions properly describe the fact that in a situation where "Pierre walks with Mary" it is true that "Pierre walks", "Marie walks", "Pierre walks and Marie walks", "Marie walks with Pierre".

Nevertheless, these conditions appear too vague: all the cases enumerated from (4) to (6) below are improperly generated by (2) and (3).

Consider the case of two animates who are both at the same time in the same place².

- (4) a. Jean s'est retrouvé hier à la banque avec la voisine qu'il ne peut pas supporter / Tough he can't stand her, John was at the bank with his neighbor

b. (??)Jean est à Paris avec Chirac / John is in Paris with Chirac

The condition (2) which properly generates (4a) does not explain why (4b) is difficult to interpret if Jean lives in Paris and Chirac is in Paris as the President of the Republic and there

is no interaction between them. The spatio-temporal association which seems sufficient for interpreting (4a) has to be reinforced by a stronger sense of interaction for (4b) to be interpretable.

The condition in (2) also misses the difference between (5a) and (5b). Consider two inanimate entities:

- (5) a. Les verres sont dans le buffet avec les carafes / The glasses are in the cabinet with the pitchers

b. (??)La porte est dans le salon avec la fenêtre / The door is in the living-room with the window

The sentence (5b) cannot describe the relation existing between a window and a door of a living-room. For it to be interpretable, the door and the window have to be figured out as taken down.

Finally, the condition in (2) misses the constraints related to the nature of the predicates:

- (6) a. Jean est gentil avec Marie / John is kind with Mary

b. (??)Jean est triste avec Marie / John is sad with Mary

The only possibility to interpret (6b) is that Mary has an influence on John's sadness. The interpretation that John is sad, Mary is sad and that they are sad together at the same time, as foreseen by (2), is excluded.

Of course these are all problematic data that a model of *avec* must explain. More abstractly, two major difficulties missed by (2) will have to be solved:

(i) *The spatio-temporal association problem*. As discussed above (cf. (4a) / (4b)) the property of spatio-temporal location is not always sufficient to ensure the association of two entities.

(ii) *Regular association vs. accidental association*. Consider two persons walking from point X to point Y. (7a) and (7b) describe this scene in a fundamentally different way:

- (7) a. Le passant A marche avec le passant B / Person A walks with person B

b. Le passant A et le passant B marchent / Person A and person B walk

(7a) means that the walk of the two persons is coordinated and that this coordination is not

² The symbol (??) means that the sentence is interpretable under specific conditions.

accidental. If one of the two persons turns around a corner, the other will do the same. This set of inferences is not enhanced by (7b), where *et* presents the coordination of the walks of the two persons as purely accidental.

In the rest of the paper we will refer to (7a) as showing a *togetherness* effect. In the following section we introduce an intensional model which takes the mechanism of this effect into account.

4 Togetherness effect

The model we are about to present is an intentional model that takes into account the properties of the entities denoted by the NPs of the construction NP1 VP *avec*_[+comitativity] NP2. This explanation contrasts with the extensional models that have been used to explain the *togetherness* effect (Lasersohn, 1998).

Our representation serves the purpose of illustrating, by a concrete case, the speculative discussion in the next section. It can be questioned on many different formal aspects, and can be further elaborated or even differently expressed. Nevertheless the model is intuitive enough to ground the philosophical discussion underlying our case study.

4.1 Shortcomings of extensional models

Lasersohn (ibid.) proposes a model of *togetherness* based on the notion of *group*:

(8) **Together:** given the eventuality³ *e*, a property *P* and a group *g*, *together* is appropriate iff $g \in P(e)$ and, for each part (proper or improper) *e'* of *e*, if it exists *x* such that $x \in P(e')$, then $P(e') = P(e)$.

Under this account, a group is thought of in terms of the minimal number of entities sharing a property in an event (or state) and all its parts. As such, this model fails to discard the cases of pure accidental association such as (7b): this notion of *group* can be applied to a scene where two (and only two) persons accidentally walk in the street from point A to point B and in all the parts (proper and improper) of this path.

³ Eventualities are spatio-temporal entities such as states and processes (Binnick, 1991).

4.2 Channel theory and intensionality

To explain the *togetherness* effect, we have developed a modal model inspired by Channel Theory of Barwise and Seligman (1997). We claim that the notion of *togetherness* is interpretable in terms of channel or the *linkage of properties* of the parts of a whole.

A whole regulating and coordinating the internal behavior of its parts is a *distributed system* or *channel*. A model considering properties and types is *intensional*: knowing the object type, one can predict its behavior.

A channel is thus defined by constraints that universally quantify over types (and not entities as in the extensional accounts), guaranteeing that the linkage of the properties of the parts (i) is regular (vs. accidental) for a given object type and (ii) take place within the structure of the distributed system.

Technically, a channel is defined as the combination of two infomorphisms. The notion of classification grounds the definitions in (10) and (11).

(9) **Classification.** A *classification* is a triple (*Objets*, *Types*, \models), where *Objets* is a set of objects, *Types* a set of categories or types, and \models a relation between *Objets* and *Types*. If $o \in \text{Objets}$ and $\sigma \in \text{Types}$, $o \models \sigma$ means that the *o* is of type σ .

(10) **Infomorphism.** An infomorphism is a pair of classifications (*Objects*₁, *Types*₁, \models_1) and (*Objects*₂, *Types*₂, \models_2) associated with two total functions $f: \text{Objects}_1 \rightarrow \text{Objects}_2$ et $g: \text{Types}_2 \rightarrow \text{Types}_1$ such that, for $o \in \text{Objects}_1$ and $\sigma \in \text{Types}_2$:

$$\begin{array}{ccc} \text{Types}_1 & \xrightarrow{g} & \text{Types}_2 \\ \vdots & & \vdots \\ \models_1 & & \models_2 & f(o) \models \sigma \text{ iff } o \models g(\sigma) \\ \vdots & & \vdots \\ \text{Objects}_1 & \xleftarrow{f} & \text{Objects}_2 \end{array}$$

Channel. A channel is a set of infomorphisms sharing a common classification called the *core* of the channel.

$$\begin{array}{ccccc} \alpha & \xrightarrow{f'} & f'(\alpha) \models g'(\beta) & \xleftarrow{g'} & \beta \\ \vdots & & \vdots & & \vdots \\ \models_1 & & \models_2 & & \models_3 \\ \vdots & & \vdots & & \vdots \\ \text{Part}_1 & \xleftarrow{f} & \text{Whole} & \xrightarrow{g} & \text{Part}_2 \end{array}$$

We claim that *avec* signals the presence of a distributed system regulating the properties of the entities it links, in a regular way. In other terms, the kind of association introduced by *avec* can be represented by a channel. We can thus formulate the abstract constraints defining the behavior of *avec*:

(11) **Under-specified sense of *avec*.** *Avec* signals that the state of affairs it refers to is structured in a way that can be described by a channel.

4.3 *Avec*-comitativity

We can now come back to the explanation of the problematic data introduced in the discussion of *avec*-comitativity and test our model.

The definition (12) establishes a clear distinction between (7a) and (7b): *avec* in (7a) signals the existence of an overall walk coordinating the two separate walks of the persons involved, where *et* in (7b) does not. It follows that only (7a) enhances a scenario that can be described by a channel. This under-specified definition is specified as follows into the meaning of *comitativity*:

(12) ***Avec*-comitativity.** In a structure $NP_1 VP$ *avec* NP_2 , *avec* signals the existence of a channel verifying the following conditions:

- (i) it links the phases describing the events involving the entities denoted by NP_1 and NP_2 ,
- (ii) each of the phases involving one of the two entities implies that the phase involving the other entity expresses an actual or potential influence,
- (iii) no other phases than the ones described in the sentence can be evoked⁴.

$$\begin{array}{ccccc}
 \alpha & \xrightarrow{f'} & f'(\alpha) \vdash g'(\beta) & \xleftarrow{g'} & \beta \\
 \vdots & & \vdots & & \vdots \\
 \models_1 & & \models_2 & & \models_3 \\
 \vdots & & \vdots & & \vdots \\
 \phi_{GN1} & \xleftarrow{f} & \phi_{GN1}; \phi_{GN,2} & \xrightarrow{g} & \phi_{GN2}
 \end{array}$$

The following set of constraints further specify this representation (the operators F , P

and \diamond have their usual meaning of *past*, *future* and *possibility*):

$$\left(\begin{array}{l}
 \text{For each } \alpha \in \Sigma, \text{ it exists } \beta \in \Theta \text{ such that} \\
 g(\alpha) \vdash g'(\diamond F \beta) \\
 g(\alpha) \vdash g'(\diamond P \beta) \\
 \text{For each } \beta \in \Theta, \text{ it exists } \alpha \in \Sigma \text{ it exists} \\
 g'(\beta) \vdash g(\diamond F \alpha) \\
 g'(\beta) \vdash g(\diamond P \alpha)
 \end{array} \right)$$

Let us analyze this definition:

(i) *Avec* links the *eventualities* which involve the entities denoted by NP_1 and NP_2 ⁵.

(ii) The types describing these eventualities are *phases* i.e. descriptions including the possible previous and past developments of the actual eventuality (Penczek, 1995).

Moreover, we have to note that the constraints characterizing the channel present modal types. This is licit within Channel Theory and is particularly useful for our purposes.

We can conclude that the channel signaled by *avec*-comitativity links the present, past and future developments of the eventualities which involve the denotations of NP_1 and NP_2 .

4.3.1 Solution of the spatio-temporal juxtaposition problem

Let us come back to the paradox of spatio-temporal co-localisation. In most cases, *avec* is used when two entities interact. Cadiot (1997) considers this condition as necessary. Nevertheless some cases of pure spatio-temporal co-localisation are supported by *avec*, such as (4a). They can now be easily explained. Consider an example:

(13) A son insu, Jean s'est retrouvé sur la montagne avec un ours / Without knowing it, John was on the mountain with a bear

In the referred state of affairs there is no interaction between John and the bear. Nevertheless, according to our experience, we know that the particular location of a person and a bear being on a mountain can evolve toward an interaction *by virtue* of them being in the same place. It is *because* John and the bear are in the same place at the same time, that they could interact. According to (13), this scenario can be described by a channel that takes the

⁴ This condition can be expressed by the notion of aggregation (Kratzer, 1989): the association has to be possible within the system itself and not by the intervention of external events.

⁵ From now on, we will refer to the denotations of NP_1 and NP_2 by X and Y respectively.

form of potential interaction and links their mutual positions.

This is not the case for the spatio-temporal location of John and Chirac in (4b). In the case where they would meet, it would not be by virtue of their being both in Paris, at least not in a default context; an extra eventuality should intervene for John et Chirac to meet and this is not allowed by (13) nor by the definition of channel in (11). There is then no distributed system regulating their particular spatio-temporal properties.

The definition (13) also explains why in some other cases *avec* is impossible. Consider the window and the door of a living-room (5b): the properties of their spatio-temporal locations are not mutually regulated. This is why the interpretation of the sentence enhances a scenario in which someone has taken them down in the course of a remaking of the house, for instance.

The same explanation holds for (6b). *Avec* forces an interpretation where the sadness (or another property) of Mary influences the sadness of John: *avec* signals a coordination of the properties of the entities it links. The definition in (12) forbids the interpretation that "Jean is sad, Marie is sad, they are sad independently from one another and they are sad in the same spatio-temporal location".

5 A model for *avec*: notions, values, inferences

Let us recall the argumentation we have been pursuing until now. *Avec* shows a very wide contextual variability and the challenge is to reconstruct a unique set of constraints explaining the coherence of its semantic spectrum. The meaning of *comitativity* has offered a privileged way toward this set defined in (12). This definition is quite abstract and is differently instantiated into the other contextual possibilities. The table 2 summarizes the definitions that can be given to each of the meanings listed in table 1.

NOTIONS	Association				
	Influence ^b			Spatio-temporal trace ^g	
VALUES	Comitativity ^d	Influence ^e	Inter-propositional ^f	Part-whole ^h	Instrumental / Manner ^q

Table 2. Model for *avec* semantic domain.

This table suggests that the meanings of *avec* can be classified into two families: *the spatio-temporal trace* and *influence*. The observable meanings, or *values*, differently instantiate the abstract constraints that we call *notions*.

NOTIONS

- ^αTwo entities are thought of as acting (or taking place) within the same scene in such a way that a connection exists between them.
- ^β*With* connects phase by phase the two eventualities in which X and Y are involved without the intervention of eventualities other than the ones described in the sentence.
- ^γThe spatio-temporal trace of X gives an access to the spatio-temporal trace of Y without the intervention of entities other than the ones referred to in the sentence.

VALUES

- ^δThe potential for the eventuality in which X (or Y) is involved to influence (or have influenced) the eventuality in which Y (or X) is involved.
- ^εThe potential for the eventuality in which Y is involved to influence the way in which X controls the eventuality in which is involved.
- ^ζThe potential for the eventuality described by the PP to influence the eventuality described in the main proposition.
- ^ηThe spatio-temporal trace of Y is accessible from X, without the intervention of entities exterior to the ones described in the sentence.
- ^θThe description of the eventuality in which X is acting implies the entity denoted by Y in its same spatio-temporal trace.

The *comitativity* meaning belongs to the *influence* family. The meanings instantiating the *spatio-temporal trace* notion can be described as signaling a channel as well, and do not have to be confused with spatio-temporal juxtaposition. The regulation of spatio-temporal traces can take different forms according to the possible meanings: *instrumental*, *manner* of *part-whole relation*.

In the case of *instrumental*, the regulation of the spatio-temporal traces takes the form of a control of X over Y. In the following scenario, John "reads" the manual:

(14) Jean apprend l'histoire avec un nouveau manuel / John learns history with a new manual

For *manner*, the regulation takes the form of the relation source / feeling: John is the source of the joy:

(15) Jean parle à Marie avec joie / John talks to Mary with joy

Finally, for the *part-whole relation*, the regulation of the spatio-temporal traces of the entities linked by *avec* is inscribed at the referent level:

(16) Une maison avec une terrasse / A house with a terrace

5.1 Prediction and pragmatic inference

Given this configuration of senses and meanings, we can now come back to the more general and speculative discussion. *Avec* shows a clear variability on the horizontal axis, and a complex organisation on the vertical axis. First of all, the distinction between notions and values roughly corresponds to the sense / meaning. The term *notion*, clearly implies that the definition has a cognitive reality and is probably learned and stored as such.

On the vertical level there is a difference in nature between notions and values: notions can be considered as models for values. The overall abstract notion defined in (12) is a model for *avec*.

The issue related to the predictive power of our model is still open.

To affirm that a model is predictive means to recognize that it is possible to generate all and only the observed meanings by an appropriate rule system. In spite of the fact that we have reconstructed an under-specified and general model for *avec*, we must recognize that it is impossible by virtue of the definition in (12) to generate all (and only) its meanings.

The main reason is philosophically evident: to generate such meanings one should previously know them and because we do not have an access to all the existing corpora, it is impossible to affirm that the model generates all the possible meanings. This argument has been well known since Wittgenstein (1953/1961).

Nevertheless, we believe that we can find more than pure *family resemblances*. First of all, even if very abstract, the polysemous domain of prepositions seems well structured: the definitions of the notions that we have inductively found show that it is possible to identify with a certain precision the semantic domain of *avec*. Moreover, our model constrains the licit interpretations.

It follows that in spite of being predictive, our model allows to formulate inferences.

Consider the interface between semantics and pragmatics. On a semantic level we have admitted that *avec* creates a scenario that can be described in terms of a distributed system regularly linking the properties of two or more entities / events. On a pragmatic level we can conclude that when using *avec*, the speaker *wants to signal* the existence of such a correlation. The hearer will then *infer* that a regular association exists between the entities / events linked by *avec* in the sentence uttered by the speaker, and that such an association must be sought. Let us look at an example.

(17) Avec les stylos dans le verre, la police donne des PV / With the pens in the glass the police give parking tickets

Consider a situation where a speaker and a hearer trust each other, that is to say, a situation where pragmatic irrelevance is not a matter. If the speaker utters a sentence such as (18), the hearer will be looking for a non accidental association between the events (as kind of entities) associated by *avec*: namely the fact that the pens are in the glass and that the police give tickets.

This is exactly what the model we have built for *avec* allows us to *infer*: the two events of the pens being in the glass and the police giving parking tickets are thought, said and interpreted as regularly (vs. non accidentally) associated.

This is the case for many familiar examples, occurring in different syntactic environments:

(18) Avec la pluie, je suis de mauvais humeur / With this rain, I am in a bad mood

(19) J'ai mis les verres avec les carafes / I put the glasses with the pitchers

This observation leads us to conclude that the model is expressive enough to be generalized and to constrain the interpretations of apparently very different meanings. A clearer formalization of these speculative conclusions on the contextual interpretation of under-specified representations is currently under construction.

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