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THE CONJUNCTION 'AND': LITERAL MEANING AND DISCOURSE VALUES

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The present paper faces two basic challenges and aims at overcoming them while showing how to deal with one word, the conjunction 'and'.

What are the challenges? On the one hand, the claim that natural languages are imperfect, ambiguous, vague tools, so that to avoid misunderstandings we must regiment them by translating them into formalized languages. On the other hand, the opposite claim that natural languages are so rich, *nuancées*, full of *ad hoc* values in discourse, that no pretense of objective and rigorous treatment of the meaning of their constituents can be put forward.

Let us see what happens in the case of 'and'.

The conjunction 'and' is formalized in first order logic by the connective ∧. The interpretation of such a connective is a function from truth values to other truth values: ∧ takes as arguments the truth values of the sentences it joins and results in the truth value of the whole sentence. The customary truth tables describe the functions attached to the logical connectives:

p	q	p∧q
V	V	V
V	F	F
F	V	F
F	F	F

The formalization of the natural language word 'and' with the logical connective ∧ raises at least two problems:

a) From the syntactic point of view, 'and' joins not only sentences but almost every part of speech and every phrase: nouns (B03 781 'She has worked extensively at Ronnie Scotts in London *and* Birmingham', B29 1584 'The club holds regular social functions including wine *and* cheese parties *and* receptions for visiting companies which give members an opportunity to meet the actors *and* actresses'[1]), NPs (B1H 2090 'It was a fortress town *and* a trading centre, as it had been for the Romans 800 years earlier'), VPs (A7A 1292

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[1] The examples are taken from the British National Corpus (http://www.natcorp.ox.ac.uk/), which gathers 100 million of tokens in written and spoken English from a wide range of sources. The first three characters of the code denote the text from which the sentence is taken, the following numerals indicate the sentence number within that text.

'Bodo put out a large hand *and* pulled the door to'), adverbs (ECD 508 'While market forces may undoubtedly bring many positive benefits, both socially *and* politically, there are many occasions when it is legitimate to subject them to regulation in order to secure confidence and fairness in the operation of the financial markets'), adjectives (KIR 3789 'On the second day of the Macari trial at Winchester Crown Court, Swindon players past *and* present have been giving evidence') and even prepositions (ABU 1764 'But a range of people inside *and* outside the House of Commons, deliver') and conjunctions (AD0 1270 'If your weight has gone up and down over the last year (or ten years!) try to remember when *and* why it was up or down'). Our aim in this paper is to show that: (i) the occurrences of 'and' that do not conjunct sentences can be rendered by ∧ only at the cost of distorting the syntactic structures of the sentences; (ii) some occurrences of 'and' cannot be formalized by ∧. So, ∧ is not a good formalization of 'and'.

b)   From the pragmatic point of view, 'and' seems to take other meanings in addition to the one expressed by ∧: e.g. temporal order (FSE 676 'He stepped away from the command console *and* bowed'), cause-effect (4KT 4859 'Lawrence was unhappy over the outspoken challenge to his authority *and* axed Slaven from his Tranmere squad'), opposition to and disappointment with an expectation (KC3 235 He is 'unemployed *and* receiving state benefit as employed'). Besides, the conjunction of NPs seems sometimes to indicate that the predicate has to be separately assigned to both conjuncts (CH8 1428 'Now my mum *and* dad come to just about every concert'), sometimes to indicate that the it has to be collectively assigned to the conjuncts (CAR 1718 'Friends *and* well-wishers gather at Kirkwall Airport to await the return of the children to Orkney'), sometimes it is ambiguous between these two readings (A0N 1958 'Alex McLaggan *and* Mary have their own roof at Grandtully', which can mean either that Alex McLaggan has a roof at Grandtully and Mary has a *different* roof in the same place or that Alex and Mary have a roof *together* at Grandtully). We'll show that 'and' has not so many meanings (it is not semantically ambiguous), and that the further meanings it seems to have (the distinction distributive/collective included) are indeed pragmatic enrichments due to inferences drawn from the text.

Finally we shall sketch a positive theory of the meaning of 'and'.

1. ∧ *is not a good formalization of every occurrence of 'and'*

The formalization of (1) in first order logic is (2):

(1)   KDM 5350 Paul and Cathy are going

(2)   Go(*Paul*) ∧ Go(*Mary*)

So a conjunction of proper names is turned into a conjunction of sentences. (1) is considered as equivalent to:

(3)   Paul is going and Mary is going

Indeed some syntacticians claimed that (3) is the deep structure of (1) and that (1) is the outcome of a syntactic transformation (cf. for example Gleitman 1965).

While (1) and (3) have the same truth conditions, a conjunction of VPs often cannot be transformed into a conjunction of sentences. This happens when the NP which is the argument of that conjunction is indefinite:

(4)   FT9 151 Former England opener Geoff Boycott chased and caught a thief

(5)   Former England opener Geoff Boycott chased a thief and Former England opener Geoff Boycott caught a thief

(4) means that Geoff Boycott chased a thief and caught him while (5) could mean that he chased a thief and caught a *different* one.

We face the same problem when a conjunction of adjectives is involved:

(6)   AYM 1288 You'll always receive a warm and friendly welcome

(7)   You'll always receive a warm welcome and you'll always receive a friendly welcome

These facts seem to prove that there exists no deep structure in which two different sentences occur.

However, first order logic possesses the formal resources to express (4) and (6), although a price must be paid: the syntactic structure of natural language sentences is completely distorted. Indefinite NPs are expressed by the existential quantifier, which can take large scope and bound every open variable in the whole formula. (4) can be formalized by (4') and (6) by (6'):

(4') $\exists x\,(\text{Thief}(x) \wedge \text{Chased}(\textit{Geoff Boycott}, x) \wedge \text{Caught}(\textit{Geoff Boycott}, x))$

(6') Always $(\exists x\,(\text{Warm}(x) \wedge \text{Friendly}(x) \wedge \text{Welcome}(x) \wedge \text{Receive}(\textit{you}, x)))$

From the syntactic point of view, in (4) firstly the verbs are conjoined and then this conjunction takes its arguments. We give a very rough and simplified representation of the syntactic structure of (4):

```
                                    S
                          ┌─────────┴─────────┐
                    Geoff Boycott             VP
                                       ┌───────┴───────┐
                                       V               DP
                                   ┌───┴───┐           │
                                chased   caught      a thief
```
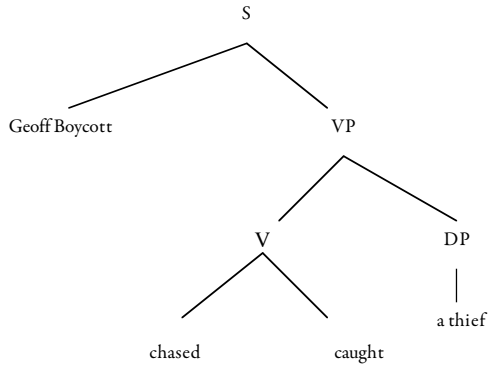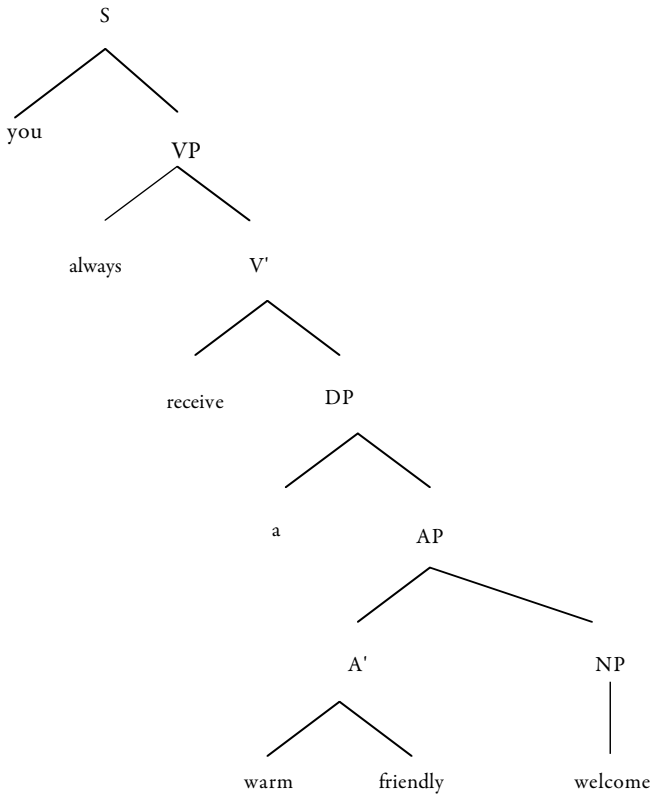
Such a structure is not mirrored in (4'), where the noun 'thief' and the verbs 'chased' and 'caught' are on the same level and their variables are all bounded by the quantifier expressed by 'a'.

The same holds in (6): firstly the adjectives are conjoined, then they modify the noun 'welcome' and finally the verb takes as argument the resulting construction:

```
        S
    ┌───┴───┐
   you     VP
        ┌───┴───┐
     always     V'
             ┌───┴───┐
          receive    DP
                  ┌───┴───┐
                  a       AP
                      ┌───┴───┐
                      A'      NP
                   ┌──┴──┐    │
                 warm  friendly welcome
```

This is lost in (6') where the verb, the noun and the adjectives are on the same level and their variables are bounded by the quantifiers expressed by 'a'.

However, when conjunctions of nouns are considered instead of conjunctions of adjectives or verbs, not only do the first order logic formalizations not mirror the syntactic structure of the sentences, they also give incorrect results. For example:

(8) There were ten friends and colleagues of Paul's at the party

(8') $\exists_{10}x$ (Colleague-of-Paul(x) ∧ Friend-of-Paul(x) ∧ To-be-at-the-party(x))[2]

(9) There were ten friends of Paul's at the party and there were ten colleagues of Paul's at the party

Clearly (8) is not equivalent to (9); furthermore (8') not only distorts the syntactic structure of (8)[3], but its formalization (8') is not suitable to express (8) either: (8') is true when ten people who are both friends and colleagues of Paul attended the party. But (8) can be true also when five friends (who are not colleagues) and five colleagues (who are not friends) attended the party; or it can be true when there were two people who are both friends and colleagues of Paul, two friends who are not colleagues and six colleagues who are not friends at the party. These possibilities are excluded by (8'). Things are even worse with regard to (10):

(10) CJN 35 116 young men and women, between the ages of 17 and 22, took part in the research between January and December 1992

(10') $\exists_{116}x$ (Young-man-between17-22(x) ∧ Young-woman-between17-22(x) ∧ Took-part-in-the-research(x))

The formula (10') is true when 116 people who are both men and women took part in the research. Since no people who are both men and women do exist, (10') cannot be true in any context; but clearly this is not true with regard to (10).

In the same way, ∧ cannot formalize conjunctions of NPs that are arguments of a collective verb:

(11) JT4 152 The vocalist and the guitarist met in a chip shop

(11') Met-in-a-chip-shop(*the vocalist*) ∧ Met-in-a-chip-shop(*the guitarist*)

(11') is true when the vocalist met in a chip shop and the same thing is true of the guitarist. Indeed it is hard even to figure out what a sentence like that could mean.

Finally, as ∧ is a function from truth values to other truth values, it is thought of as a formal device to render the conjunction of constative sentences to which a truth value can be assigned: so ∧ cannot formalize performative sentences which have no truth value.

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[2] As usually, '$\exists_n x\ P(x)$' is the abbreviation of: $\exists x_1...\exists x_n\ (x_1 \neq x_2 \wedge ...\ x_{n-1} \neq x_n \wedge\ P(x_1)\ \wedge...P(x_n))$

[3] In the syntactic tree firstly the nouns are conjoined, then they are modified by the PP 'of Paul's' and then determined by the determiner 'ten'; finally the DP built in this way becomes an argument of the verb. All this structure is clearly lost in (8').

To sum up, in this first section, we have shown that ∧ cannot formalize every use of 'and' in natural language. In addition to ∧, the symbol of the intersection between sets ∩, has also been used in order to formalize the conjunction 'and', for example by Partee & Rooths (1983). We could demonstrate that this formalization runs into problems similar to those in the case of ∧, but we will do not so for lack of space.

2. *Discursive meanings*

As mentioned above, 'and' can carry many different meanings according to the discursive contexts where it is used. There are at least two possible positions regarding this: (a) firstly, 'and' is an ambiguous word with many possible meanings, one of which is selected by the context of use; (b) secondly, 'and' carries only one, very poor, meaning, while all the other meanings which seem to be possible are, in fact, the results of pragmatic implicatures bound to specific discursive contexts.

In what follows, we defend the second position given above, starting with the argument about the alleged collective and distributive meanings.

2.1 The distinction collective/distributive is not a semantic one

There are many different reasons in favour of a pragmatic solution.

First of all, according to Winter (1996), if the meaning of 'and' were ambiguous between a collective and a distributive one, it should not be hard to find out languages where these two meanings are expressed through two different words. For instance, the Italian word 'riso' is ambiguous, since its meaning can be "laugh" (noun) or "rice": in other languages, the two meanings of 'riso' are expressed through two different words, such as 'Lachen' and 'Reis' in German, or 'rire' and 'riz' in French. The same should also hold true for 'and': but this is not the case. In fact, as Payne shows in his comparative study (Payne 1985), there is no language which expresses the distributive and the collective meanings of 'and' through two different words. The fact that even very different languages systematically convey these two meanings using always just one word is a strong argument in favour of the conclusion that these two meanings do not really exist and that 'and' has just one meaning.

Secondly, reasons of economy are involved. Claiming that the conjunction 'and' is ambiguous implies claiming that the ambiguity of 'and' is not among a limited number of meanings, but among an open, indefinite, and hardly manageable, set of meanings. As a demonstration of this, we come back to the distinction distributive/collective: some scholars, like Partee & Roth (1983), or Hoeksema (1988), agree that 'and' has two different meanings, namely a distributive and a collective one. But, let us consider the following sentence:

    (12)   Students and professors wrote a manifesto

This sentence has at least three possible readings: (a) a collective one: all the students and professors have taken part in the writing of one common manifesto; (b) a distributive one: each student and each professor has written one single manifesto; (c) an intermediate one: all the students together have written one manifesto, while all the professors together have written another one. Claiming that 'and' carries an ambiguous meaning implies that the ambiguity of 'and' is at least in three senses, since there are at least three possible readings of 'and' (collective, distributive, intermediate).

But there is more to it than this. Let us consider the following sentence (taken from Gillon 1987):

(13)   Rodgers, Hammerstein and Hart wrote musicals

Gillon makes it clear that Rodgers collaborated both with Hammerstein and Hart in writing musicals, while Hammerstein and Hart never worked together.

Among the many readings of (13), the right one cannot be the distributive, since Rodgers, Hammerstein and Hart never wrote a song on their own, but always through some kind of collaboration; but the same holds also for the collective reading, since all the three songwriters never worked together. The predicate "writing musicals" neither has to be individually (i.e. distributively) attributed to Rodgers, Hammerstein, or Hart, nor collectively to all of them, but it should be attributed to two overlapping subsets of the set formed by the three songwriters.

Thus, a further reading must be added to the distributive, the collective and the intermediate ones: in this fourth reading, the predicate is neither attributed to the single elements nor to the full set of the referents, nor to some partition of it, but to some overlapping subsets of it (technically, to a cover of it).

The process of recognizing further readings does not stop here. For instance, arguing about an intermediate reading between the collective and the distributive ones, we should consider more than just one intermediate reading. In fact, a set can be subdivided in many different ways and the predicate can be attributed to the cells resulting from these different subdivisions. This implies an explosion of the number of possible readings which becomes difficult to manage since 'and' would be a word with really many different possible meanings.

A final reason against the ambiguity of 'and' is that the collective/distributive difference holds when using plurals without the presence of 'and':

(14)   The four hundred firemen have put out fifteen fires

Two of the possible meanings of (14) are that the four hundred firemen have together put out the fifteen fires, or that everyone of the four hundred firemen have put out fifteen fires (which is pragmatically an improbable reading, even though semantically still possible). This is the same difference in reading we have noted for NPs which are joined through 'and'. Claiming that 'and' plays a role in making the distinction collective/distributive leaves no way to explain all the different readings of sentences such as (14). Or, maybe, a different explanation must be taken into account: but giving

two different explanations for what seems to be just one phenomenon is just uneconomic.

2.2 Temporal, causal and opposition meanings are not semantic ones

Although we have argued that the meaning of 'and' is not ambiguous between a collective and a distributive sense, it could still remain true that 'and' has other different meanings, such as temporal, causal, etc.

According to the theory of the ambiguity of 'and', this word shows many possible meanings within the linguistic system and each specific context of use selects one of them. There are many arguments against such a theory. For instance, given that one of the possible meanings of 'and' is temporal order, this meaning would be selected by contexts such as the following:

(15)   He woke up and brushed his teeth

Now removing 'and' from (15), the result is:

(16)   He woke up. He brushed his teeth

The meaning of temporal order of the two events seems not to be lost.

But, if in (15) the meaning of temporal order is attained through 'and', why does this meaning still remain, when 'and' is removed? The Maxim of Manner by Grice requires the speaker to be orderly, i.e. expressing the contents of his talk with regard to their temporal order. Thus, unless further clarifications by the speaker or the context make the inference false, the addressee's inference from (15) and (16) is that the speaker's purpose is that the agent has performed the actions in the same (temporal) order of the clauses in the sentence. Another argument in favour of considering the meaning of temporal order as a pragmatic inference is the possibility of removing the implicature, without resulting in a contradiction:

(17)   He woke up and brushed his teeth, but not in this order

(17) is a non contradictory sentence. It would be such, if the temporal order was included in the semantic meaning of 'and': that things happened in a specific temporal order would be, in fact, stated and, later on, denied. The above remarks about translation are still worthwhile: if 'and' had two meanings (one including and one not including the temporal order), there could be languages where these two meanings are expressed through two different words. But this is not the case.

The same holds good also for the alleged causal meaning of 'and':

(18)   He turned the key and the car started

Again, the causal relation between the two events is still expressed even if 'and' is removed:

(19)   He turned the key. The car started

Our claim here is that there is nothing in (18) and (19) which semantically conveys that the key-turning has caused the starting of the car. A possible reading of (18) and (19) is that the car starting has not been caused by the key-turning, but by something else[4].

But such a reading is easily rejected, since key-turning usually causes the cars to start and speakers know it thanks to their encyclopaedic knowledge. Now, (18) and (19) report that the key has been turned and the car started: there is no reason to argue that the key-turning has not been the cause of the car's starting. The speaker in (18) and in (19) does not say anything to deny this natural hypothesis: he knows that the addressee will guess this and does not act in any way to prevent it. The addressee has the right to make this inference and the speaker knows that the addressee has got this right. So, if the speaker is cooperative, he has used (18) and (19) in order to make the addressee understand that the key-turning has been the cause of the car's starting. But that this causal relation between the two events exists is just a pragmatic inference derived from the context and our encyclopaedic knowledge about how cars work; it is not semantically conveyed by 'and'.

Levinson (2000), reforming Grice's thought, suggests the following conversational maxim (here reported in a shortened form):

The I[nformativeness]-Principle.

Speaker's maxim: "say as little as necessary", i.e. produce minimal linguistic information sufficient to achieve your communicational ends
Recipient's corollary: amplify the informational content of the speaker's utterance, by finding the most specific information, up to what you judge to be the speaker's intended point. Specifically:
  i.   assume that stereotypical relations obtain between referents or events, unless: (1) that is inconsistent with what is taken for granted; (2) the speaker has broken the maxim by choosing a prolix expression;
  ii.   assume the existence or actuality of what a sentence is "about";
  iii.   avoid interpretations that multiply the entities referred to (assume referential parsimony).

If the [I] principle by Levinson is indeed a maxim followed by speakers in their productive and interpretative strategies, this explains why from (18) and (19) the implicature that there is a causal relation between the two involved events can be easily drawn.

In particular, the maxim requires that the addressee assumes the stereotypical relations among the events referred to by the speaker, unless there are contrary specifications. The addressee has to enlarge the informational content of the sentence, assuming

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[4] There are, in fact, contexts where the implicature is removed: "He turned the key and the car started. But he had not started the car: the battery cables had been unplugged. The car has been started through a remote control just in the moment when he had turned the key". All this is not contradictory, as it would be if a semantic meaning of 'and' were here involved.

that these relations are verified although the speaker has not explicitly said so. Assuming that cars stereotypically start through key-turning, this is the most natural interpretation of (18) and (19).

Another supposed meaning of 'and' would be to express the opposition between two conjuncts: in this case, the meaning of 'and' would be very close to that of 'but':

(20) It is a beautiful day. Everyone is enjoying it outdoors and Paul is studying indoors

(21) It was a very interesting proposal and you have rejected it

In (20) and (21), the first conjunct establishes an expectation which is denied by the second. Here we have to wonder if the opposition between the two conjuncts is embedded in the meaning of 'and', or if it is inferred from the fact that what is expressed by the two conjuncts is itself in opposition (although not contradictory).

An argument in favour of this second hypothesis is that it is possible to use 'and' instead of 'but' only if a clear and explicit opposition between the two conjuncts actually exists. When the opposition between the two conjuncts can be unclear to the addressee and must be explicitly expressed by the speaker, the use of 'but' is mandatory:

(22) She is beautiful and clever

(23) She is beautiful but clever

That an opposition really exists between beauty and cleverness is a disputable matter: if the speaker claims that the two properties are in some way in opposition to each other, he must be explicit on this, since the opposition cannot be inferred merely from the meaning of the two conjuncts. Thus, he has to use 'but', as shown in (23); while in (22) the use of 'and' makes the opposition disappear.

The alleged opposition meaning of 'and' would exist only in those cases where the opposition between the two conjuncts is clear: so, in the light of this, it is more economic to claim that the role of 'and' is just to join the two clauses, while the opposition between them is due to their own meanings and not to the meaning of 'and'.

Again, the opposition between the two clauses still holds good even without 'and': this shows furthermore that the opposition is due not to 'and', but to the meanings of the clauses themselves:

(24) It is a beautiful day. Everyone is enjoying it outdoors. Paul is studying indoors

(25) It was a very interesting proposal. You have rejected it

To highlight the disappointment of what we would have expected, the final clauses of (24) and (25) are often uttered in a descending intonation and a lower tone.

3. *Towards a minimalist theory of the meaning of 'and'*

We have excluded that the conjunction 'and' might be formalised with ∧; we have also excluded that it might have a rich and complex meaning or that it might be ambiguous

among various meanings. What has to be done then is to find a positive meaning of 'and', which does not coincide with the usual formalizations, but is minimal, i.e. which can be the semantic basis of all its syntactic occurrences and of all its uses. Our claim is quite simple: the function of 'and' is that of conjoining the semantic value of the second conjunct to the semantic value of the first conjunct in order to produce a structure which has the semantic values of both. In other words, taking two elements X and Y of the same syntactic kind, and assuming that the semantic value of X is α and that of Y is β, the structure 'X and Y' will have as its semantic value the result of the conjunction of β and α. The claim has obviously to be specified according to the elements joined by 'and', that is to say, according to the syntactic kind of X and Y: if X and Y are two declarative sentences, then 'X and Y' will be a structure such that both X and Y are asserted. If on the contrary the two sentences are directives, then the conjunction 'and' will establish a structure where both the orders are given. Otherwise if X and Y are two directive sentences, the conjunction will produce a structure where both the orders are given. If X and Y are predicates, then 'X and Y' will predicate both X and Y of the subject of the sentence; if X and Y are NPs, and if therefore their function is to refer to objects, then 'X and Y' will have as its semantic value the result of the sum of the references of Y to those of X, so that such a structure will refer to the objects to which X refers as well as to those to which Y refers. If X and Y are adjectives and if therefore their function is to ascribe properties to the objects to which a noun refers, then 'X and Y' will ascribe both the properties expressed by X and Y to the objects to which the noun refers. If X and Y are nouns and if their function is to refer to objects[5] , once more 'X and Y' will refer to the objects to which X refers as well as to those to which Y refers. Eventually, if X and Y are adverbs and therefore their task is to modify and to specify an event, the state or the action expressed by the verb, or the property expressed by an adjective, then 'X and Y' will attribute to the verb or to the adjective both the modifications. We don't think that a further meaning has to be attributed to the conjunction 'and'. Obviously what is here outlined is just the draft of a theory: technical details depend on the adopted formalism. In any case we affirm that, whatever the formal theory adopted, if it aims to express the meaning of 'and' in natural languages, it has to equip itself with resources apt to add the referents of a noun to those of another one, to add the attribution of a property to that of another one, to add the modification of a verb to that of another one, etc. $\land$ and $\cap$ can play this role with at least some of the syntactic types which 'and' joins, but not with all of them: they are more apt when it is a matter of adding the attribution of an adjective to that of another adjective, or the predication of a verb to that of another verb, or the modification of an adverb to that of another adverb, but in many cases they fail, when NPs and nouns are taken into account and what becomes necessary is to add referents to refer-

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[5] If the function of both nouns and noun phrases is to refer to objects, what is their semantic difference? We think that nouns have only a potential reference which is actualized or filtered by (possible) determinants of NPs. Yet, nothing in our claim about the meaning of 'and' depends on this particular theory.

ents. Two choices are possible, then: either to express the conjunction with different formal resources, using for instance ∩ for predicates, adjectives or adverbs and another sign for NPs and nouns, or to look for an alternative and more univocal formalization. In this second case, it would be a question of radically reforming our present formalizations.

We do not think there can be anything to add to the semantic meaning of 'and'. Our thesis is therefore a very weak one. Its strength is in stating that any stronger thesis either loses in generality or it attributes to the semantics of 'and' what is just a pragmatic inference.

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