

Milan Bily
 Department of Linguistics
 University of Lund, Sweden

EXPERIENCE WITH COMMENTATOR, A COMPUTER SYSTEM SIMULATING VERBAL
 BEHAVIOUR

0. The project "COMMENTATOR" at the department of general linguistics at the university of Lund is intended to test ideas about language production. The system implemented in BASIC on the ABC 80 micro-computer generates a scene on the monitor where two persons, Adam and Eve, move randomly around a gate. Not only the present positions of Adam and Eve are shown on the screen but even the positions before the last "jump". This setting is also used for presenting human subjects the same sort of stimuli as the computer. The moves are generated randomly but the operator can choose the length of jumps. The initial placement of Adam and Eve can be determined by the operator, too, as well as the instruction for the machine concerning the "focus of attention" (Adam or Eve) and the primary goal of the focused actor (the gate or the other actor). On the operator's command the computer makes written comments on the development happening on the monitor screen. (The present version of COMMENTATOR comments in Swedish but it is intended to use the same set of abstract semantic predications "percieved" by COMMENTATOR for production in several languages, all according to the operator's choice. As COMMENTATOR is a research tool, it does not use any ready-made sentences describing foreseeable situations.)

1. The system works roughly as follows: From the primary information (the coordinates of the gate and the two actors) some more complex values are derived (distances, relations "to left", "to right" etc). Then the topics and their "goals" are determined. After that the conditions are tested for the use of the abstract predicates in the given situation - the so-called question menu. This results in positive or negative abstract propositions. The abstract sentence constituents are ordered as subjects, predicates, and objects. Connective elements are added if possible. These connect the last propositions to the previous ones, i.e. conjunctions or connective adverbs are inserted in the proposition. The use of proper names, pronouns, or other NPs is chosen on the basis of reference relations to the preceding proposition. The abstract propositions are substituted by surface phrases and words. The assembled structure is printed. When the whole repertoire of comments is exhausted, a new situation is generated on the screen and the process is repeated. (For a more extensive description of the program and one version of the program itself see Sigurd 1980.)

2. To my knowledge, COMMENTATOR is the only system of its sort in Sweden, if not in the whole of Scandinavia, but there exist some related projects in other countries implemented on larger computers, such as SUPP described in Okada (1980). (SUPP is primarily aimed at recognition of picture patterns.) However, a lot of linguistic research has been done in recent years that will appear useful for the further development of automatic systems of this sort. Badler (1975) is one example of descriptions relevant for COMMENTATOR;

for additional bibliography see Sigurd (1980), Viberg (1981), Okada (1980).

3. The text produced by COMMENTATOR may look like this:

Eva är till höger om Adam. /Eve is to the right of Adam./
 Han är till vänster om henne. /He is to the left of her./
 Han är till vänster om porten också. /He is to the left of
 the gate, too./
 Han närmar sig den. /He is approaching it./
 Han närmar sig Eva också. /He is approaching Eve, too./
 Hon är närmast porten dock. /lit. She is closest to the gate,
 however./
 Hon är inte nära den. /She is not close to it./
 Adam är inte nära den heller. /Adam is not close to it, either./

As can be seen from the sample, the commentary does not vary very much, owing to the limited vocabulary available to the program at the present stage of development. However, to enlarge the vocabulary would not be difficult. A real problem is to instruct the computer how to avoid unnecessary repetitions of redundant information. The second sentence of our proof exemplifies this. The first sentence already implies what is repeated (from "Adam's point of view") in the second sentence. There must be a certain ordering of propositions in the generating subsystem that guarantees that the amount of redundancy is limited. This ordering must also exclude correct but quite misleading commentaries such as the following sequence describing the situation after Adam's last jump:

Han är nära porten. /He is near the gate./
 Han är i den. /He is in it./

Thus what is needed is a better question menu than the existing one. The questions must be ordered according to their importance starting from the most relevant question down to less important question. The importance of this ordering is obvious when we consider the use of negation. In the preliminary versions of COMMENTATOR there were unproportionally many negated sentences. Now negated sentences are limited to "answers" to the natural continuations down the question menu. In other words, the first statement about a certain actor and a certain "goal" cannot be a negated sentence. E.g., "Adam närmar sig Eva. Han är inte nära henne dock." /Adam is approaching Eve. However, he is not close to her./

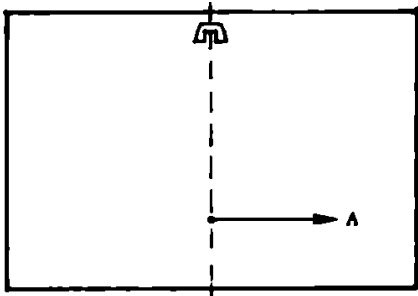
4. Another question that has to be solved satisfactorily is the question of correct reference. COMMENTATOR today is able to do some simple pronominalization, such as substituting the full subject or object of the previous sentence by a pronoun, correctly specified as to grammatical case and genus in a following sentence. It cannot yet refer via a pronoun to both the subject and object of the previous clause. ("Adam närmar sig Eva. De är nära porten." /Adam is approaching Eve. They are near the gate./) What is more important, the program can't observe the restrictions put on pronominalization by the rules of Functional Sentences Perspective. This is not so obvious in the present version of COMMENTATOR, where all NPs are pronominalized if the same (coreferential) NP occurs in the previous sentence. However, intersentential pronominalization is not always obligatory and it remains to motivate pronominalization or

its absence. The necessity of discovering explicit rules of co-reference formulated in FSP terms would become obvious if the produced text were in a language distinguishing between degrees of Communicative Dynamism expressed by various sorts of pronouns, such as Czech, Polish, Russian or Chinese, which differentiate between the "most given" subjects with zero pronouns versus thematic, though to a lesser degree, pronominal subjects, or Czech and Polish, which make the same differentiation as to pronouns in oblique cases (the "most thematic" objects have reduced, enclitic forms while the "less thematic" objects have full forms). (For the discussion of this problem see Bílý 1981a, Chapter 3.)

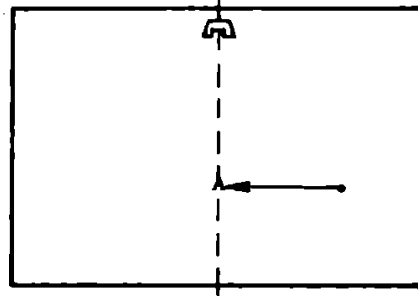
5. As may have been expected, the exact, explicit meanings of the predicates are crucial for the success of COMMENTATOR. In its present version, all such predicates as "is approaching", "is moving away from", "is to the left of", "is to the right of" etc. are based on measuring the absolute, physical distances in terms of rows and columns on the screen. This is, of course, hardly satisfactory. The result is that if Adam is twenty rows below the gate and one column to the left from the center of the gate, "Adam är till vänster om porten." /A. is to the left of the gate./ will be one of the comments produced, which is hardly compatible with comments of human speakers. Similarly, it is stated that "Adam närmar sig porten." /A. is approaching the gate./ when the distance between Adam and the gate after the last jump is smaller than the distance before this jump, all measured in absolute units via Pythagoras' theorem. In many cases this may be correct, but at times it feels completely wrong because the direction of the jump points to the conclusion that Adam is bound to miss the gate with his present direction, the shorter distance notwithstanding. The boundary for "approaching" depends obviously on the distance from the object approached. The lesser the distance the less derivation from the right course is accepted. It also depends on the speed of the approaching object (judged in our case by the length of the jump). The longer jump in the wrong (or not quite correct) direction, the harder restriction on "approaching". The insufficiency of measuring the "reality of the screen" in physical units only also becomes obvious when both objects are moving. It is not correct to say that A and E are approaching each other if the distance between them has diminished after the jump but they have passed the point of minimal distance and are, in fact moving away from each other again. A third case which has not yet been taken into consideration is a movement circumventing unpassable obstacles blocking the path. Even then it is not possible to express the conditions for the use of the predicate "is approaching" in terms of physically measurable distance in the present simple way. It seems necessary to distinguish between states ("is near to", "is to the left of" etc), results ("has approached", "has moved away from" etc), and processes ("is approaching", "is going away from" etc).

Thus the picture of the usual predicates used by different versions of COMMENTATOR becomes quite complicated. What is quite interesting is that certain predicates that one would be inclined to consider symmetric poles in a contrary opposition appear to be asymmetrical - for example, "is approaching" and "is moving away from" show quite

different restrictions. "Is moving away" is possible in certain cases where movement in the opposite direction could not be called "is approaching":

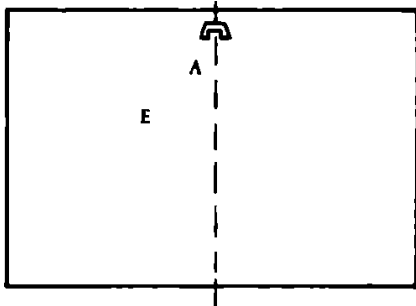


Adam is moving away from the gate.

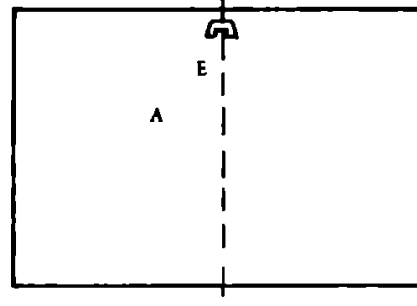


Adam is approaching the gate.

It is well-known that comparatives and superlatives of quantitative adjectives express differences of comparable in some absolute units, while positives are relative values, non-measurable in any absolute units. (The best poet in the town does not have to be a good poet. If Adam is nearer to the gate than Eve, he still does not have to be near to the gate etc.) The relativity of the positives becomes obvious when, e.g. the predicate "is near to" is chosen the first time in a "microtext". The utmost boundary for nearness is thus established which cannot be passed:

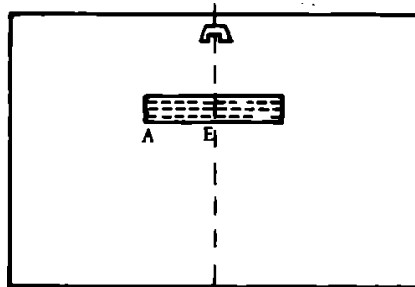


Adam is near the gate.
?? Eve is also near the gate.



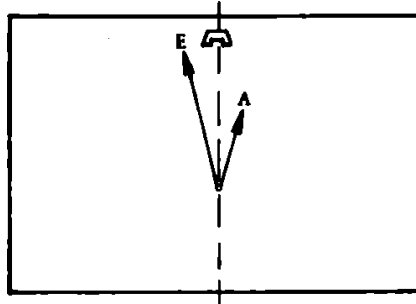
Adam is near the gate.
Eve is even near/Eve is also near the gate.

At least some informants differentiate between "being nearer" and "standing nearer"



A. is standing nearer the gate (than E)
E is nearer the gate (than A)

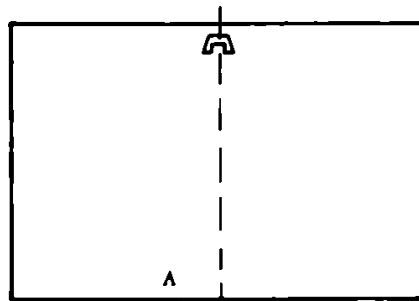
Thus "standing nearer" behaves in a way similar to "approaching". If Adam moved from the place where Eve is now, he would be approaching the gate, too. "Standing nearer" is thus perceived as something like "the result of a movement at the speed of zero", while "being" is purely static. Thus "being nearer/nearest" etc is a state expressed absolutely in the difference of physical measurement units, "being near" is a state measured relatively (in some relation to some reference point th size of the object one is near to, the frame of the background etc.),
Some more examples may illustrate my point:



A is nearer to the gate now.
A is approaching the gate.
A has approached the gate.

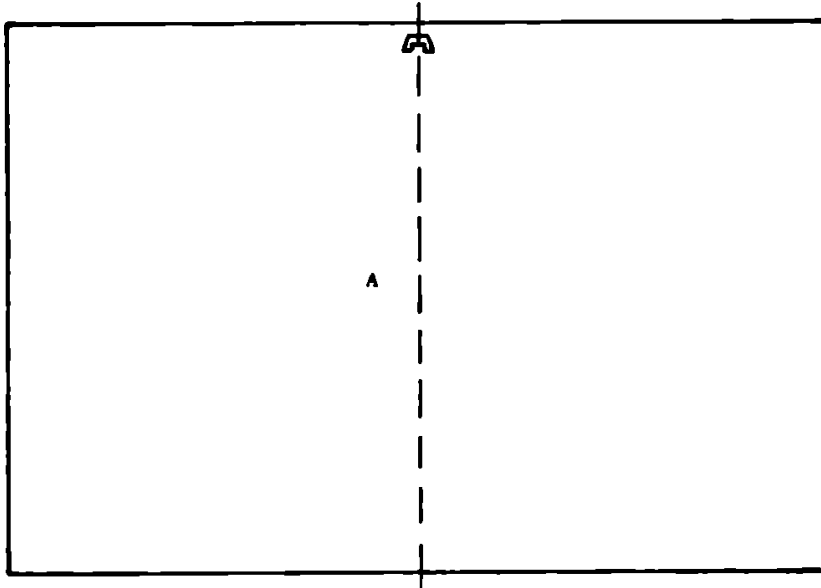
E is nearer to the gate now.
*E is approaching the gate.
E has approached the gate.

As I have already mentioned, "to the left of" is a function of the vertical and horizontal distance. Another factor that must be taken into consideration is the size of the referential frame:



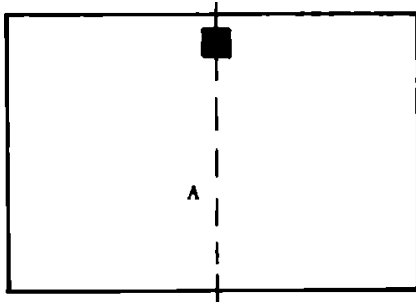
?? A is to the left of the gate.

If the frame is sufficiently enlarged (the more, the better) the same predication becomes quite okay with the distances between A and the gate kept unchanged:

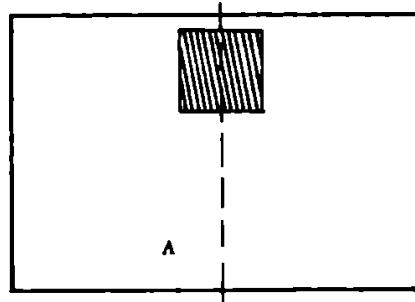


A is to the left of the gate.

The size of the objects related is of equally importance:



??A is to the left of the square.



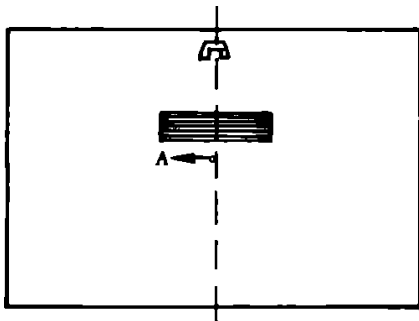
A is to the left of the square.

To sum up, it seems that the usual (and in my opinion rather boring) semantic analyses of the sort "a bull is a male cow" are hopelessly static. What is needed are dynamic semantic descriptions, i.e. descriptions in terms of algorithms applied in the process of mental computation when the choice of the appropriate lexical items is carried out.

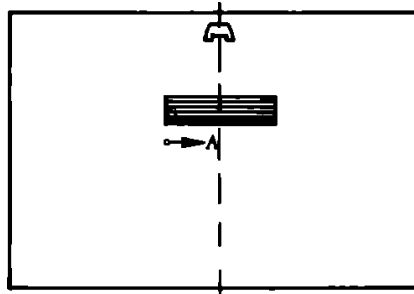
6. When describing positions and movements in my COMMIE, the revised COMMENTATOR program, we obtain something like following set of parameters (The descriptions must be seen as first approximations only, we can hardly expect that they would hold even for a more advanced description of a larger vocabulary.):

1. States: +Relative ("being near to" etc)
2. States: -Relative (being nearer to" etc) - measurable absolutely
3. Results: -Relative, +Directional ("standing nearer to", "having approached" etc)
4. Processes: +Relative, +Directional ("be approaching" etc)

5) Processes: -Relative, +Directional ("be moving away from" etc)
 The difference between 1) and 2) is obvious from what has been said above. The difference between 3) and 4) lies in 3) being measurable in absolute units (considering the direction of the movement to a certain extent), while the direction becomes more prominent in 4), where the distance cannot be generally measured in absolute units. 3) differs from 5) by being a result, while 5) is a process. 4) and 5) are both processes and depend on the direction of the movement, but while 4) is relative, unmeasurable simply in the physical distance on a bee-line, 5) the direction of the movement taken into consideration, can be measured absolutely. The predicates that contain the feature +Directional are at times ambiguous, or to be more exact, they can be used for descriptions of movements in opposite directions, depending on the expectation of the future movement:



A has approached the gate
 (provided that we expect
 a further movement "round
 the corner")



A has approached the gate
 (provided that we expect the
 movement to stop in the present
 position)

7. The new version of COMMENTATOR called COMMIE is meant to take into consideration the problems discussed here. To achieve a greater variation of comment three persons and two gates are generated. In order to assist test persons in their interpretations of the stimuli as movements, the present localization of the actors is completed by the last two states.

COMMENTATOR is primarily intended to be an instrument of linguistic research. "Making a computer talk meaningfully" demands an explicit description of the meanings of the words used in the program. (cf 5.) Beyond the level of the sentence two additional important demands have to be met: The program ought to curb repetitions of redundant information to the "human level", where "unnecessary" repetitions do occur but are chiefly limited to an occasional reconfirmation of validity of an earlier proposition that may have already slipped from the speaker's/listener's memory, or where the repetitions are used to convey difficult, complex information from another point of view in the interest of promoting understanding. (cf 3.) Secondly, the program has to cope with a far from simple and easy to understand human language better. Beside the purely theoretical aspects of COMMENTATOR there are many more practical ramifications on the horizon. It can help us to simulate, understand and cope with various disorders in speech production. Another application would be in language teaching. An explicit, better understanding of

language typology based on the comparison of how certain mental concepts are conveyed via different languages would be of a great help. And, of course, an "intelligent" machine verbally commenting various processes could substitute and/or complement various traditional dials and screens. An automatic radar surveillance commenting on changes of interest would be one of the most obvious applications of a future, more advanced version of the presently existing COMMENTATOR.

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