Relevance Only

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Abstract

In this paper, a single notion of exhaustivity will be defined in terms of *relevance* that accounts for (i) standard exhaustification; (ii) scalar readings; and the intuition that mention-some answers can sometimes be completely resolving. It will be shown that this notion of exhaustivity leaves something to be done for 'only'. Moreover, an analysis will be given of 'only' in terms of relevance that is stronger than exhaustivity in a subtle way. Finally, it will be suggested how exhaustivity and 'only' could interact with disjunctions.

1 Introduction

Rooth (1985) analyzes *only* as follows (neglecting the assertion/presupposition distinction and assuming that ϕ is of type st):

(1) $[[only\ \phi]] \quad = \quad \{w \in [[\phi]] : \neg\exists p \in [[\phi]]^f :\ w \in p \text{ and } p \neq [[\phi]]\}$

In this formula, $[[\phi]]^f$ is the focus-semantic value of ϕ, a semantic value that is determined on top of its ordinary semantic value $[[\phi]]$. If ϕ is a sentence like (2a), then its focus-semantic value will be something like (2b).

(2) a. John introduced $[\text{Bill}]_F$ to Sue.

b. $\{[[\text{John introduced d to Sue}]] : d \in Alt(Bill)\}$

For (1) to be an acceptable rule, it is crucial to limit what the alternatives to ϕ are. It has been argued by various authors that the rule makes sense only in case the alternatives to ϕ differ from ϕ only in a constituent of type e, i.e., just for sentences of the form (2a). Only in that case it can be (naturally) assumed that the alternatives are *independent* of

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one another.[1] In case *groups* of individuals are treated on a par with a 'real' individual like Bill, however, even this limitation is not strong enough anymore. Analyzing sentences of the form

(3) Sue only introduced [Bill and Mary]$_F$ to Sue.

by Rooth's interpretation rule (1) gives rise to the false prediction that the following elements of the focus-semantic value of (3) are not true.

(4) a. John introduced Bill to Sue.

b. John introduced Mary to Sue.

To get rid of these false predictions, something like the following has been proposed by Zeevat (1994) and used by Butler (2001):

(5) $[[only\ \phi]] \quad = \quad \{w \in [[\phi]] : \neg\exists p \in [[\phi]]^f : \ w \in p \text{ and } p \subset [[\phi]]\}$

Actually, they are not using alternative semantics, of course, and use more something like a background-focus structure (cf. von Stechow, Krifka). Also, their analysis is not an analysis of 'only', but rather one of *exhaustification*. Assume a sentence is of the form $\langle B, F\rangle$, and that F and F' range over groups. Then they treat the exhaustification of $\langle B, F\rangle$, $exh\langle B, F\rangle$, more along the following lines:

(6) $[[exh\langle B, F\rangle]] \quad = \quad \{w \in [[B(F)]] : \neg\exists F'[F' \neq F \wedge B(F')(w) \wedge [[B(F')]] \subseteq [[B(F)]]]\}$

Thus, $exh(B, F)$ is true in world w just in case $B(F)$ is the *most informative* true proposition among its alternatives. Depending on the predicate/question (*Who is sick*, *How far can you jump*, or *In how many seconds can you run the 100 meters*), the group denoted by focus-value F in the answer is predicted to be the *maximal* (first two questions) or *minimal* (last question) value that is true.

Although this is a very pleasing result, it gives, as Zeevat (pc) noted himself, rise to a problem too: if we exhaustify already in case of *free* focus, why would we ever use *only*? The goal of this paper is to help to resolve this question.

2 Scalars and utility

Bonomi & Casalegno (1993) have argued in the last part of their paper that 'only' can also have a 'scalar' reading where it rules out alternatives that are 'higher' on a certain scale. Consider the following sentences:

(7) a. Peter only saw [the secretary of state]$_F$.

b. Peter did not see the special envoy to the Middle East.

[1] If all meanings of type $\langle e, \langle e, t\rangle\rangle$ would be alternatives to generalized quantifiers like *a man* and *two men*, Rooth's rule is in deep trouble in case these latter quantifiers would be in focus. See von Stechow (1991) and especially Bonomi & Caslegno (1993) for discussion.

Bonomi & Casalegno point out that (7a) can easily mean that the secretary of state was the *highest* official Peter got to see, in which case it would exclude his having seen the president, but not his having seen the special envoy to the Middle East. Notice that these (lack of) implications don't follow from rule (6): That Peter saw the secretary of state is not entailed by him having seen the president, nor does it entail that he saw the special envoy to the Middle East. The scalar reading of 'only' is perhaps most obvious in *games*. Suppose we are playing a card game against each other, and the *goal* is to win, and winning depends exclusively on who has the highest card. The king of diamonds is higher than the jack of hearts. You show me the king of diamonds and ask: 'What do you have?' Although I have three cards in my hands, I say 'I *only* have the jack of hearts', meaning that this is the highest card I have and (thus) the only one that counts.

To account for this scalar reading involving a scale '>' between propositions – and notice that this is one that cannot be reduced to entailment – Bonomi & Casalegno propose that 'only' not only has an exhausification meaning, but also a scalar one, and they analyze this as (something like) (8).

(8) $[[only\ \phi]] \quad = \quad \{w \in [[\phi]] : \neg\exists p \in [[\phi]]^f : w \in p \text{ and } p > [[\phi]]\}$

But, of course, not only 'only', but also free focus gives rise to scalar readings. And, as emphasized by Hirschberg (1985), also to ones where the scales cannot be defined in terms of entailment. Assuming that 'exhaustification' simply means 'picking out (one of) the best reading(s)', to account for scalar readings for free focus we have to give an exhaustification-meaning defined in terms of scales too:

(9) $[[exh\langle B, F\rangle]] = \quad \{w \in [[B(F)]] : \neg\exists F'[B(F')(w) \wedge [[B(F')]] > [[B(F)]]]\}$

I propose that to interpret **free focus** – i.e. the use of focus that does not associate with an explicit operator like *only*, *even* or *too* –, the latter rule is the basic one,[2] and thus that we should give up exhaustification rule (6) proposed by Zeevat. But how, then, can we account for the standard exhaustification effect? I propose that the ordering relation $>$ is always one of **relevance**: in w, $[[B(F)]]$ is (one of) the most relevant true proposition(s) among the alternatives. Optimizing relevance simply means optimizing *utility* to be determined in a decision theoretic framework.

3 Decision Theory and Utility of propositions

Decision theory is a theory that tells us which action an agent will or should perform given his beliefs and his desires. It is normally assumed that the beliefs of an agent can be represented by a *probability function*, a function from events to real numbers that add up to one. To represent the preferences, or desires, of the agent, on the other hand, we need not only a probability function, but also an additional function that assigns to each action a payoff given an event, a *utility function*. A *decision situation* can then (in the finite case) typically be represented by a *decision table*, which identifies the conditional gain associated with every possible combination of the acts under consideration and the possible mutually exclusive events with their probabilities of occurrence:

[2]the second conjunct as implicature, perhaps.

				Actions		
World	Probability	a_1	a_2	a_3	a_4	a_5
e_1	1/9	5	1	4	2	7
e_2	2/9	3	3	5	6	1
e_3	4/9	1	3	0	3	3
e_4	2/9	6	2	3	5	2

Once we have both the probability and the utility function around, the most sensible way to determine which action the agent should perform is by *maximizing the expected value*. The expected value of each action is determined by multiplying the conditional values for each action/event combination by the probability of that event, and summing these products for each act. The expected utility of action a_1, for instance, is $(5 \times 1/9) + (3 \times 2/9) + (1 \times 4/9) + (6 \times 2/9) = 27/9 = 3$. The action which should be chosen is a_4, because it is the action which maximizes the expected utility, $36/9 = 4$.

Assuming that the relevant possible events are indeed exclusive, we can say that the probability functions take *worlds* as arguments. If we assume that the utility of performing action a in world w is $U(w, a)$, we can say that the expected utility of action a, $EU(a)$, with respect to probability function P is

$$EU(a) \quad = \quad \sum_w P(w) \times U(w, a).$$

The decision situation of the agent as described above is also known as a *decision problem*, and can in general be modeled as a triple, $\langle P, U, \mathcal{A}\rangle$, containing (i) the agent's probability function, P, (ii) her utility function, U, and (iii) the alternative actions she considers, $\mathcal{A}$. Given such a decision problem, we might denote the utility of the action with maximal expected utility of this decision problem by UV(Choose now):

(10) $UV(\text{Choose now}) \quad = \quad max_a EU(a)$.

Before we can determine the utility of new information A, we first have to determine the expected utility of an action conditional on learning A. For each action a, its conditional expected utility with respect to proposition A, $EU(a, A)$ is $\sum_w P(w/A) \times U(a, w)$. Now we can denote the utility of the action which has maximal utility after learning A by UV(Learn A, choose later):

(11) $UV(\text{Learn } A\text{, choose later}) \quad = \quad max_a EU(a, A)$.

The utility of proposition A, $UV(A)$, can be determined as the difference between the expected utility of the action which has maximal expected utility in case you are allowed to choose *after* you learn that A is true, and *before* you learn that A is true:

$$\begin{aligned} UV(A) \quad &= \quad UV(\text{Learn } A\text{, choose later}) - UV(\text{Choose now}) \\ &= \quad max_i EU(a_i, A) - max_i EU(a_i) \\ &= \quad [max_i \textstyle\sum_w P(w/A) \times U(a_i, w)] - [max_i \textstyle\sum_w P(w) \times U(a_i, w)] \end{aligned}$$

Notice that this general rule leaves open how utility should be measured, i.e., what does U depend on? For linguistic applications, two sorts of notions of relevance have been proposed. The first notion might be called an *argumentative*, or *goal oriented* notion of relevance. The goal is to make a proposition h common ground, and the relevance of proposition A is measured in terms of in how far it helps to increase h to be common ground. Merin (1999) has proposed to measure goal-oriented relevance in terms of the Peirce/Turing/Good notion of *weight of argument*, $r_h(A)$, and used it to account for several linguistic phenomena.

(12) a. $r_h(A) \quad = \quad log\frac{P(h/A)}{P(\neg h/A)}$

b. $A >_h B \quad \text{iff} \quad r_h(A) > r_h(B)$

According to this notion of relevance it can be the case that $A >_h B$ although A and B are propositions that are logically, or informationally, *independent* of each other. In terms of this notion we can define scales that cannot be reduced to entailment. Indeed, in terms of this notion we can account for the scalar readings mentioned above. It is important to note that in case our agent wants to argue for h, we can show (cf. van Rooy, 2002) that $UV(A)$ reduces to $r_h(A)$.[3]

In other cases utility or relevance is thought of in more Gricean and cooperative terms. The relevance of an assertion is measured in terms of in how far it helps to resolve an other agent's question, or decision problem. In case Q is the underlying question/decision problem, Groenendijk & Stokhof (1984) value A as a (strictly) better assertion/answer than B, $A >_Q B$, just in case A eliminates more answers of Q than B does:

(13) $A >_Q B \quad \text{iff} \quad \{q \in Q : \ q \cap A \neq \emptyset\} \subset \{q \in Q : \ q \cap B \neq \emptyset\}$

Notice that this notion comes down to (one sided) *entailment* in case $Q = W$, where W denotes the finest-grained partition corresponding to the question how the *world* looks like. In van Rooy (2002) it is shown that this comparative notion of relevance is induced by the general $UV(\cdot)$ function, in case (i) only truth is at stake, and (ii) probabilities are irrelevant. Thus, the comparative relevance-relation '$>$' used in (9) and defined in terms of $UV(\cdot)$ reduces either to (12b), corresponding with a *scalar* reading, or to (13), which in special cases comes down to entailment, giving rise to the standard exhaustive reading.[4]

4 Resolving answers and 'only'

Notice, though, that if '$>$' comes down to '$>_Q$' it might be the case that the background question/decision problem Q does *not* give rise to a partition. It might be the case, for instance, that Q corresponds with (14) that most naturally gives rise to a *non-partitional* set of propositions.

(14) Where can I buy an Italian newspaper?

[3]More precisely, in those case $UV(\cdot)$ reduces to a function that is continuously monotone increasing to $r_h(\cdot)$. Thus, to a function that gives rise to the same ordinal scale as $r_h(\cdot)$.

[4]Actually, under special cases also $r_h(\cdot)$ comes down to entailment, see van Rooy (2002).

Suppose that you can buy an Italian newspaper at the station in u and w, and at the palace in v and w, then Q can be thought of as non-partitional $\{\{u,w\},\{v,w\}\}$. If I answer (14) by saying 'At the station', this intuitively does not rule out that I cannot buy one at the palace. And, indeed, that's what comes out according to our rule (9). In both worlds u and w, there is no alternative true answer that would eliminate more elements of Q than answer 'At the station' does. Thus, although optimizing relevance measured in terms of '$>_Q$' gives rise to a *mention all* reading in case Q is a partition, in case Q is not a partition it naturally allows for *mention-some* readings. Thus, according to our analysis of exhaustivity, (9), an exhaustive reading of an answer might be equal to a mention-some reading. I take this to be a desirable feature of the analysis, because in specific circumstances a mention-some reading of the answer 'feels' like being completely *resolving* (cf. Ginzburg, 1995).

Notice that this feature leaves something open to be done for *only*. Indeed, I propose that (9) should *not* be the rule that analyzes this particle. As observed by Butler (pc), it seems that 'only' restores (classical) exhaustivity. Whereas answer 'At the station' to question (14) allows naturally for a mention-some reading, this is not the case anymore for answer 'Only at the station'. How could we account for the extra effect of 'only'? I will propose that this is actually very easy. The meanings of 'exhaustivity' and 'only' are closely related, but the meaning of the latter is somewhat stronger: whereas exhaustivity says that *no better* true answer could be given, 'only' says that there is even *no alternative* true answer that is *equally good*. Slightly differently: whereas saying that F is the exhaustive answer to the question means that there is no alternative that (i) is true, and (ii) *more* relevant than $B(F)$; saying that F associates with 'only' means that there is no alternative different from F such that (i) it is true, and (ii) it is more or *equally* relevant as $B(F)$.

(15) $[[only\langle B,F\rangle]] = \quad \{w \in [[B(F)]] : \neg\exists F'[F' \neq F \wedge B(F')(w) \wedge [[B(F')]] \geq [[B(F)]]]\}$

Thus, '$onlyB(F)$' says not just that $B(F)$ is *a* best answer, but it also says that it is *the unique* one. In our model described above it will hold that answer 'Only at the station' will just denote $\{u\}$: world w is ruled out, because there is an alternative answer to 'At the station', nl. 'At the palace', that (i) is true in w, and (ii) is equally relevant as 'At the station'.

Notice that if '$>$' is measured in terms of underlying question Q, and in case $Q = W$, (15) comes out as being equal to (6). I conclude that Zeevat's problem about the effect of 'only' can be met by making a subtle distinction between exhaustification and 'only'.

5 Disjunction and exhaustification

Our analysis seems straightforward, but also problematic for the case of explicitly non-exhaustive answers: in case the answer (focus) is in *disjunctive* form. If our question is of a typical *mention-all* kind, like (16a), the exhaustified reading of disjunctive answer (16b) will be the empty proposition:

(16) a. Who did John invite?

b. Bill or Mary.

The reason is that if we assume that the whole term-answer is in focus, we can conclude from (16b) that the more informative term-answers 'Bill' and 'Mary' must be false, and thus that no world will be in the extension of the exhaustive value of background (16a) applied to focus (16b).

As convincingly argued by Simons (2001), however, an answer like (16b) is appropriate only in case we assume that the disjuncts themselves are appropriate answers. Putting it slightly different, this suggests that a disjunctive answer is only appropriate in case each of its disjuncts by themselves are *exhaustive*, or *resolving*, answers. This suggests that disjunctive answers should be interpreted as follows:

(17) $[[exh(A \vee B)]] \quad = \quad [[exh(A)]] \cup [[exh(B)]]$

In case (16a) gives rise to a mention-all reading this has the effect that answer (16b) is equivalent to (18)

(18) Bill and nobody else or Mary and nobody else.

Notice, however, that this does not, and should not, come out in case (16b) is given as answer to a question like (19) that typically is interpreted as being of the mention-some variety:

(19) Who has got a light?

But meaning (18) can be arrived at in this case as well when we front (16b) with 'only'. This could be accounted for by assuming that 'only' distributes over the disjuncts. In case 'only' does not distribute over the disjuncts, the disjunctive answer fronted with 'only' is now predicted to mean (20):

(20) Only Bill has got a light, only Mary, or only both of them.

6 Conclusion and outlook

In this paper I have shown how a single notion of relevance can account for both the standard concept of 'being a resolving answer' and for scalar readings of answers. In other work I show that a similar analysis can be used to account for the different kinds of readings of *questions* as well. Our relevance-induced notion of exhaustivity leaves something to be done for 'only' and in this paper I show how relevance can help to determine the meaning of this particle as well.

On the other hand, I agree with Zeevat that there is more to 'only' than just the exhaustification effect. According to Zeevat, '*only* ϕ' indicates that ϕ is less than *expected*. I believe that this should rather be 'less than *hoped* for'. According to Merin (1994), 'only' indicates *preference reversal* (John did (only) a little). It seems to me that our notion of relevance can be used to account for this intuition as well. Perhaps this can also explain why 'only nobody' and 'only everybody' are bad answers. A full analysis has to wait for another occasion, however.

Our analysis of 'only' also suggests a similar analysis of another particles like 'just'. Also this particle seems to give rise to both a scalar and an exhaustification reading.

But, then, what is the difference between these two particles? According to one of my informants (David Atlas) 'just' more naturally gives rise to a scalar reading than 'only' does. According to another (Egon Stemle), it is much more natural to say 'just nobody' than to say 'only nobody'. The standard analysis of such particles makes use only of informativity. Our additional use of preferences might help to give a more appropriate treatment of this particles as well. Something similar holds for 'even'. And indeed, Merin (1999) suggests that the scale involved for the analysis of 'even' should be induced by relevance, rather than by informativity. A closer look at these issues, however, must be left for another paper.

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