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# Pragmatics and mindreading: Forward and backward inferences in shared intentional contexts

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**Abstract:** The general hypothesis discussed here is that pragmatic understanding is embedded in a more general understanding of action. To this purpose I first summarize ideas from Grice, Levinson and relevance theorists, all contributing to the view that utterance understanding is based on inferential recognition of the speakers' communicative goals, and that this process may be affected backwards by expectations about non-communicative goals. I also provide reasons to think that the double dynamic of forward and backward inferences described by relevance theorists is present in action execution and observation as well, and that we construe shared intentional contexts which automatically mesh ours and others' goals. Finally, the suggestion is made that, in order to account for the full contribution of mindreading to utterance understanding, Relevance Theory needs to consider not only the comprehension procedure in itself, but also the way in which it interacts with other external mechanisms.

**Keywords:** pragmatics, mindreading, joint action, inference, goal

## 1 Introduction

Paul Grice (1989) has famously described human communication as a case of expression and recognition of intentions, thus laying “the foundations for an inferential model of communication, an alternative to the classical code model” (Wilson et al. 2002a: 249). According to the inferential model, “the linguistic meaning recovered by decoding is just one of the inputs to a non-demonstrative inference process which yields an interpretation of the speaker's meaning” (idem). In the last decades, this emphasis on speaker's intentions has naturally brought about some convergence between pragmatics and research on mindreading, one important example of which is Sperber and Wilson (2002). Although in that paper the focus was on pragmatic understanding as a special

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case of mindreading, Relevance Theory (from now on RT) has nonetheless provided some clues about a different issue, that is, how pragmatic understanding is embedded in a more general understanding of action. In this paper I intend to analyze that issue more closely, by focusing on two aspects.

The first is RT's proposal according to which pragmatic comprehension is characterized by a double inferential movement. On the one hand, there are said to be forward inferences from the explicit meaning of the utterance and a number of contextual assumptions towards contextual conclusions, one of which is the implicit meaning of the utterance. On the other hand, there are said to be backward inferences from contextually expected conclusions towards contextual assumptions and the explicit meaning of the utterance. I intend to show that the role assigned by RT to backward inferences naturally brings into the picture the relationship between pragmatics and the understanding of non-communicative goals, insofar as communicative intentions are often embedded in non-communicative actions. Moreover, I will consider here an interesting parallelism with the research on action, which has recently focused on the double inferential dynamic thanks to which the connection between represented means and ends can be used both to predict ends from means and to retrodict means from ends. Such a parallelism does not necessarily imply that there is nothing specific in pragmatic processing. It might be the case that pragmatic understanding requires specialized processes nonetheless. However, these two considerations together – that a forward-backward dynamic is present in both domains, and that it can also cross the boundary between them insofar as action understanding can affect utterance understanding by means of backward inferences – strongly suggest, at least at a certain level of description, a common cognitive process.

The second aspect I intend to focus on is the hypothesis that performing and understanding communicative actions require the formation of shared intentional contexts. Jordan (2009) has proposed the notion of “group-intentional context” in order to account for the fact that, in collective behaviors, action options must be distributed across different agents (Jordan 2009: 127). In practice, agents have to represent their and others' goals as nested within each other: in Bratman's (1992) terms, agents have to mesh subplans. There is a clear connection with the first aspect mentioned above. The embedding of communicative intentions within non-communicative actions presupposes the ability to manage iterative goal structures, constituted by chains of means and ends. There are reasons to think that, in the context of these goal structures, we are also able to quickly and automatically embed others' goals within our own plans of action as well as our goals within the plans of action attributed to others. This meshing of ours and others' goals is likely to make utterance

production and comprehension more intertwined with each other than they are usually thought to be.

In sum, my suggestion is that humans have a general ability to automatically construe means-ends chains that cross the boundaries a) between language and action, b) between action and perception, and c) between the representation of ours and others' goals. Against this background, I will return to RT in order to analyze its position towards an issue that has been, as far as I can tell, little addressed: the way in which pragmatic inferencing and mind-reading might interact with each other. My provisional conclusion will be that, even if one adopts a modularist view, a full understanding of pragmatic processing requires consideration of the interaction between the pragmatic module and a variety of other mechanisms, including the ones required for action understanding. I will not address the further issue of whether a common mechanism for the construction of means-ends chains in language and action might raise problems for a modular view of pragmatics. This would require a detailed analysis of the nature of this mechanism, which is matter for another paper.<sup>1</sup>

## 2 Pragmatic inferences, forwards and backwards

Paul Grice (1989) has described utterance understanding as a rational enterprise. More precisely, in his view the hearer assumes that the speaker is a rational agent pursuing her communicative goals and producing utterances that can be inferentially interpreted by the hearer as means to express those communicative intentions. Grice, however, was not committed to any specific cognitive account of how such rational inferences would be put into effect in comprehension. He was well aware that utterance understanding in context is normally rapid and effortless, and he considered his own exemplifications of inferential comprehension as post hoc rationalizations of cognitive processes in need of specification. Thus, the pragmatic tradition stemming from Grice has been left to cope with the issue of how to reconcile the implicit structure of comprehension, as it admits of being reconstructed in terms of rational inferences, with the rapidity and effortlessness that apparently make comprehension an example of automatic processing. The most straightforward manner to comply with both of these requirements is probably the solution adopted by Relevance Theory (Sperber and Wilson 1986/1995), which assumes that the inferential process

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<sup>1</sup> See below note 4.

responsible for utterance understanding is spontaneous and intuitive rather than conscious and reflective (Wilson et al. 2002a: 278).

Conceiving of pragmatic inferences in terms of automatic, unconscious processes has intuitive advantages over approaches in which inferences are held to be conscious. In order to account for the fact that comprehension is rapid and effortless and that we lack any introspective evidence of explicit reasoning while understanding utterances, it may seem natural to assume that any possible contribution of consciousness to comprehension is dispositional rather than actual. A clear example of this attitude is Recanati's (2004: 42–44) claim that spontaneous inferences can be considered "conscious" insofar as they are "available to consciousness". That is, the inferences involved in comprehension are not presumed to be *actually* consciously processed in the normal case, but they are nonetheless deemed to be open to conscious inspection and this is enough for Recanati to conceive of them as cases of conscious, not unconscious processing. In his view, an inference is conscious in a tacit, dispositional sense when "the cognitive agent to which it is ascribed [...] is *itself* capable of making the inference explicitly and of rationally justifying whatever methods it spontaneously uses in arriving at the "conclusion"" (Recanati 2004: 50)

However, this view raises a serious problem for a cognitive account of comprehension. Such a dispositional but not actual process is not a cognitive process proper, it is just the possibility that a process occurs in substitution for the one that is actually occurring. Thus, when Recanati tells us that a cognitive agent is capable of providing a conscious justification of "whatever methods it spontaneously uses in arriving at the 'conclusion'", what is certain is only that the spontaneous process employed by the agent is not *actually* a conscious justification. Therefore, Recanati leaves us in the dark as to the actual process involved (see Carston 2007; Mazzone 2013b). In contrast, it is precisely this kind of process that Relevance Theory attempts to describe.

In this regard, the thesis that inferential comprehension is based on unconscious processing seems preferable to that according to which it must be conscious. The claim of unconscious goal processing is also consistent with research in social psychology – centering on Bargh's (1989, 1990) notion of non-conscious goal pursuit – aimed to show that goal-directed behavior is often processed automatically. Bargh has challenged the traditional view, which conceived goal pursuit as a conscious and effortful process. In his view, our previous experience shapes "associative networks that include contexts, goals that are regularly pursued in these contexts, and means that one usually uses to attain these goals" (Hassin et al. 2009: 550–551). These associative networks then allow for goal pursuit via spreading of activation. In the last decades decisive evidence has accumulated that priming goals may automatically

activate behavior representation and resultant action, “enabling the goal-directed behavior to occur directly and independent of conscious intentions” (Dijksterhuis et al. 2007: 105), even when priming is unobtrusive or unconscious (for recent reviews see Ferguson et al. 2007; Hassin et al. 2009).<sup>2</sup>

Interestingly, Huang and Bargh (2014: 123) points to striking similarities between conscious and unconscious goal operation, including similar effects upon individual judgment and behavior. Specifically, “people who are unaware that they are pursuing a goal respond to the world in a way that maximizes the likelihood of goal completion”. In other words, automatic goal pursuing tends to be just as effectively goal-driven as controlled goal pursuing, which means in turn that the agent must be representing the very same coherent structure of goals, means and situational constraints that needs to be taken into account both in conscious decision making and in rational reconstructions of action.

In sum, both relevance theorists (with regard to utterance understanding) and social psychologists (with regard to action) maintain that appropriate inferential decisions concerning goal pursuing can be made by means of unconscious, automatic processes.

Relevance Theory has another advantage over accounts that adopt a more traditional view of inferential processing: the former allows a deeper understanding of the actual relationship between inferences and decisions than the latter. Inferences are traditionally thought of as ways for making decisions (e.g., Simon 1959). Just as human agents can be thought to decide their behavior by means of an inferential course of thoughts, so hearers might decide inferentially what is the communicative intention underlying an utterance. However, it is far from obvious that the inferences by which we rationally explain behavioral decisions (and utterance understanding) are sufficient to account for actual decision making. What we do in rational reconstructions is to construct chains of thoughts which appear to provide adequate post hoc justifications for actions (or utterance interpretations). But, to say the least, more than one behavior may be rationally justified in a given situation

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<sup>2</sup> The claim that goals can be pursued in a wholly automatic fashion is not completely uncontroversial and the relevant evidence has been recently subjected to critical scrutiny (Newell and Shanks 2014). However, there is at least strong converging evidence for the general claim that, even if consciousness plays some role in goal-directed action, this role has mostly to do with goal maintenance and shielding, while the general structure of action is provided by an automatic flow of activation (see Mazzone and Campisi 2013; Mazzone 2014). In the same vein, it can be argued that conscious attention has a role to play in pragmatic understanding as well, but that this role consists in the maintenance of representations in support of automatic inferencing – in other words, it is not a case of conscious reasoning proper (for this claim, see Mazzone [submitted b]).

and more than one interpretation may be rationally justified for a given utterance. Do agents (hearers) consider all possible courses of action (utterance interpretations) before they make their decisions? And in this case, how do they decide between different inferences?

In a word, the mere existence of a rational inference counting as a justification for a course of action (or an interpretation) is not enough to explain decision making. From a cognitive point of view, one is further bound to explain how that inference is arrived at, and how it is that the agent is satisfied with it. Now, these are precisely two main reasons why Sperber and Wilson (1986/1995) are discontent with Grice's theory. In practice, they propose that the automatic process in charge of utterance understanding is a "fast and frugal heuristic", the "relevance-theoretic comprehension procedure", that can be summarized as follows: "Follow a path of least effort in computing cognitive effects: test interpretive hypotheses in order of accessibility; stop when your expectations of relevance are satisfied" (e.g., Wilson et al. 2002a: 259, 277). Now, just as one would expect from a heuristic, the relevance-theoretic comprehension procedure has the effect of restricting the space of decisions. Hearers do not need to take into consideration all possible interpretations: they just consider the most accessible one, and then move on to consider the next only in case the first is not sufficiently relevant. In this view, accessibility of interpretations is what explains how a given interpretation is arrived at. But the procedure aims as well to provide an answer to the second issue left open by Grice: explaining what makes the inferential process stop. The proposal is that an interpretation is eventually accepted by the hearer insofar as it satisfies the expectations of relevance raised by the utterance itself.

In line with this view, in Relevance Theory the construction of an inference is not conceived of as the end point of the process. Relevance theorists have recently insisted (e.g., Carston 1997, 2002; Sperber and Wilson 1998; Wilson et al. 2002b) on the thesis that the pragmatic inferential process is not a sequential one proceeding linearly from premises (i.e., the explicit content of utterances, a number of contextual assumptions) to conclusions. On the contrary, there are at work simultaneously both forward inferences from premises to conclusions and backward inferences "from an expected (type of) conclusion to a set of premises that might be used to derive it" (Wilson and Carston 2006: 421). By qualifying the conclusions as "expected", the authors mean that they are directly suggested by the context. Thus, even if a rational conclusion comes to be drawn by way of a forward inference from premises, this is not necessarily the end point of the process: the conclusion itself can be assessed against the context, with the possibility that it is not deemed contextually relevant, while a different conclusion can trigger a backward inference to different premises.

Consider, for example, the following exchange:

- (1) Peter: Will Sally look after the children if we get ill?  
 Mary: Sally is an angel.

The most accessible concept for the word “angel” is something like the encoded concept ANGEL which has as its property SUPERNATURAL BEING OF A CERTAIN KIND. If forward inferences were all there is to pragmatic understanding, this concept would be contributed to the explicit content and some inference should be drawn from it in order to get hypotheses about the implicit content. But RT proposes instead that the concept, and the related explicit content, can also be adjusted thanks to backward inferences from contextually expected conclusions. Specifically, Peter’s question, insofar as it requires a yes/no answer, can be thought to raise the expectation that Mary intends to claim either SALLY WILL LOOK AFTER THE CHILDREN IF WE GET ILL or its negation, and this expectation in turn licenses a backward inference towards the explicit content, which has to be coherent with either the affirmative or the negative claim. Thus, the concept ANGEL can be contextually modulated until the explicit content provides a premise which has either the affirmative or the negative claim as its conclusion.

I want to emphasize that such role attributed by RT to backward inferences can be framed in terms of chains of means and ends, and that this is coherent with what Grice said about the embedding of communicative intentions within non-communicative actions. The expectation that Mary will adopt the goal of answering affirmatively or negatively Peter’s question is a guess based on context (and the knowledge of language). Assuming she has that goal, Mary can be expected to provide an explicit content which is a proper means to pursue it. So, she is attributed the goal to convey an explicit content as a means to pursue another goal, that is, the goal to convey a certain implicit content.

Grice made a similar appeal to context as a way to make guesses about the speaker’s goals, so as to license backward inferences to (what we now use to call) the explicit content of the utterance. In the following quotation, Grice (1957: 387) gives an example in which a non-communicative goal triggers a backward inference to the speaker’s meaning:

In cases where there is doubt, say, about which of two or more things an utterer intends to convey, we tend to refer to the context (linguistic or otherwise) of the utterance and ask which of the alternatives would be relevant to other things he is saying or doing, or which intention in a particular situation would fit in with some purpose he obviously has (e.g., a man who calls for a “pump” at a fire would not want a bicycle pump).

In the final example, since the context suggests the non-communicative goal of extinguishing a fire, the interpretation of a request for “a pump” is adjusted accordingly. In other words, non-linguistic context is suggested to play here the same role played by Peter’s question in our previous example: it settles the goal which licenses backward inferences in the service of utterance interpretation.

With his notion of “activity type”, Stephen Levinson (1992) has given an important contribution to this idea that communicative intentions can be embedded within wider goal structures. Activity types are defined as social patterns of goal-directed behaviors in specific settings, delivering as such expectations about what’s going on next. Specifically, activity types raise expectations about the communicative actions to come. This means that each communicative action tends to be interpreted as a move in the current activity type, and therefore as something whose goal is expected to be a sub-goal of the general activity. Levinson gives the following example: the sentence “C’mon Peter” may have a variety of meanings, but if one hears it during a basketball game it acquires a very clear sense, based on the kind of goal the speaker may have in that precise context. Other examples of activity types are trials and lessons, analyzed by Levinson in order to show that questions in English may have very specific uses (i.e., goals), which “are closely tied – indeed, derived from – the overall goals of the activities in which they occur” (82).

In sum, the tradition stemming from Grice has explored the idea that communication is a goal-directed, inferential activity related to a more general ability to manage iterative goal structures in the service of action. RT has importantly developed this general picture in a number of ways: it has proposed that the inferential process involved is automatic; it has raised the crucial issue of how the relevant inferences are arrived at, and how it is that the addressee is satisfied with them; it has analyzed the inferential process in terms of a double movement of forward and backward inferences. In the next section I intend to show that a similar double movement has been conjectured by recent accounts of action execution and comprehension.

### 3 Forward and backward inferences in action

To start with, the Event Coding Theory of Bernhard Hommel (2003; Hommel et al. 2001) claims that action goals are represented as perceptual effects associated to the motor act representations which have proved apt to pursue those effects in the past. Thanks to association between motor acts and



perceptual effects, it is possible both for the observer to make forward inferences from the observed movements to the intended effects, and for the agent to make backward inferences from the intended effects to the required movements. However, such a distinction between forward inferences in action observation and backward inferences in action execution might be a rough simplification. Both the inferential directions have been suggested to play a role both in execution and observation of action.

Let us start from action execution. Wolpert and colleagues (e.g., Wolpert et al. 2003) have proposed a computational theory of motor control based on the now widespread hypothesis that action execution involves a dynamic of prediction and control, making an appeal to both inverse (controller) and forward (predictor) models. In practice, while Hommel focuses on the fact that backward and forward inferencing are respectively crucial for planning and interpreting action, Wolpert and colleagues have importantly insisted that the dynamic between forward and backward models imbues action control itself. In their view not only does action execution require that a motor program is inversely computed, on the basis of information about intended outputs and the actual situation, but also forward models are computed in order to predict the motor and sensory effects of actions, thanks to an offline simulation which flows parallel to – though more rapid than – the actual implementation of motor programs. Prediction is crucial, amongst other things, for fast correction of movement before feedback can be obtained (Glenberg and Gallese 2012: 908).

While these studies suggest that both forward and backward models are required for action execution, a similar conclusion can be drawn with regard to action observation. For one example, it is well known that Rizzolatti's group, and especially Vittorio Gallese, has explained intention reading in terms of a form of prediction. At least in the simplest cases, the goal of an action would be the motor act in which the action culminates. In practice, on the basis of statistical chaining of motor acts we can make a forward inference to the likely intended goal of a given motor act, and thus to the underlying intention:

Determining why a given act (e.g. grasping a cup) was executed can be equivalent to detecting the goal of the still not executed and impending subsequent act (e.g. bringing the cup to the mouth). (Gallese 2007: 662)

However, other studies conducted by this group seem to show that there is more than forward inferences to perceptual recognition of intentions. In particular, Iacoboni et al. (2005) tested observers with actions (such as grasping a cup) both out of context and in contexts suggesting different intentions (drinking tea, cleaning up). In the latter condition (presence of context) there was increased

activation of premotor mirror neuron area, a result strongly suggesting – in the author’s words – that “this mirror neuron area actively participates in understanding the intentions behind the observed actions” (Iacoboni et al. 2005: 532). Since in those experiments the manipulated factor is the presence/absence of a context, it follows that, in order to recognize the underlying intention of an observed motor act, mirror areas may be sensitive not only to subsequent motor acts but also to statistically relevant contexts. In other words, it is the context which suggests the intended goal (in the example, respectively the intention either to drink the tea or to clean up) independently from any forward inference starting from the observed action. This might even cause an adjustment in the comprehension of the observed action itself. For instance, in Iacoboni et al.’s setting the context “after tea” might suggest the goal “clean up” and then a backward inference from this goal might modify the interpretations of the action acting as a means, in case this had been erroneously interpreted as a “drinking” grip.

The analogy with RT’s view, according to which communicative intentions can be suggested directly from the context and then cause backward adjustment of the explicit content, should be clear enough. More generally, as we have seen, the hypothesis that automatic processes operating on goals involve both forward and backward inferences is widespread in research on action. Let us now turn to the idea that goals of different agents can be embedded within a shared intentional context.

## 4 Meshing goals in shared intentional contexts

Language is not only a kind of action, it is more specifically a kind of *joint* action (e.g., Clark 1996; Tomasello 2008). In fact, as many scholars have emphasized (e.g., Brennan et al. 2010; Garrod and Pickering 2004; Kecskes 2010; Pickering and Garrod 2013), spoken language is mostly used in dialogue, and we should refrain from conceiving of dialogue as mere “serial monologue”, in which interlocutors alternate between production and comprehension” (Pickering and Garrod 2013: 330). On the contrary, in dialogue – insofar as it is a specific case of joint action – interlocutors can be thought of as co-agents participating in a common coordinated event which they jointly co-produce.

One way to frame this conception of interlocutors as co-agents is in terms of the philosophical analysis of shared cooperative activities (SCA) proposed by Bratman (1992). According to Bratman, in order for there to be SCA, agents must have – amongst other things – the intention to accomplish a given activity

in accordance with, and because of, meshing subplans aimed at the accomplishment of that activity. In other words, each agent should have a representation of the other agents as participating in the joint action, and a representation of her own plans of action as just a component of that wider (joint) action.

There is some evidence that this is the case. In experimental settings, individuals engaged in joint tasks are shown to share task representations and integrate each other's task in their own action planning (Sebanz et al. 2003). The evidence comes from cooperative versions of interference tasks (like the Simon task or the Erikson flanker task), in which the task at issue is split between two participants. In traditional interference tasks, conflicts between simultaneously activated representations of responses arise within a single agent – in terms of errors and delayed response times – when irrelevant stimuli are presented together with a target stimulus that requires a different response by the agent. In research on joint action the tasks at issue are divided between two co-actors and, as a result, there appears to be conflict among self- and other-generated responses in a way that resembles conflict among two self-generated responses (Atmaca et al. 2011; see also Milanese et al. 2010; Wenke et al. 2011). Thus, it seems rather safe to conclude that “when people perform different parts of a task they tend to represent the whole task at hand rather than just their own part in the task” (Atmaca et al. 2008: 418).

On similar grounds, Jordan (2009) has argued that humans live in a shared intentional context which makes joint action and communication possible in the first place. More specifically, on the basis of evidence that “actions are planned in terms of the distal effects they are to produce” and that “planning and perception share common neural resources” (Jordan 2009: 127), Jordan argues that “perception actually takes place in terms of what one *plans* to do” and that

a component of one's observing [actions] is the activation of the plan for that same event in the observer. As a result, as humans observe each other generating events [...] they find themselves directly linked with each other at the level of plans (i.e., goals or intentions). (Jordan 2009: 129)

In sum, the idea is that our and others' plans of action are directly connected with each other so as to form a shared intentional context linking perception and execution of actions. In this perspective, a reasonable hypothesis is that the double movement of forward and backward inferences we described above can cross the boundary between executed and observed actions, so that pursued and observed goals can be combined and even assessed together in a wholly automatic fashion. This hypothesis seems reasonable in the light of the previously mentioned evidence that the forward-backward dynamic seems to be present

both in execution and observation of action, and that agents automatically represent the others' goals as if they were their own.

Dialogue gives us simple behavioral examples of such goal nesting. Let us consider the following example from Pickering and Garrod (2013):

(2a) A: I'm afraid I burnt the kitchen ceiling.

(2b) B: But have you

(2c) A: burned myself? Fortunately not.

In this dialogue, specifically in 2c, A anticipates and completes what B is going to ask. Thus, the first part of her linguistic production ("burned myself?") does not pursue an independent communicative goal of A, it pursues instead a (presumed) communicative goal of B (though described from A's point of view: "myself" instead of "yourself"). In practice, based on context and previous experience of social interactions, A predicts the likely completion of B's utterance and therefore his communicative goal.

Such an example makes apparent that our and others' communicative goals can be meshed together within the same linguistic act. But even when our and others' goals are not so apparently meshed in a single individual act, planning our utterances requires nonetheless that we incorporate the others' goals into our plans. Let us consider another example (from Wilson and Carston 2006, modified):

(3a) A: Will Caroline help us clear up the flood damage?

(3b) B: Caroline is a princess.

(3c) A: Too bad!

On its face value, A's last utterance only makes sense on the assumption that the intended meaning of 3b is that Caroline will not help them to clear up the flood damage. Thus, A's decision to utter 3c depends on her decision about the communicative intention of B in 3b.

In sum, dialogue seems to be a form of joint action in which each interlocutor has to integrate the other's communicative goals into her own action planning, to the point that within the same utterance the speaker can easily shift from the other's to her own goals (as in 2c). In the light of our previous considerations, this integration of goals might be accomplished in a wholly automatic fashion by means of a forward-backward mutual adjustment which crosses the boundary between action execution and observation.

## 5 How pragmatics and mindreading are linked up

In a broadly Gricean view, as Sperber and Wilson (2002: 3) puts it, “pragmatic interpretation is ultimately an exercise in mind-reading”. In Section 2 I have in fact summarized ideas from Grice himself, from Levinson and from relevance theorists, all contributing to the view that utterance understanding is based on inferential recognition of the speakers’ communicative goals, and that this process may be affected backwards by independent expectations about contextually relevant goals. Since these latter goals may also pertain to non-communicative actions, it follows that there must be some way in which the ability to understand non-communicative goals interact with the kind of mindreading involved in utterance understanding.

In Section 3 I have provided some considerations in favor of the view that communicative and non-communicative mindreading might be characterized by a similar automatic mechanism delivering inferences both from means to ends and from ends to means. Although the above considerations are far from conclusive, the hypothesis of such similarity is of some interest in itself: if the same ability to construe means-ends chains were responsible for the understanding of both utterances *and* non-communicative actions, this might explain how communicative means and non-communicative ends can be combined with each other as well.

Moreover, Section 4 has provided reasons to think that the process by which we manage means-ends chains does automatically mesh ours and others’ goals, so as to construe shared intentional contexts which are crucial for (both cooperative and competitive) social actions. Again, although more research is needed to clarify the issue, these reasons are further support for the claim that the construction of means-ends chains is quite directly and automatically driven by information from different sources: perceptual and sensorimotor information concerning both communicative and non-communicative, ours and others’ actions.

Now I want to ask, which is RT’s position with regard to the interaction between general mindreading abilities and the ability to understand the speaker’s communicative goals? The first thing to say is that RT has not very explicitly focused on this issue. The main exception is in fact Sperber and Wilson (2002), whose main aim, though, was to make clear the differences, not the interaction, between the two processes. In a sense this is coherent with RT’s general purpose of providing a cognitive explanation of what is *specific* to utterance understanding. In this perspective, general mindreading abilities are external to the relevance-theoretic comprehension procedure described above (see Section 2),

although information on mental states may possibly be handed to, and then processed by, the comprehension procedure. On such basis, Mazzone (2009) has raised the issue of whether RT can really accommodate the idea that intention reading drives comprehension. A more cautious formulation would be that, in order to account for the full contribution of mindreading to utterance understanding, RT needs to consider not only the comprehension procedure in itself, but also the way in which it interacts with other external mechanisms.

These external mechanisms include, of course, the ones accounting for general mindreading abilities: if we assume that identifying the speaker's meaning involves "a sub-module of the mind-reading module, an automatic application of a relevance-based procedure to ostensive stimuli" (Sperber and Wilson 2002: 20) and if we also assume that understanding non-communicative goals may affect the relevance-based procedure by providing the input for backward inferences, then it follows that a complete account of utterance understanding as a mindreading process has to consider the interaction between the dedicated pragmatic sub-module and the (rest of the) mindreading module.

For another example, Mazzone (2013a) has argued that conscious working memory might account for the special role played by speaker-related information in utterance interpretation. Since both utterances and the speakers uttering them tend to attract the conscious attention of addressees, it might be the case that "representation of the speaker in working memory reliably enhances the activation of speaker-related information and, consequently, the role it plays in determining the content of interpretations" (Mazzone 2013a: 106).

On the other hand, in reply to Mazzone (2009, 2013a), Mazzarella (2013: 30) concedes that RT "needs to provide an explanation of the cognitive mechanisms by which considerations about the communicator's mental states affect pragmatic interpretation", but she proposes a different account based on the mechanisms for epistemic vigilance, that is the mechanisms which, according to Sperber et al. (2010), "check the quality of incoming information and the reliability of the individual who dispenses it" (Mazzarella 2013: 20). Sperber et al. (2010) have proposed that epistemic vigilance mechanisms operate on the interpretation resulting from the comprehension process: in practice, they assess the believability of this interpretation. Mazzarella suggests, however, that those mechanisms might have a wider role than that. Since according to RT the interpretation process is based on the presumption of optimal relevance, and specifically on the assumption that the ostensive stimulus is the most relevant one compatible with the communicator's abilities and preferences, checking these abilities and preferences is key to assessing the *acceptability* of the

interpretative hypotheses in the first place. In other words, before assessing the believability of the speaker's meaning, epistemic vigilance might have a role in identifying it.

I just want to note that Mazzarella's suggestion is not incompatible with, and possibly needs to be complemented by, the other two points discussed above. First, it is at least a plausible hypothesis that both mindreading and epistemic vigilance can be affected by the functioning of conscious working memory, specifically with regard to the role possibly played by it in enhancing the activation of speaker-related information. Second, Sperber et al. (2010) proposes that epistemic vigilance and mindreading are tightly intertwined but distinct abilities, and it is mindreading what is actually needed to explain the recognition of non-communicative goals licensing backward inferences in pragmatic processing. In sum, there seems to be a variety of mechanisms, possibly including working memory, mindreading and epistemic vigilance mechanisms, whose interaction with the relevance-theoretic comprehension procedure must be considered in order to provide a complete account of utterance understanding.

## 6 Conclusions

My previous considerations suggest two things. First, a complete explanation of pragmatic processing requires us to consider how the pragmatic "module" – in Sperber and Wilson's (2002) terms – interacts with other cognitive mechanisms. Second, this interaction involves, amongst other things, the quick and automatic construction of means-ends chains that cross the boundaries between actions and utterances, and between ourselves and others.

These conclusions do not put into question the view of pragmatics put forth by RT, at least with regard to the aspects of the theory considered here. As I said above, Mazzone (2009) raised the issue that RT might have problems with assigning a genuine role to intention understanding in comprehension. But this claim was based on aspects of RT that were outside the scope of the present analysis.<sup>3</sup> Specifically, as far as the mutual adjustment of forward and backward inferences is concerned, I find RT's proposal entirely convincing and the present paper is mainly intended as a contribution to the development of that notion.

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<sup>3</sup> Especially, the issue concerned the definition of relevance and some related aspects: this is now further clarified in Mazzone (2015).

Another possible disagreement with RT concerns the modularity issue. Assuming that general mindreading abilities and the ability to understand the speaker's communicative goals do interact as I have suggested so far, how different and even segregated from each other – how *modular* – the underlying mechanisms are? I will limit myself to briefly discuss some theoretical options.

A first parsimonious option is that the very same mechanism is responsible for both the abilities, and that the only segregation between the two processes is what little is allowed by the existence of different bodies of knowledge which license inferences that are specific for the respective domains. In this case, a single mechanism would be responsible for both language and action understanding. This option seems to be rejected by Sperber and Wilson (2002), since they argue that the problem of identifying the speaker's meaning has a particular nature and difficulty compared to general mindreading, and this is why they propose the existence of a “dedicated comprehension module, with its own principles and mechanisms” (idem: 3). But this again admits of a parsimonious interpretation, according to which the dedicated pragmatic module is a high-level functional description of something that is actually implemented by more basic, general processes. This interpretation would naturally accommodate our previous considerations about the similarity between goal processing in pragmatics and in action, and about their interaction: it would be in fact compatible with the claim of a basic process accounting for the automatic construction of chains of goals which is common to, and cross the boundary between, utterance and action processing.

A different possibility is that understanding goals requires radically different processes in utterance and action processing. This option seems to me less attractive in view of the general picture sketched here, but a full demonstration would require that the possible implementation of the double inferential process were addressed in some detail, which is matter for another occasion.<sup>4</sup>

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<sup>4</sup> I further analyze the double inferential process as a general strategy of the brain in a paper conceived as complementary to this (Mazzone 2015), while in Mazzone (submitted a) I address the issue of modularity in more general terms.



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## Bionote

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