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1. Aims and structure of the project

The starting points of the project are the following observations: Linguistic theory has quite concise ideas of the functioning of language and how to formalize this process. On the semantic side, in generative grammar, this formalization stops at the interface (Logical Form, LF), which transmits information to and receives information from the conceptual-intentional system. But how does this interaction work? Generative grammar has not worked out this step, because traditionally it falls beyond the scope of linguistic theory. That is to say, this linguistic theory deals with language in a narrow sense, theorizing on the »Narrow Language Faculty«. (cf. Radford 2004 and Chomsky 1998ss.) On the other side, non-linguistic cognitive theories have other aims, use other conceptions, and are not, generally, interested in linguistic theory proper. Thus, there is, up to date, no theory and consequently no formalism about the functioning of the LF interface. My project aims at filling this gap for the first time. During the first phases of the project, however, it became clear that, with regard to the processes and faculties subsumed under the headline of the conceptual-intentional system, there is no commonly accepted framework of systematically describing them and consequently setting up a neuro-cognitive model to implement the functions involved.

The question of the nature of mentally represented content and its role in both theoretical and practical reasoning is not a topic of cognitive psychology and linguistics alone. It constitutes one of the most classical fields of philosophy and continues to animate lively debates in contemporary philosophy. At the heart of the discussions lies the so-called problem of intentionality. By intentionality philosophers refer to the observation that mental contents (thoughts and feelings) as well as linguistic meanings are essentially *about* something. They relate to objects and (presumed or real) facts in the exterior world. On the other hand, modern science assumes that mental facts and events are in some sense located and instantiated in the human brain. Now, the following problem arises: The brain is in the first place a physical (and biological) object. As such it obeys to the laws of physics (and biology). There is no physical or biological law known to us where anything like (intentional) meanings exists. Where is the place of the mind and intentional mental states within the overall scientific picture of the world? The specific relational nature of intentional states is in conflict with scientific principles of causal explanations. Without an answer to the problem, the methodological foundations of empirical psychology and cognitive sciences are open to substantive criticism.[1]

Thus, the project pursues two aims:

(1) To set up a principled account of the conceptual-intentional system and to develop a formalism to describe it.

(2) To work out, on the basis of (1), a model of the functioning of the interface between the »Narrow Language Faculty« and the conceptual-intentional system.

[1]It is true that there are a number of proposals how to overcome this difficulty. An influential one has been put forward by Jerry Fodor (1987). Due to limited space, I have simplified the discussion turning on this problem. The reader who is interested in the details of these debates might want to turn to my (Hagen 2000) and references cited there. In that place I argue that this approach doesn't in fact escape from the fundamental difficulty.

In the course of pursuing aims (1) and (2), the design is planned to be done in such a way as to avoid the philosophical difficulties related to the notion of intentionality. In line with this, I renounce the notion of mental representations as an explanatory primitive. Instead, I propose to replace it by more elementary concepts.

For my enterprise, I adopt the following strategy: First, I look out for a way to getting to grips with the functioning of the conceptual-intentional system. In order to form hypotheses on this system, I need a detailed description of the tasks it actually performs. To this end, I argue that the functioning of the system has two sides: One lies, as it were, before our eyes, the other side is hidden in each person's head.

(1) The first side regards people's reasoning as we can directly observe it when they talk or argue for or against something.[2]

(2) The second side concerns

   (a) what people think, but actually don't say, and

   (b) internal processes in the brain that lead up to decisions, processes inaccessible to the conscious self.

The brain processes of the latter sort (2b) are beyond the scope of my project. Considerations about what people think without actually saying it (2a) will play a role to some extent, in particular when I examine those phenomena of human communication where the listener is able to effectively understand much more than what has actually been said. A prime example for this is figurative speech, e.g. metaphor and irony. But, as I will illustrate in a section dedicated to this topic (chapter 1 of the thesis), there is much more to it. It is the publicly observable aspect of reason and reasoning (see (1) above) that is of major interest for the project. From this perspective, we can see immediate reflections of reason at its work, and in this case we may suppose that language and thought largely coincide. The object of analysis is, from this point of view, human communication and language *use*. Here I am concerned with language »in a broad sense«, to use Chomsky's terminology. Nonetheless, a principled account of this specific human activity of speaking and reasoning/arguing serves as a basis for a description the tasks that the conceptual-intentional system is able to perform.[3] To develop a model for the faculty of reasoning and understanding meanings, my methodology is guided by the idea of deriving principles of the underlying cognitive operations. This will be done, after I have outlined a suitable description of communication. To carry out this analysis, lean on Robert Brandom's work (Brandom 1994), which offers a detailed account of language use, that is, of language rationally employed for communicative ends. After this, I revert to the other side of the interface and to syntax itself.

A would like to add a final note on issues of cognitive development in the child. In my view, hypotheses on the syntax-semantics interface are related to developmental issues. When I analyze communication, I assume a tight relation between language processing and reconstructing meanings. The meanings of interpreted utterances are in turn embedded within a wider network of inferential connections. Complexity in the latter domain of meaning and inferring goes hand in hand with the richness of syntactic (and lexical) means available for encoding (aspects of) them. Consequently, corresponding to layers of semantic logic, varying in complexity and building one upon

[2]Strictly speaking, all we can directly observe is noises originating from some mouth. However, psychological and linguistic research is perfectly impossible, if one doesn't grant that we can be confident in the psychological reality of meaningful speech, in this sense »observable« indeed.

[3]To my knowledge, it is not yet clear whether the loose talk of »system« which I employ is to be translated into positing a specialized »module« characterized by automatically performed operations and highly specialized inputs, outputs and tasks. If the system is not modular in this sense (as I assume), it may subserve also functions in other domains like mathematical calculation. I will not take into consideration such further functions .

another, I expect to find steps of syntactic complexity which emerge successively in early language learning. Failure to get one syntactic (and semantic-conceptual) layer right entails – according to my hypothesis – failure to reach the normally ensuing ones in the usual fashion. As it stands, this is to be taken only as a working hypothesis. I'm prepared to have to qualify in the face of empirical findings on linguistic and cognitive child development and the relationship between them.[4] I will return to developmental issues in section 3 below.

The rest of this project description is structured as follows: In section 2, I will sketch some main traits of Brandom's theory. Subsequently, in section 3, I will consider some aspects of the model that relate to developmental issues. In section 4, I will illustrate the way I utilize Brandom's ideas to derive a cognitive model. Finally, I will indicate how Chomsky's framework might enter into the picture in section 5.

2. Brandom: Keeping score and inferentialist semantics

Brandom sets out to sketch a comprehensive model of linguistic communication. As a philosopher, his main interest lies in a description of what sorts of details enter into human communication. For him, this is at the same time a means for understanding human rationality. In opposition to other approaches, he emphasizes the normative character of linguistic communication (and hence of language). From his point of view, language is primarily to be characterized as language use, where regulating norms play an elementary role. In other words, language use is always liable to be evaluable as correct or incorrect, and as adequate or inadequate – relative to some situation and context.

I go on to sketch some traits of the Brandom's theory by way of displaying some of the most central notions and ideas. Two notions lie at the heart of the model:

(1) Scorekeeping.

(2) The hypothesis of semantic inferentialism.

In addition, another idea is central to it:

(3) Communication is in a substantive part concerned with justifying. In its basic form, it is to be characterized as a »game of giving and asking for reasons«.[5]

The notion of a »score« to be kept by the participants in this »game« is inherited from Lewis. A score of a game is a description of its significant parameters (assigning values to them), which determine which moves are allowed to whom, and hence count as »correct« moves. Examples are the number of goals in a soccer match, or the positions of the pieces on the board in a game of chess.

Next, talk of correct or incorrect moves and a score to be kept is further qualified as a reciprocal undertaking, acknowledging and attributing of entitlements and obligations (Brandom's term is »commitments«).[6] The meaning of an utterance is (in part) to be characterized as a change of entitlements and commitments. This feature is termed »deontic scorekeeping«.[7]

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[4]My presumable all too simplistic equation above leaves unexplained, for example, the fact that the acquisition of syntax as achieved at an age of around six years, while the cognitive development has not ceased to evolve – or might never cease to evolve during the whole life-span. As for Chomsky's position at this issue, he wouldn't endorse my claim.
[5]This formula has been coined by Sellars, and incorporates Wittgenstein's notion of the »language game« (»*Sprachspiel*«).
[6]These are to be understood broadly in accordance with what in the theory of speech acts is called illocutionary force or role. (cf. Searle 1969)
[7]As reported by Calvin and Bickerton (2000: Chapter 10), phenomena akin to keep a score can be observed also in chimpanzees: »[T]he building of [...] alliances takes time [...]. It places a heavy load on the memory, too, if you have to remember over weeks and months who you owe and who owes you.« And: »In addition to remembering who groomed

Brandom privileges one type of »move« or speech act, namely assertive ones, or claims. His argument to do so is that they alone can serve as both premises and consequences in an inference (a piece of reasoning).[8] Now all the elements taken together are expressed in the following formula, cited from Dummett: »Learning to use a statement of a given form involves [...] learning two things: the conditions under which one is justified in making the statement; and what constitutes acceptance of it, i.e., the consequences of accepting it.« (Brandom 1994: 118, Dummett 1973: 453.) The consequences of putting forward a claim comprise, among other things, to be taken to subscribe to all claims that follow from it. In some cases also perceptual contents and testimony by others are among the appropriate circumstances of putting forward a claim. For example, the claim »These leaves aren't green any more.« includes perceptual content among its conditions to be uttered (or else possibly testimony). In other cases, appropriate (re-) actions are part of the set of the consequences of claiming something. For example, if I claim »I am hungry.«, I commit myself to initiate suitable actions to provide for some food (if nothing else prevents me in doing so). By this way, the mental and social domain of reason and reasoning is embedded or anchored within the empirical world.

This leads directly to the second notion, that of semantic inferentialism. The meaning of a claim is identified with its (potential) role in inferences, both as premise and as consequence. Brandom extends this principle down to the level of subpropositional words and concepts. He accomplishes this by first discriminating singular terms and predicates as the basic elements of a (simple) judgement or claim. Singular terms are expressions by which we refer to individual persons and objects. He derives them from claims expressing propositions. He observes that singular terms (and only these) have in common a particular feature. Particular subclasses of them can be used to refer to the same thing or person. In simple claims, they can be substituted for one another, such that the claim obtained in this way continues to express the same proposition. The frames that keep unchanged while different singular terms are filled in are defined as predicates. For these, other rules hold.

Some philosophical considerations, which I cannot reproduce here, lead Brandom to claim a primate of propositions and claims over (subpropositional) concepts. This is mirrored by the systematic top-down approach of his analysis, starting from commitments and propositional contents and ending up with words (and logical particles). Here I stop my review of some of the central notions. I would like to emphasize that the picture presented here is very rough and leaves aside quite lot of important details.

3. Developmental considerations

While trying to make use of much of this for a cognitive model of language use (and, in part, language processing), I depart in a few details, however, from Brandom's original version of the theory. This is mainly due to a more cognitively oriented perspective in contrast to Brandom's rather philosophically oriented perspective. Problems arise in relation to the issue of modeling social and linguistic learning and cognitive development. One urgent problem originates from in the postulate of the primacy of propositional contents over concepts. How could these propositional contents be learned, assuming this primate, given that there is a potentially infinite number of them? How could

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who and how often, who gave meat to who and how often, chimpanzees and other primates have to *keep track* of how often partners stood by them in fights, how often they ran away, and doubtless other types of behavior too.« (Emphasis added.)

[8] I disagree with Brandom on this point. For example, if someone asks another one a question or if an officer commands a soldier to do something, for the addressee the question or the command are well reasons (premises) for an assertion or an action. So conceived, also speech acts other than claims can – contrary to Brandom – serve as premises. One might transform these reasons into claims, such as »The fact that he asks me is true.« But this is only a matter of notation style. Furthermore, contrary to what he proclaimed earlier in his book, in a later passages he speaks about practical commitments (a sort of self-directed injunction) to entail other practical commitments. So he must concede that practical (non-assertive) commitments can serve as premises, too.

the child (or an extraterrestrial) ever come to an end in forming hypotheses on the intended meaning, and which interpretation should he chose to begin with? To be sure, Brandom's model contains in fact a developmental dimension, but it pertains to the phylogenetic development (in a broad sense, that is, without reference to evolution theory and genetics proper). Furthermore, a developmental dimension is manifest also in another regard: The model of linguistic interaction is built up in a stepwise fashion, proceeding from simpler modes of social interaction to increasing degrees of complexity. However, the aspect of ontogeny, and specifically learning is, as far as I can see, no part of Brandom's view of linguistic communication.

4. Exploring the cognitive foundations to perform the tasks of scorekeeping and inferring

I start with considering the processing of inferences implied in construing something as carrying some particular meaning, and go on to account for the logic of scorekeeping afterwards. Instead of according a privileged status to propositions and claims, I assume a parallel processing that starts to figure out the intended referent to arrive at the proposition expressed through a construal of the predicate. On the other hand, the construal of the predicate is achieved by evaluating the proposition obtained as to what its consequences were, given it would be true. If I restrict my attention for the moment to assertions and theoretical inferences alone, the story goes like this:

Suppose, an interlocutor is telling me something. Before he is doing so, I am already in possession of a body of background knowledge as to which facts obtain in the world. In a preliminary fashion, this body can be regarded as a set of propositions held true. Now, what does a system's holding true a proposition constitute (corresponding to its keeping a particular representation)? Applying the principles of inferentialist semantics, it comes to this: Holding true a particular proposition consists in being disposed to infer specific other propositions (holding *these* true), in the light of further propositions about the world. The content of a proposition is defined as its role in inferring, as a function that takes premises as arguments and conclusions as values. Now, I receive the interlocutor's message. I set up my body of background knowledge, my prior disposition to draw inferences from what I come to know. Applying my knowledge about the conceptual contents normally associated with the words (and applying syntactic derivations) I arrive at a provisional interpretation regarding the proposition expressed. This includes, first of all, identifying the referent (of the singular term) whom a claim has been made about. Now I perform a mapping between the string of words and a particular proposition (the task of the syntax-semantic interface). The proposition, in turn, is identified with inferential roles, as indicated above. Now, several possibilities arise:

The proposition mapped onto the interlocutor's utterance forms already part of my body of knowledge.

The proposition isn't among the set of propositions held true. I have to assess whether I should believe the interlocutor and thus modify my prior epistemic dispositions, or else disbelieve it and dismiss it as false. In the latter case I may also form another hypothesis on the intended meaning, that is, select another mapping from word string to propositional content. In that case, the procedures starts again, going through (1) or (2). The procedure stops when I have arrived at a definite interpretation, attributing propositional content held true or false to the interlocutor's utterance.

Now, if the discourse is to continue and the interlocutor and I exchange further claims, affirmations and refusals, I need to keep track of what has been contended by him and myself. Utterances in the further course of the discourse are to be interpreted in the light of what has been said before by each of us two. To this end, I need to store the interlocutor's manifested beliefs (and their consequences) separate from my own. I need to index them, as it were. This is (one of the aspects of) what is meant be »keeping the score«.

Brandom goes on to introduce, among other things, the logic of anaphoras and indexicals into his model. In the cognitive model developed in the thesis, I demonstrate how this translates into cogni-

tive operations to be postulated. I extend this by incorporating other pieces of semantic structure not attended to by Brandom. These concern quantification, argument structure and thematic roles, and discourse phenomena such as presupposition. For this purpose, I assume principles and formal insights from the Discourse Representation Theory (DRT) (see e.g. Kadmon 2001).

When I have at hand all the elements pertaining to semantics, I can go on to explore the constraints that semantics lays on syntax (and the mental lexicon). How does syntax and semantic structure interact at the interface?

Due to expository reasons, I have somewhat neglected the role and functioning of the mental lexicon. Now I shall give some hints about this issue. Starting from the theses developed on the functions of conceptual-intentional cognition, I formulate a specific hypothesis on the mode of encoding lexical items. In particular, the inferentialist hypothesis of semantics implies a certain type of hierarchical and connective (associative) internal organization of the mental lexicon as a whole. Furthermore, the lexical items have to include enough information in order to yield semantically rich enough meanings – as analyzed thus far. Lexical information is conceived of as (possibly weighted) connections with other lexical nodes bringing about the base for inferences. Partly, these matters do not pertain to words alone, but to (inflectional and derivational) morphems.

5. Reconciling the mentalist and the pragmatist points of view

My enterprise as depicted here is rather uncommon in one respect. I put at one table two paradigms that at times seem to inhabit different planets: The mentalist approach, as promoted among others by Chomsky, and the point of view that could be called pragmatist approaches, which emphasize the importance of the social and normative dimension of language (use). I have tried to put these perspectives together as far as it goes. At this point of the investigation, I have finally arrived at the syntax side. I now want to pass on to the Chomskyan framework. I evaluate how the presented overall picture of cognition and the tenets of Chomsky's minimalist program (in its latest version) fit together. Special attention will be dedicated to the concepts of »probes« and »phases« (see Chomsky 1998 ss. and Radford 2004 for this terminology). Phases are units of linguistic elements smaller than an entire sentence. These are, according to this theory, the units on which alone syntactic operations are performed (probably within the working memory). After the resulting chunks have been handed over to the phonological and the conceptual-intentional components, the syntax module has no more access to them – except a particular part of them, called »edge«. Probes (i.e. a mechanism that induces operations like agreement, case and movement of constituents) play a central role in the process of syntactic processing (called »derivation«). They cannot transcend phase boundaries.

One aspect of the theory is bound up with questions in the domain of semantic processing. From the point of view of speech production and as far as simple sentences are concerned, Chomsky holds that conceptual content is handed over to the language system in two steps, corresponding to two phases. In of them, the type of action and the entities involved in the action are specified, whereas the other one contains indications on the temporal setting and illocutionary force. In the course of my work I have to assess whether this idea fits into my hypotheses about the conceptual-intentional system or if it (or some hypothesis of mine) has to be rejected or modified. From a developmental point of view, Chomsky’s idea is interesting as well, because the first of the phases mentioned is acquired earlier then the second one.

This work of coming up with Chomsky's account has still to be done. I also intend to attempt to establish a point of contact between language processing on this micro-level and neurological findings, especially as data on the working memory are concerned.

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