Context as Partial Beliefs, and the Pragmatic Modelling of Presuppositions.

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Abstract

During the last decade, increased activity around the semantics-pragmatics boundary has re-emphasised the need to address the role of context in the interpretation process of human language. This trend has been driven mainly by attempts to develop formal approaches to deal with typically pragmatic phenomena. In particular for presupposition, the pragmatic phenomenon *par excellence*, several accounts (e.g., Stalnaker, 1974; Karttunen , 1974; Gazdar, 1979; Heim, 1983; Van der Sandt, 1988, 1992; Beaver, 1993) have given firm evidence of the impact of context.

Invariably, traditional contextual models run into severe problems by the consequences of Possible World based notions of propositionhood, which prevents the formulation of partial, revisable information states.

Starting from a notion of proposition developed in Property Theory (Turner, 1987), we develop a formal model of contexts as partial beliefs entertained by agents, who do not necessarily hold compatible views. We show how this model can be exploited in the treatment of the projection problem for conditionals. We demonstrate that a model along these lines does not suffer from the usual disadvantages.

1. Introduction.

Semantic, context-independent theories of presuppositions are defeated by the two distinctive properties of presuppositional behaviour: defeasibility, and the projection problem. Presuppositions are often defeated in contexts where contrary beliefs are held without any sense of semantic or pragmatic anomaly. The Projection Problem poses special problems because not all the presuppositions of the component parts of a complex sentence are inherited.

On the other hand, several pragmatic accounts of presupposition have been developed (e.g., Stalnaker, 1974; Karttunen, 1973, 1974; Karttunen and Peters, 1979; Gazdar, 1979; Soames, 1982; Heim, 1983; van der Sandt; 1988,1992; and Beaver, 1993). Though they take contextual factors into account, most of these theories run into problems as they require that presuppositions be entailed by the context, or that the presupposition be known to all participants prior to the utterance to avoid infelicity, and as they represent propositions, and contexts, as sets of Possible Worlds.

Our account avoids these problems. Like Gazdar (1979), we attempt to explain presupposition behaviour in context in function of consistency. On the other hand, we derive contexts from partial beliefs of agents who do not necessarily hold compatible views. We cast context as a consistent subset of agents' beliefs, namely, those propositions that are relevant to the situation. To achieve this, we use a two-valued notion of proposition taken from Property Theory (Turner, 1987), whilst the behaviour of the partial belief states is governed by Obeid's K-T three-valued logic (Obeid, 1990,1996)).

Our emphasis is not only on the behaviour of presuppositions in context, but also on the impact of agents' beliefs on all aspects of presupposition behaviour. In particular, we contend that only the beliefs of the agent can trigger the defeat, accommodation or failure of presuppositions. Accommodation occurs when the utterance contains new information, satisfaction when it contains old information, and failure/defeasibility when it contains information that is inconsistent with the

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agent's belief state. To deal with complex sentences, we give a recursive definition which solves the projection problem.

2. Context Dependency _ Properties of Presuppositions.

2.1 Defeasibility

Presuppositions can be defeated in circumstances where contrary assumptions are made, or by virtue of beliefs contrary with what is expressed by an utterance.
Consider, for example, the sentence below

(1) The King of France is not bald.

Its presupposition, *There is a King of France*, is defeasible, and can lead to a reading where The King of France is not bald because there is no King of France.

Note that the possibility of defeating the presuppositions under these circumstances seems to depend on whether or not the presuppositional sentence is negated. In a positive sentence the presuppositions cannot be defeated since the resulting sentences are contradictory. Witness the distinction between the following sentences:

(2) *The King of France is bald though there is no King of France.[2]

(3) The King of France is not bald: you must have been mistaken _ There is no King of France.

2.2 Projection Problem

It was originally antecipated by Langendoen and Savin (1971) that the presuppositions of a sentence should be compositional, in the sense that the presuppositions of all constituents of a complex sentence will be projected as presuppositions of the complex sentence. This is not the case, and the particular behaviour of presuppositions in complex sentences turns out to be a really distinctive characteristic of presuppositions.

For example, consider the sentences below.
(3) The King of France is (not) bald.
(4) There is a King of France.
(5) If there is a King of France, then the King of France is (not) bald.
(6) If John is right, then the King of France is (not) bald.

(4) is presupposed by (3) and (6) but not by (5). In this case the presupposition of the consequent follows from the antecedent.

Now, consider the following sentence.
(7) If John came to the party, then the hostess must have been glad that there was a policeman present.

Consider the following contextual assumption.
John is a policeman.

In this context the presupposition of (7), namely, *There was a policeman present* is not projected as a presuppostion of (7) by virtue of the assumption held in the context of utterance.

As such, presuppositions raise questions not just about individual sentences and their truth or falsity but also about the uses of sentences in context.

3. Partiality, Context and Agents' Beliefs

[2]Following the convention I will write unacceptable sentences with a preceding asterisk

3.1 Property Theory x Possible Worlds

The notion of possible worlds serves semantic representation languages in order to account for intensionality. In such approaches, a proposition is a set of possible worlds - a function from possible worlds to truth values - which associates with each relevant world or circumstance a truth value: true with the worlds in which the proposition is true, false with the worlds in which the proposition is false. However, this notion of proposition is insufficiently intensional because propositions which are truth-functionally equivalent become indistinguishable because they denote the same sets of possible worlds. There are, for example, situations that even when an agent may know a certain proposition p, and there may be some proposition q, denoting the same set of possible worlds we may not want to conclude that the agent knows q. Under these circumstances, the possible worlds account of knowledge and belief forces us to conclude that if the agent knows p (s)he has to know q.

Property Theory (Turner, 1987) provides a radical alternative to Possible Worlds, in modelling propositionhood and allows a more fine-grained notion of proposition. Propositions, properties and relations are basic, and are independent of truth conditions or sets. Two properties are distinct if they have different names, and propositions are prevented from being equal just because they have the same truth conditions.

Conceptually, Turner's Property Theory can be split into two components, or levels. The first is a language of terms, which consists of the untyped λ-calculus, embellished with logical constants. A restricted class of these terms will correspond to propositions. When combined appropriatelly using the logical constants, other propositions result. Some of the propositions will, further, be true propositions. When combining propositions with the logical constants, the truth of the resultant proposition will depend upon the truth of the constituent propositions. There may be terms that form propositions when applied to another term. These terms are the properties. The act of predication is modelled by λ-application. The propositionhood and truth of terms is formalised in a meta language of well formed formulae (wff). This is a first order logic with just two primitive predicates: P for "is a proposition", and T, for "is a true proposition". Axioms concerning T are restricted so that only terms that are propositions are considered. This is a highly intensional theory as the notion of equality is that of the λ-calculus, which is weaker than the notion of logical equivalence: propositions are not to be equated just because they are always true together. Similarly, properties are not to be equated just because they happen to hold of the same terms (Fox, C.)

The theory has obvious advantages for semantic modelling contributed by its fine-grained intensionality. For instance, Chierchia (1984), Ramsay (1990, 1992, 1994). However, when dealing with pragmatic, or context-dependent phenomena, Property Theory has further advantages in that it avoids the problems of "omniscience" arising from possible world based models. More specifically, when using a possible world notion of proposition, the "meaning" of a sentence can only be determined by examing its extension - which is a set of possible worlds. The intension is derived subsequently. A proposition corresponding to "John walks" is a partition on the set of possible worlds. The extent of this partition can only be explored if an agent knows, for each possible world, whether it belongs to the set where the proposition is true, or to the set where it is false. Consequently, it is impossible for an agent to entertain a proposition unless (s)he is omniscient. This in turn causes severe difficulties when attempting to model partial information states. Property Theory on the other hand, offers a notion of propositionhood where a proposition is a basic, model-theorectic object. It's truth conditions are derived secundarily, by a Truth predicate. The requirement for omniscience does not apply and, consequently, it is possible to model partial information states as collections of propositions. (De Roeck et al., 1991).

3.2 The Model

When people communicate, they must know different things, or there would be no point in communicating. This suggests that any intuitively appealing of communication must allow for partiality in what agents know. Agents retain inferential capabilities, so we assume their beliefs are consistent, and the model represents agents as partial, consistent sets of propositions. This constrains the agent's reasoning capacity, which must now deal with partial information. Agents' beliefs may

now be subject to revision. An agent can only interpret an utterance with respect to what (s)he knows. Consequently, we cast contexts as a consistent subset of an agent's beliefs, namely those propositions which bear on the interpretation of the utterance on hand. Interpretation relies on maintaining consistency in the context whilst adding the utterance's information. Failure to complete the proof will point to those propositions which induce failure. Note that a context is entirely local to an agent, and that agents may hold incompatible and inaccurate beliefs.
This model, and an accompanying implementation, was first developed to deal with modal and hypothetical questions (De Roeck et al., 1991). It builds on the definition of proposition taken from Property Theory (Turner, 1987), a weak first order theory with fine grained intensionality, which allows a classical two-valued notion of proposition whilst maintaining partial information states governed by Obeid's K-T three-valued logic (Obeid, 1990,1996).

K-T is a propositional, non-monotonic logic which employs Kleene's strong three-valued connectives, and which is extended with two modal operators (the language can be propositional as the knowledge base is sorted and closed). The semantics of the logic are expressed in terms of states of partial information wich allow an agent to be uncertain about the truth or falsity of his knowledge, and where possible, to make assumptions on the basis of what is not known to be false. Complete information is hard to obtain, even in the most manageable situations: in most cases, a reasoner does not know everything that is pertinent to the investigation at hand. There are propositions whose truth status cannot be decided. Traditionally, the issue of revision and partiality is addressed at the level of the proposition, where (non-monotonic) formalisms resort to adding intermediary truth values between truth and falsity. This, in fact, is one of the basic and most important features which distinguishes three-valued logics from the classical ones. Apart from the fact that this is intuitively unappealing (in the sense that propositions seem to be things that are true or false - but which one needs not know whether they are true or false), this traditional approach has a further disadvantage in that it causes logical difficulties. In particular $A \rightarrow A$ is not an axiom of such logics.

The model we propose - that of deploing partial collections of classical two-valued propositions in belief states governed by a three-valued logic has none of these disadvantages.

We use the framework to model the effects of context on presupposition behaviour in the interpretation process.

4. Pragmatic Presupposition for Simple Sentences

How do presuppositions arise? The model we are presenting assumes there are candidate presuppositions, called elementary presuppositions, which are tied to particular words or syntactic constructs occurring in the sentence (van der Sandt(1988)). Whether a particular elementary presupposition survives as a presupposition of the sentence depends on a number of conditions. The model is embodied in a series of recursive definitions (Definition 1 to 6). Here, we start out exploring the base case for simple sentences. In the following section, we introduce the recursive rules for the presuppositions of complex sentences. In this paper we illustrate the projection problem for conditionals only. For a treatment of conjunction and disjunction, see Manara & De Roeck (1996b).

Definition 1 _ Elementary Presuppositions (ε-presuppose)

A sentence S with propositional content ϕ ε-presupposes ρ iff (i) S contains lexical items or syntactic constructs (called presuppositions triggers) that trigger ρ and (ii) $\{\phi\} \cup \{\rho\}$ is consistent.

Elementary presuppositions are candidate presuppositions which may or may not survive as presuppositions of the utterance. They propositions which can be derived entirely on the basis of syntactic information in the sentence, without any reference to context. Candidate presuppositions must, furthermore, be consistent with the propositional content of the sentence from which they derive. For example, *Charles has borrowed Philip's tie* has as elementary presuppositions the following propositions: *Charles* exists, *Philip exists, Philip's tie exists*. In contrast, *The King of France does not exist* has as an elementary proposition *France exists*, but not *There is a King of France*.

The following three definitions expand on the relationship a candidate presupposition may entertain with a context - i.e. a consistent subset of an agent's belief cast as a collection of propositions. We distinguish three cases: accommodation, satisfaction and failure. Elementary presuppositions which do not meet the criteria laid out here will not survive as they are undefined.

Definition 2 _ Accommodation (α-presuppose)

An utterance $U(S,C,\phi)$[3] α-presupposes ρ in a context C iff (i) S ε-presupposes ρ; (ii) $C \cup \{\rho\}$ is consistent and, (iii) $C \not\models \rho$.

We define accommodation as the situation where an elementary presupposition contributes new information to the agent's belief state. Note that in the logic K-T, this will happen in all cases where the agent holds no prior beliefs which explicitly confirm or contradict the elementary presupposition in question. For example, if an agent has no knowledge about Andrews' family circumstances, then the elementary presupposition *Andrew's sister exists* will be accommodated for the sentence *Andrews' sister has bought a car.*

Definition 3 _ Presupposition Satisfaction (σ-presuppose)

A presupposition ρ of an utterance $U(S,C,\phi)$ is satisfied by the context of utterance C iff (i) S ε-presupposes ρ and (ii) $C \models \rho$.

Satisfaction occurs when an agent already holds beliefs which confirm the information contained in an elementary presupposition. For instance, if an agent is fully aware of the British political system, the presupposition *The Queen of England exists* will be satisfied for the sentence *Sarah loves the Queen of England.*

Definition 4 _ Presupposition Failure

$U(S,C,\phi)$ fails ρ iff (i) S -presupposes ρ and (ii) $C \models \neg\rho$.

Presupposition failure is the result of an elementary presupposition contradicting beliefs the agent already holds.

Because we are working with partial belief states containing propositions which are not grounded possible worlds, contradiction in a context is not irrecoverable. Indeed, it is possible to identify exactly which propositions give rise to the contradiction and devise a strategy for restoring consistency.

Elementary presuppositions deriving from negative sentences are defeasible. This is exactly the effect Russel tried to achieve by introducing scope ambiguity in negation.

Definition 5 _ Defeasibility

$\forall\rho$ if _ ε-presupposes ρ then defeasible (ρ), where _ is a negative sentence.

If the elementary presupposition causing the contradiction is defeasible, consistency in the context can be restored by defeating it.
If on the other hand, it is not defeasible, the agent can restore consistency by either rejecting the utterance, or revising previously held beliefs. The decision as to which course of action to take rests with the agent and is beyond the scope of this work.

We equate pragmatic presupposition with accommodation.

Pragmatic Presupposition (Π-presuppose)

$U(S,C,\phi)$ Π-presupposes ρ iff $U(S,C,\phi)$ α-presupposes ρ.

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[3] *$U(S,C,\phi)$ is the utterance of sentence S with propositional content ϕ in context C.*

Examples:
1. S = The King of France is bald, S ε-presupposes (a.o.) ρ = There is a King of France. (i) If in C nothing is known about the government system of France, ρ will be accommodated. (ii) If in C it is known that France has a king, then ρ will be satisfied. (iii) If in C it is known that France has no king, then ρ will fail. Note however that ρ is not defeasible, and stalemate is reached.

2. S = The king of France is not bald. S ε-presupposes (a.o.) ρ = There is a King of France. If in C it is known that France has no king, ρ fails. Note however that ρ is defeasible (S is negative) and the agent may defeat ρ (leading to a reading the King of France is not bald, because there is no King of France).

5. Complex Presuppositional Effects

Langendoen and Savin (1971) contended that presuppositions of a complex sentence should be derivable compositionally. Yet, in particular, conditionals have given rise to formulations of the projection problem where presuppositions of lower clauses are sometimes not inherited by the role of the complex sentence. Conditionals are the typical example where contextual effects interfere with presuppositional behaviour, and we will focus on them for this reason. Similar effects, however, are visible in conjunctions and disjunctions and we have developed accounts for those, which can be found in Manara and De Roeck (1996). For conditionals, the advantages of our model of context are immediately visible. Truth conditional, entailment based accounts - such as (Karttunen, 1974; and Heim, 1983) - tend to experience problems as the requirement that presuppositions are entailed by the context of utterance leads to incorrect predictions[4]. Most of these problems can be traced to the commitment such theories have to the notion of truth (built in possible world foundations) rather than the simple requirement of consistency. Instead, our model of context, allows us to exploit the power of consistency in partial information states, regardless of the truth or falsity of the proposition involved.

Starting from the basic formulations given above, we propose a treatment which predicts correctly which presuppositions survive in conditionals.

Definition 6
Cond 1
An utterance $U(\text{if } S_1 \text{ then } S_2, C, \psi \rightarrow \chi)$, where S_1 ε-presupposes ρ_i and S_2 ε-presupposes $\gamma_{1...n}$, α-presupposes (σ-presupposes, fails) ρ_i iff (i) $\{\chi\} \cup \{\gamma_1,...,\gamma_n\} \cup \{\rho_i\}$ is consistent or ρ_i is defeasible, and (ii) $U(S_1,C,\psi)$ α-presupposes (σ-presupposes, fails) ρ_i .

Cond 2
An utterance $U(\text{if } S_1 \text{ then } S_2, C, \psi \rightarrow \chi)$, where S_1 ε-presupposes $\rho_{1...n}$, and S_2 ε-presupposes γ_i, α-presupposes (σ-presupposes, fails) γ_i iff (i) $\{\psi\} \cup \{\rho_1,..., \rho_n\} \cup \{\gamma_i\}$ is consistent or γ_i is defeasible, and (ii) $U(S_2,C', \chi)$ α-presupposes (σ-presupposes, fails) γ_i, where $C' = C \oplus \{\psi\} \oplus \{\rho_1,..., \rho_n\}$.[5]

Examples:
3. S = If there is a King of France, then the Queen of France is bald. S_1 ε-presupposes ρ_1 = France exists. S_2 ε-presupposes γ_1 = France exists, γ_2 = There is a Queen of France. If C contains *France exists*, then U(S, C, $\psi\rightarrow\chi$) σ-presupposes ρ_1 and γ_1, and α-presupposes γ_2. U(S,C, $\psi\rightarrow\chi$) Π-presupposes γ_2.

[4]For instance, for Heim (1983) the sentence *If John makes coffee, his wife will be happy* presupposes *If John makes coffee, he has a wife*.
[5]*$C' = C \oplus \{\beta\}$ is the consistent update of C with β by revising C.*

4. S = If the King of France has a son, then the King of France's son is bald. S_1 ε-presupposes ρ_1 = France exists, ρ_2 = There is a King of France. S_2 ε-presupposes γ_1 = France exists, γ_2 = There is a King of France, γ_3 = The King of France has a son. If *C* contains *France exists* and *There is a King of France*, then $U(\text{S}, C, \psi\rightarrow\chi)$ σ-presupposes ρ_1, ρ_2, γ_1, γ_2, γ_3. $U(\text{S}, C, \psi\rightarrow\chi)$ carries no pragmatic presuppositions. If *C* contains *There is no King of France*, then γ_2 will fail as γ_2 is not defeasible.

5. S = *If there is no King of France, then the King of France is bald. S_1 ε-presupposes ρ_1 = France exists. S_2 ε-presupposes γ_1 = France exists, γ_2 = There is a King of France. Regardless of the content of *C*, S is unacceptable as γ_2 is not defeasible.

6. S = If the King of France does not exist, then the King of France is not bald. S_1 ε-presupposes ρ_1 = France exists. S_2 ε-presupposes γ_1 = France exists, γ_2 = There is a King of France. If in *C*, it is not known that France exists, nor that France has a king, then $U(\text{S}, C, \psi\rightarrow\chi)$ ε-presupposes ρ_1, *σ-presupposes* γ_1 and γ_2 is cancelled as it is defeasible. $U(\text{S}, C, \psi\rightarrow\chi)$ pragmatically presupposes ρ_1.[6]

6. Comparison with other work

Using our model, we can successfully treat cases which are problematic for other approaches.
(a) John does not realize that Zorn's Lemma is inconsistent with the Axiom of Choice. (Gazdar, 1979) [7]
Gazdar (1979) can never presuppose *Zorn's Lemma is inconsistent with the Axiom of Choice* because there are no worlds in which this is true. Our model predicts (a) Π-presupposes *Zorn's Lemma is inconsistent with the Axiom of Choice* in an empty context.
(b) If France has an intelligent king, then the King of France is the only intelligent monarch in Europe. (Soames, 1982)
Gazdar (1979) predicts (b) presupposes *There is a King of France.* In our model *There is a King of France* is satisfied, but not Π-presupposed.
(c) If John has children, then Mary will not like his twins. (Heim, 1983)
Gazdar predicts (c) presupposes nothing. Our model predicts (c) Π-presupposes *John has twins* in contexts where nothing is known about John's children.
(d) If John has twins, then Mary will not like his children. (Heim, 1983)
Gazdar predicts (d) presupposes *John has children*. Our model predicts this is not a pragmatic presupposition.
(e) The King of France didn't come. van der Sandt (1992) and Beaver (1993) predict inconsistency in contexts where there is no King of France. Our model specifies that the elementary presupposition *There is a King of France* is defeasible.
(f) If John made coffee, then his wife will be happy. (van der Sandt, 1992).
Heim predicts (f) presupposes *If John made coffee, he has a wife* in contexts where it is not known whether John has a wife or not. In possible worlds accounts, like Heim's, presuppositions must be satisfied by the context of utterance (i.e., entailed by the context) in order for an utterance of S to be felicitous. Our model predicts (f) Π-presupposes *John has a wife*.
(g) If the problem was difficult, then Morton isn't the one who solved it. (Soames, 1982).
Karttunen and Peters (1979) filtering conditions predict wrongly (g) presupposes *If the problem was difficult, then someone has solved it* and not, as in our model *Someone has solved the problem.* Beaver(1993) also predicts the same conditional presupposition as Karttunen and Peters. In his account presupposition is represented as a test of the context which is represented by sets of possible worlds: a presuppositional sentence is a valid utterance in a given context if its presupposition has no effect on that context, i.e., the presupposition must be entailed by the context of utterance.

7. Conclusion

[6]Note that ρ_1 is also defeasible.
[7]For each case, the author who mentioned it is given in brackets.

In this paper, we have formulated a treatment of satisfaction, failure and defeasibility of presuppositions with respect to a context drawn from an agent's beliefs.

The hallmark of our approach is the combination of a classical two-valued notion of propositionhood with partial belief states in our model. This allows us to exploit the notion of consistency, whilst circumventing the problems caused by entailment in traditional, possible world based solutions. Consequently, we are able to equate presupposition with accommodation, which occurs when elementary presupposition contributes new information, and to account for defeasibility independently of the issue of (local) accommodation. We present a notion of unacceptability of utterances based on the violation of presuppositional constraints.

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