How and Why Conventional Implicatures Project

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It is well-known that a single utterance may convey different types of information, for example *new* and *old* information. It is not always clear, however, how these types of content relate to each other. One way to pursue a unified semantic analysis would be to see how different types of content that exhibit the same semantic property relate to each other. Of particular interest in this context is the property of *projection*; the indifference of linguistic content to semantic operators such as negation. The three most prominent classes of projection phenomena are anaphora, presuppositions, and conventional implicatures (CIs; as defined by Potts [7]) [10]. The correspondence between the former two forms the basis for one of the major accounts of presuppositions [11, 2]. In contrast, formal analyses of CIs have mainly focused on differentiating between the semantic contribution of presuppositional and CI content by introducing different meaning dimensions [7, 5], or different types of discourse updating [1]. However, such accounts shed little light on the commonalities underlying the projection behaviour that is shared among the three classes.

We propose a unidimensional and incremental analysis of conventional implicatures, which highlights their correspondence to presuppositions, and anaphora. We focus on supplemental CIs, triggered by subordinated constructions such as appositives, e.g., *"John, a linguist, was not at the party"*. Our analysis is based on the observations that (i) CIs always attach to an anchor, and (ii) the anchor itself always projects, and (iii) CIs always project to their anchor. These observations have led to several syntactocentric analyses for CIs [e.g., 5, 9, 6], but these fail to capture the *semantic* properties underlying the projection behaviour of CIs, presuppositions and anaphora. We therefore propose a Montagovian semantic analysis that treats CIs as 'projection-anaphoric' (*p-anaphoric*) to their anchor, that is, they introduce an equality between their projection site and the one introduced by their anchor. At the same time, CIs contribute novel information to the discourse context created by the anchor. In contrast, presuppositions are 'reference-anaphoric' [cf. 11], which signals previously established content and entails p-anaphoricity. The analysis is formalized in Projective DRT [12], a representational framework in which projection sites are explicitly part of the semantic representations. It explains the interpretational differences between presuppositions and CIs, without stipulating a fundamental distinction between them.

CIs are projection-anaphoric.   van der Sandt's [11] proposal to treat presupposition projection as anaphora resolution, formalized in DRT [3], is based on the observation that presuppositions behave in a way similar to anaphora. CIs, on the other hand, are more similar to regular assertions, since they are infelicitous in a context in which their content has already been established, as in *"John is a linguist.(...) #John, a linguist, .."*. Like presuppositions, however, CIs provide backgrounded information and project out of embedded contexts. These characteristics can be brought together by treating CIs as *projection-anaphoric* to their anchor: their content is novel (i.e., non-anaphoric), but projects along with the presupposition triggered by their anchor, thus contributing novel information to the interpretation context of the anchor. Moreover, since CIs are non-restrictive, they require a specific, and therefore projecting anchor. This explains why CIs are infelicitous when anchored to a non-specific indefinite, as in #*"No man, a linguist,.."*. Thus, besides 'piggybacking' on their anchor, CIs require their anchor to project, which explains why, like presuppositions, they tend to project globally. In order to formalize this behaviour, we need a framework in which projection is explicitly part of the semantic representation. This is part and parcel of Projective DRT [12], an extension of DRT [3] in which labels and pointers explicitly reflect the interaction between the introduction and interpretation context of projected content.

CIs in PDRT. In Projective DRT, the correspondence between anaphora and presuppositions is taken a step further by treating projection as variable binding. Each context introduces a *label* that can bind the *pointers* associated with the discourse referents and conditions, indicating where the content is interpreted. To formalize p-anaphoricity, we add structural information to PDRSs, via a subordination relation between contexts [cf. 8]. The projection of presuppositions is signalled by means of a strict subordination ($<$). CIs project as well, but also introduce an equality between their projection site and the one provided by their anchor. The PDRS in (1) has pointers for three contexts named 1, 2 and 3; x_i is a discourse referent pointing to (i.e., is interpreted in) PDRS i, and K_j is a PDRS labelled j. The constraints posed on the contexts are shown after the conditions.

(1)   Mary, a linguist, laughs.
$$[\, x_3, \ z_2 \mid Mary_3(x), \ linguist_2(z), \ x =_2 z, \ laugh_1(x) \mid 1 < 3, \ 1 < 2, \ 2 = 3]_1$$

In contrast to a van der Sandtian analysis of CIs based on variable trapping, PDRT predicts the infelicity of attaching a CI to a non-projecting anchor. Due to the p-anaphoricity of CIs together with their projecting nature, this results in conflicting contextual constraints, as illustrated in example (2), with the conflicting constraints indicated in bold.

(2)   #No man, a linguist, laughs.
$$[[\neg_1[\, x_2, \ z_3 \mid man_2(x), \ linguist_3(z), \ x =_3 z, \ laugh_2(x) \mid \mathbf{2 < 3}, \ \mathbf{3 = 2}, \ 2 < 1]_2]]_1$$

An incremental construction procedure is crucial for a proper account of CI content, because of its interaction with asserted content, e.g., via anaphoric dependencies [1]. In PDRT, this incremental construction can be formalized using Montague semantics [cf. 4]. Importantly, since projection is directly part of the incremental construction, in contrast to van der Sandt's account, anaphoric dependencies and conflicting contextual constraints are directly available during discourse construction. To test and evaluate the non-trivial procedure of dealing with projection variables during discourse construction, we have implemented PDRT as a Haskell library, called PDRT-SANDBOX.

Towards a unified account of projected content. Formal approaches to semantics aim to capture all aspects of the meaning of an utterance. This means incorporating different types of content (for example, *old* versus *new*), while taking into account the interaction between them. Our account paves way for such a unified analysis of projected content. By treating CIs as projection-anaphora, we can explain their kinship to presuppositions and anaphora, without introducing an extra level of complexity to account for the fact that they introduce novel information.

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