35. Situation Semantics and the ontology of natural language

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Abstract
Situation Semantics emerged in the 1980s with an ambitious program of reform for semantics, both in the domain of semantic ontology and with regard to the integration of context in meaning. This article takes as its initial focus the topic of a situation-based ontology, more generally discussing the approach to NL ontology that emerged from situation semantics. The latter part of the article will explain how recent work synthesizing situation semantics with type theory enables the original intuitions from situation semantics to be captured in a dynamic, computationally tractable framework.

1. Introduction
Situation Semantics emerged in the 1980s with an ambitious program of reform for semantics, both in the domain of semantic ontology and with regard to the integration of context in meaning. In their 1983 book Situations and Attitudes (Barwise & Perry 1983), Barwise and Perry argued for the preeminence of a situation-based ontology and took contexts of utterance to be situations, thereby offering the potential for a richer view of context. For situation semantics and utterance–oriented interpretation, see article 36 (Ginzburg) Situation Semantics. This article takes as its initial focus the topic of a situation-based ontology, more generally discussing the approach to NL ontology that emerged from situation semantics. The latter part of the article will explain how recent work synthesizing situation semantics with type theory enables the original intuitions from situation semantics to be captured in a dynamic, computationally tractable framework.

As a semantic framework, Barwise & Perry (1983) view Situation Semantics as following on – but also crucially breaking from – the tradition of Montogovian model theoretic semantics. The strategy this latter embodies they view as being Fregean: intensions providing a logically fruitful way of explicating ‘[Frege’s] third realm, a realm neither of ideas nor of worldly events, but of senses.’ (Barwise & Perry 1983, 4) Given Barwise and Perry’s ambitious program they reject aspects of the Frege-Montague programme as cognitively intractable, and argue that the ontology it postulates is unnecessarily coarse grained. For instance, the choice of truth values as the denotata of declarative sentences they view as resting on a bad argument (‘The slingshot’).

The desiderata for a semantic framework Barwise and Perry put forward include the following:
The priority of information: language has *external significance,* as model theoretic semantics has always emphasized, but, as cognitive scientists of various stripes emphasize, it also has *mental significance,* yielding information about agents’ internal states; in this respect see also article 11 (Kempson) *Formal semantics and representationalism.* What is needed is a way of capturing the commonality between the external and the mental, a matter exacerbated when multimodal meaning (gesture, gaze, visual access) enters into the picture.

Cognitive realizability: in common with all other biological organisms, language users are resource bounded agents. This requires that only relatively “small” entities feature in semantic accounts, hence the emphasis on situations and their characterization in a computable fashion.

Structured objects: semantic objects such as propositions need to be treated in a way that treats their identity conditions very much on a par with ‘ordinary’ individuals. Such entities are *structured objects:*

(1) The primitives of our theory are all real things: individuals, properties, relations, and space-time locations. Out of these and objects available from the set theory we construct a universe of abstract objects. (Barwise & Perry 1983, 178)

That is, structured objects arrive on the scene with certain constraints that ‘define them’ in terms of other entities of the ontology in a manner that is inspired by proof theoretic approaches. This way of setting up the ontology has the potential of avoiding various foundational problems that beset classical theories of properties and propositions. For propositions, these problems typically center around doxastic puzzles such as logical omniscience and its variants.

An important component in fulfilling these desiderata, according to Barwise and Perry, is a theory by means of which external (and internal) reality can be represented – an ontology of some kind. The formalism that emerged came to be known as Situation Theory – its make up and motivation constitute the focus of sections 2, 3, and 4 of the paper. These proceed in an order that reflects the evolution of Situation Theory: initially as a theory of situations, then as a theory that includes both concrete entities such as situations and abstract ones such as propositions, finally as a more extended ontology, comprising in addition entities such as questions, outcomes, and possibilities. Section 5 of the paper concerns the emergence of a type theoretic version of the theory, within a formalism initiated by Robin Cooper. Section 6 provides some concluding remarks.

2. Introducing situations into semantics: Empirical motivations

Situation Semantics owes its initial prominence to its analysis of the naked infinitive (NI) construction, exemplified in (2). Here is a construction, argued Barwise (1989b), that intrinsically requires positing situations – spatio-temporally located *parts* of the world. One component of this argument goes as follows: the difference in meaning between (2a) and (2b) illustrates that “logically equivalent” NIs (relative to an evaluation by a *world*) are not *semantically* equivalent. And yet, the intuitive validity of the inference from (2b) to (2c) and the inference described in (2d) shows that NIs bring with them
clear logical structure. This is a purely linguistic argument, to add to other more methodological ones, that the appropriate ontology for NL cannot be one based solely on worlds, but must include events and situations.

(2) a. Bo saw Millie enter.
   b. Bo saw Millie enter and Jan leave or not leave.
   c. Bo saw Jan leave or not leave.
   d. Bo saw Jan not leave. So, it’s not the case that Bo saw Jan leave. In fact, Bo saw Jan engaged in something inconsistent with leaving.

The account of NI clauses is based on a theory of situations characterized in terms of situation types. Here a few words on nomenclature are due. Barwise and Perry used the term ‘situation’ as a cover term for what have often been called ‘eventualities’, including events, situations, states and so forth; for detailed discussion see also article 34 (Maienborn) Event semantics. I will stick with this choice here, for historical reasons, but the wider intended extension should be noted throughout. Similar remarks apply mutandis mutandi to the term ‘situation type’. Indeed this is Barwise and Perry’s original name of such entities, which subsequently came to be known as states-of-affairs, infons, or SOAs. The return to the original term is intentional given the current type theoretic turn discussed in section 5.

Situation types are structured objects that function as ‘potential properties’ situations can possess: situation types are taken to be structured from two components, a relation $R$, and an assignment $\alpha$, which assigns real world entities to the argument roles of $R$, as in (3a). The notation in (3b) indicates that the situation $s$ is of the type given by the situation type $\langle R; \alpha \rangle$. If a situation fails to be correctly classified by a situation type $\sigma$, this is notated as in (3c); ‘$|$’ was traditionally notated as $\models$.

(3) a. $\langle \langle \text{CALM}; \text{loc} = \text{Jerusalem} \rangle \rangle$
   b. $s : \langle \langle R; \alpha \rangle \rangle$
   c. $s : /\langle \langle R; \alpha \rangle \rangle$

Situation types are assumed to come in positive/negative pairs, i.e. every relation/assignment pair gives rise to a positive situation type and a negative situation type. We will assume the positive ones to be (notationally) unmarked and notate the corresponding negative with an ‘overline’, as in (4a). Because situations are partial, there is a difference between a situation failing to be correctly classified by $\sigma$ and being correctly classified by $\bar{\sigma}$. For any situation $s$ and situation type $\sigma$, (4b) holds, but (4c) generally fails. The intuition is that classifying $s$ with $\bar{\sigma}$ means that $s$ actually possesses information which rules out $\sigma$; rather than simply lacking concrete evidence for $\sigma$. So, for instance, a situation I perceive in London, $s_{\text{London}}$, would typically neither be of the type $\langle \langle \text{CALM}; \text{loc} = \text{Jerusalem} \rangle \rangle$, nor of the type $\langle \langle \text{CALM}; \text{loc} = \text{Jerusalem} \rangle \rangle$. $s_{\text{London}}$ is simply indeterminate about the issue of Jerusalem’s calamity or calmness. Cooper (1998) has proposed a pair of axioms that attempt to capture this intuition. (4d) states that if a situation $s$ supports the dual of $\sigma$, then $s$ also supports positive information that precludes $\sigma$ being the case. (4e) tells us that if a situation $s$ supports the dual of $\sigma$, then $s$ also supports information that defeasibly entails that $\sigma$ is the case. I discuss some linguistic evidence relating to (4e) in section 4., in connection with negative polar interrogatives.
The treatment of NIs and its wider semantic implications opened various debates, debates in which one of the main issues was: does an account of NIs require a radical overhaul of the underlying semantic ontology? Muskens (1989) showed that a Montogovian framework could offer an account if it embraced 4-valued logic. Higginbotham (see Higginbotham 1983, 1994) argued that Davidsonian event theory was sufficient to explicate NIs. Neale (1988) and Cooper (1998) subsequently provided counter arguments to Higginbotham. Cooper claimed, \textit{inter alia}, that the existence of negative situation types in Situation Theory allows it to explicate cases like (5a) in terms of the perceived scene satisfying (5b), which seem beyond Higgibotham’s Davidsonian account, which is limited to something like (5c):

\[(5)\]
a. Ralph saw Mary not serve Bill.

\[s: \langle\langle\text{Serve}; \text{server} : m, \text{servee} : b\rangle\rangle\]

b. \(s: \sigma\) or \(s: \sigma\)

c. \(s: \sigma\) or \(s: \sigma\)

d. \(\forall s, \sigma[s: \sigma \implies \exists (\text{Pos}) \psi[s: \psi \text{ and } \psi \implies \sigma]]\)

e. \(\forall s, \sigma[s: \sigma \implies \exists (\text{Pos}) \psi[s: \psi \text{ and } \psi > \sigma]]\)

However one thinks these debates played out – the reckoning must be done relative to the range of phenomena and tractability each framework can ultimately accommodate – one apparently uncontroversial outcome is the recognition that situations are needed in the ontology. Nonetheless, the question that arises is this: how significant are situations for semantics? A syntactic analogy might be the following: there is incontrovertible evidence that NL is not context free, as demonstrated e.g. by Swiss German crossing dependencies. Are situations exotica like Swiss German Crossing Dependencies, or are they an absolutely pervasive feature like unbounded dependencies, inability to deal with which renders any grammar quite unviable? Barwise and Perry’s claim was that the latter is the case. Their claim is that situations are at the heart of semantic use. As discussed in detail in article 36 (Ginzburg) \textit{Situation Semantics}, one of the early claims of situation semantics, following Austin, was that the meaning of declarative sentences is to be explicated as relating utterance situations to described situations. This intuition can be made concrete: anaphora shows that (described) situations enter into context as a consequence of the assertion of an episodic sentence, even if the assertion is not accepted, as in (6b):

\[(6)\]
a. A: Jo and Mo got married yesterday. It was a wonderful occasion.

b. A: Jo’s arriving next week. B: No, that’s happening in about a month.

Barwise and Perry also argued, and their arguments were sharpened by Robin Cooper (see Cooper 1993, 1996), that a given utterance can also concern an event/situation that is distinct from the described situation. Ever since Russell (1905), at least one influential school has sought to explain the meaning of singular definites using some notion of uniqueness; for detailed discussion see article 41 (Heim) \textit{Definiteness and indefiniteness}. More generally, quantification presupposes a domain (cf. terms such as \textit{the domain of discourse, the universe} etc). With some notable exceptions (e.g. McCawley 1979,
Lewis 1979), until Barwise and Perry’s proposal, the requisite relativization was not considered a matter to be handled in semantic theory. Barwise and Perry’s essential idea is that in language use more than one situation comes into the picture: they make a distinction between the described situation, the situation which roughly speaking a declarative utterance picks out, and a resource situation, so called because it is used as a resource to fix the range/reference of an NP. Cooper’s argument is based on data such as (7), modelled on an example from Lewis (1979), where two domains are in play, a local one and a New Zealand one. The former is exploited in the first two sentences, after which the New Zealand domain takes over. At the point marked ǁ we are to imagine a sudden shift back to the local domain. By assuming that domains are situations we capture the fact that once a shift is made, it encompasses the entire situation, ensuring that the dog referred to is local:

(7) The dog is under the piano and the cat is in the carton. The cat will never meet our other cat because our other cat lives in New Zealand. Our New Zealand cat lives with the Cresswells and their dog. And there he’ll stay because the dog would be sad if the cat went away. ǁ The cat’s going to pounce on you. And the dog’s coming too.

For computational work using resource situations, integrated also with visual information see Poesio (1993). For experimental work on the resolution of definites in conversation taking a closely related perspective see Brown-Schmidt & Tanenhaus (2008).

3. The Austinian picture

The ontology we have discussed so far comprises situations and situation types (as well as of course the elements that make up these entities – individuals, role to individual assignments). Situations are the main ingredient in a treatment of bare perceptual reports and play a significant role in underpinning NP meaning and assertion. This is essentially the ontology of *Situations and Attitudes* in which there were no propositions. These were rejected as ‘artifact(s) of the semantic endeavor’ (*Situations and Attitudes*, loc. cit). As Barwise & Perry (1985) subsequently admitted, this was not a move they were required to make. Indeed propositional-like entities, more intensional than situations, are a necessary ingredient for accounts of attitude reports and illocutionary acts. *Sets* of situations, although somewhat more fine grained than sets of worlds, are vulnerable to sophisticated variants of logical omniscience (see e.g. Soames’ puzzle in Soames 1985). Nonetheless, Angelika Kratzer has initiated an approach, somewhat confusingly also known as *Situation Semantics*, that does attempt to exploit sets of situations for precisely this role and develops accounts for a wide range of linguistic phenomena, including modality, donkey anaphora, exhaustivity, and factivity. See Kratzer (1989) for an early version of this approach, and Kratzer (2008) for a detailed, recent survey.

The next cheapest solution available within the *Situations and Attitudes* ontology would be to draft the situation types to serve as the propositional entities. Indeed, situation types are competitive in such a role: they can distinguish identity statements that involve distinct constituents (e.g. (8a) corresponds to the situation type in (8c), whereas (8b) corresponds to the situation type in (8d), while allowing substitutivity of co-referentials and cross-linguistic equivalents, as exemplified respectively by (8e) and (8f), the Hebrew analogue of (8b):
(8) a. Enesco is identical with himself.
b. Poulenc is identical with himself.
c. \langle Identical; enesco, enesco \rangle
d. \langle Identical; poulenc, poulenc \rangle
e. He is identical with himself.
f. Poulank zehe leacmo.

Nonetheless, post 1985 situation theory did not go for the cheapest solution; as we will see in section 4, not succumbing to ontological stinginess pays off when scaling up the theory to deal with other abstract entities.

Building on a conception articulated 30 years earlier by Austin (1970), Barwise & Etchemendy (1987) developed a theory of propositions in which a proposition is a structured object \( \text{prop}(s, \sigma) \), individuated in terms of a situation \( s \) and a situation type \( \sigma \). Here the intuition is that \( s \) is the described situation (or the belief situation, in so far as it is used to describe an agent’s belief, or utterance token, in the case of locutionary propositions discussed below), with the relationship between \( s \) and \( \sigma \) being the one introduced above in our discussion of NIs, leading to a straightforward notion of truth and falsity:

(9) a. \( \text{prop}(s, \sigma) \) is true iff \( s: \sigma(s \text{ is of type } \sigma) \).
b. \( \text{prop}(s, \sigma) \) is false iff \( s:/\sigma(s \text{ is not of type } \sigma) \).

In saying that a proposition \( \text{prop}(s, \sigma) \) is individuated in terms of \( s \) and \( \sigma \), the intention is to say that \( \text{prop}(s, \sigma) = \text{prop}(t, \tau) \) if and only if \( s = t \) and \( \sigma = \tau \). Individuating propositions in terms of their “subject matter” (i.e. the situation type component) is familiar, but what is innovative and/or puzzling is the claim that two propositions can be distinct despite having the same subject matter.

I mention three examples from the literature of cases which motivate differentiating propositions on the basis of their situational component. The first is one we saw above in the case of definiteness resolution, where the possibility of using ‘the dog’ is underwritten by distinct presuppositions; the difference in the presuppositions resides in the different resource situations exploited:

(10) a. \( \text{prop}(s_{\text{local}}, \langle \text{UNIQUE, Dog} \rangle) \)
b. \( \text{prop}(s_{\text{newzealand}}, \langle \text{UNIQUE, Dog} \rangle) \)

A second case are the locutionary propositions introduced by Ginzburg (2010). Ginzburg argues that characterizing both the update potential and the range of utterances that can be used to seek clarification about a given utterance \( u_0 \) requires reference to the utterance token \( u_o \) as well as to its grammatical type \( T_{u_0} \) (see article 36 (Ginzburg) Situation Semantics for details). By defining propositions (locutionary propositions) individuated in terms of \( u_0 \) and \( T_{u_0} \) one can simultaneously define update and clarification potential for utterances. In this case, there are potentially many instances of distinct locutionary propositions, which need to be differentiated on the basis of the utterance token – minimally any two utterances classified as being of the same type by the grammar.

The original motivation for Austinian propositions was in the treatment of the Liar paradox by Barwise & Etchemendy (1987). This paradox concerns sentences like (11a,b) which, pretheoretically, are false if true and true if false. Although one approach to this
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issue involves banning self reference, this is an arbitrary prohibition that runs counter to the felicity of various self referential utterances such as (11c). Moreover, as Kripke (1975) showed, Liar paradox cases can arise in certain contexts from sentences that are normally perfectly felicitous.

(11) a. This claim is false.
   b. What I am saying now is false.
   c. This is the last announcement about flight 345.

Very briefly, Barwise and Etchemendy’s diagnosis is that the apparent paradox is similar to ones involving other implicit parameters (time zones, spatial orientation,...), where “paradoxes” loom if perspectives are ignored:

(12) a. A (in Tashkent): It’s 9pm, B (in Baghdad): No, it’s 7pm; Does not license: It’s 7pm and it’s not 7pm.
   b. (A and B facing each other) A: The cupboard is to our right. B: No it’s to our left. Does not license: The cupboard is to our right and to our left.

Similarly, for the Liar, according to Barwise and Etchemendy: the phenomenon dissolves as a paradox once one adopts the Austinian conception of propositions, which recognizes the situational relativity of propositions. In their formalization, liar utterances like (11a) express propositions which satisfy the equation in (13):

(13) \( f_s = \text{prop}(s, \langle \langle \text{True}, f_s \rangle \rangle) \)

The existence of such circular propositions is ensured in Barwise and Etchemendy’s account given their use of the non-well-founded set theory developed by Aczel (1988), though the Austinian conception does not depend in any way on using such set theory. In Barwise and Etchemendy’s model theory situations are modelled as sets of situation types. A situation \( s \) is of type \( \sigma \) iff \( \sigma \in s \) and, moreover, for any actual situation \( s \) and proposition \( p \): (a) \( \langle \langle \text{True}, p \rangle \rangle \in s \) only if \( p \) is true, (b) \( \langle \langle \text{True}, p \rangle \rangle \in s \) only if \( p \) is false. Given this, a proposition such as (13) ends up being false – if \( f_s \) is true, then \( \langle \langle \text{True}, f_s \rangle \rangle \in s \). This entails that \( f_s \) is false. Once we accept the falsity of this proposition, there exist situations in which the situation type \( \langle \langle \text{True}, f_s \rangle \rangle \) is factual. The minimal such situation is \( s_1 = s \cup \langle \langle \text{True}, f_s \rangle \rangle \) and, hence, \( \text{prop}(s_1, \langle \langle \text{True}, f_s \rangle \rangle) \) is true. This account thereby captures an intuition that liar claims are double edged.

This solution crucially depends on a view of propositions as concerning situations and not worlds. As Barwise and Etchemendy explain in detail, in an alternative solution (which they label Russellian), where propositions are not relativized by a situational parameter, there is no way to accommodate the existence of propositions that are not true but whose falsehood is internal to the world.

Let us take stock: the Austinian conception builds up from an ontology with situations and situation types and adds to these propositions \( \text{prop}(s, \sigma) \) whose truth condition involves that \( s \) is of type \( \sigma \). Some empirical pluses: it enables accounts of NP situational relativity, update/clarificational potential of utterances, and the Liar (though this latter also requires non-well-founded set theory). It also enables an account of situational anaphora (see e.g. the examples in (6)). As with any theory that employs non-concrete
entities, a variety of issues arise – for critical discussion in context of the Liar, see Moss (1989) and McGee (1991). The most obvious ones center on the vagueness of situations. For instance, how can Austinian propositions be shared? How can we be clear about the identity of propositions? Aren’t we populating the world with a flood of propositions?

Taking these in reverse order – technically, it is indeed true that the world is potentially populated with lots of propositions. However, like other contextual parameters, the situations which figure as possible described/belief/utterance situations are in most possible applications ones that are in some sense accessible to the relevant agent. As for sharing Austinian propositions, this is a trickier issue. The undoubted vagueness of situations means that there is a technical issue here, if one insists that successful communication presupposes agents resolving all aspects of content identically. However, this criterion is equally problematic for property terms, a difficulty that does not stop semanticists from postulating such entities as denotations of various expression types. The reason for this is that typically agents will agree on the central, defining characteristics of properties. By the same token, it is also the case that given two very similar situations $s$, $s'$ by and large propositions of the form $\text{prop}(s, \sigma)$, $\text{prop}(s', \sigma)$ will have identical truth values. These highly sketchy comments are only intended as directions by means of which these issues can be addressed, theoretically – but of course a proper debate requires a detailed theory of situations. For such a theory see inter alia Barwise (1989a) and other papers in Barwise (1989c), and various papers in Cooper, Mukai & Perry (1990), Barwise et al. (1991) and Aczel et al. (1993). Worlds have a role to play in such a theory, typically viewed as maximal situations that resolve all issues. Whether one needs to admit possible situations is a more controversial issue. A treatment of modality, for instance, does not require this, as pointed out by e.g. Schulz (1993) and by Cooper & Poesio (1994) – the non-actuality can be encoded entirely in the situation types. Still, it is certainly possible to develop a version of situation theory that has possible situations, to the extent there are good linguistic or philosophical reasons for this, as argued by Vogel & Ginzburg (1999).

One might also wish to link discussion to more empirical investigations. Indeed, for whatever it is worth, arguably, this type of representation for utterances jives well with psychological work on memory (see e.g. Fletcher 1994 for a review), which argues that the two robust memory traces from an utterance are (a) the situational model and (b) the propositional text base. The former is a representation which integrates various modalities (e.g. visual and linguistic stimuli), whereas the latter differs from the surface form of an utterance for instance in that referents have been resolved. It is also worth pointing out that it would be quite consistent to develop an ontology which involved a mixed picture of propositions: as recognized already by Barwise & Perry (1985), one might wish to avoid positing a described situation with general sentences, such as Two and two are four or Fish swim. See Glasbey (1998) and Kim (1998) for proposals that some propositions are Austinian, whereas others (e.g. mathematical and individual-level statements) are Russelian i.e., do not make reference to a particular situation.

But wait, I have talked about situations and propositions and their use in reference, assertion or even metacommunicative interaction – what of the attitudes? While writing Situations and Attitudes Barwise and Perry’s original hope was that replacing worlds with situations would yield an account of one of Montogovian semantics’ bugbears, namely attitude reports, on which see also article 60 (Swanson) Propositional attitudes. However, this hope did not survive even past the penultimate chapter of the book. A solid result of philosophical work of the 1990s (e.g. Richard 1990 and Crimmins 1993) is that no
viable theory of propositions can on its own deliver a viable theory of the attitudes. This is because attitudes have structure not perfectly mirrored by their external content, a realization of which prompted Barwise and Perry to abandon their initial essentially proposition-based account. The most striking illustration of this is in puzzles like Kripke’s Pierre (Kripke 1979), who is unaware that the wonderful city of Londres about which he learnt as a child is the same place as the squalid London, where he currently resides. While his beliefs are perfectly rational, we can say of him that he believes that London is pretty and also does not believe that London is pretty.

One possible conclusion from this (see e.g. Crimmins 1993), a way out of paradox, is that attitude reports involve implicit reference to attitudinal states: relative to information acquired in France, Pierre believes London is pretty; relative to information acquired on the ground in London, he believes the opposite. Here is yet another important role for situations in linguistic description. One way to integrate this in an account of complementation was offered in Cooper & Ginzburg (1996) and Ginzburg (1995) for declarative and interrogative attitude reports, respectively. This constitutes a compositional reformulation of the philosophical accounts cited above.

The main idea is to assume that attitude predicates involve at least three arguments: an agent, an attitudinal state and a semantic entity. For instance with respect to belief, this relates an agent’s belief in a proposition to facts about the agent’s mental situation. This amounts to linking a positive belief attribution of proposition \( p \) relative to the mental situation \( ms \) with the existence of an internal belief state whose content is \( p \). An example of such a mental situation is given in section 5.

4. A wider ontological net

The ontology of ST was originally designed on the basis of a rather restricted data set. One of the challenges of more recent work has been to extend this ontology in order to account for two related key domains for semantics: root clauses in conversational use and verb complementation. A large body of semantic work that has emerged since the late 1970s demonstrating that interrogative clauses possess denotations (questions) distinct in semantic type from declarative ones; imperative and subjunctive clauses possess denotations (dubbed outcomes by Ginzburg & Sag 2000) distinct in semantic type from declarative and interrogative ones; facts are distinct from true propositions; for detailed empirical evidence for these distinctions, see Vendler (1972), Asher (1993), Peterson (1997) and Ginzburg & Sag (2000); see also article 66 (Krifka) Questions and article 67 (Han) Imperatives.

The main challenge in developing an ontology which distinguishes the diverse menagerie of abstract entities including propositions, questions, outcomes and facts is characterizing the structure of these entities, indeed figuring out how the distinct entities relate to each other. As pointed out by Ginzburg & Sag (2000), quantified NPs and certain adverbs are possible in declarative, interrogative and imperative semantic environments. Hence, the ontology must provide a semantic unit which constitutes the input/output of such adverbial modifiers and of NP quantification. To make this concrete – the assumption that the denotation of imperatives is of a type distinct from \( t \) (however cashed out) is difficult to square with (a simplistic implementation) of the received wisdom that NPs such as ‘everyone’ are of type \( << e, t >, t > \). If the latter were the case, composing ‘everyone’ with ‘vacate the building’ in (14c) would yield a denotation of type \( t \):
(14) a. Everyone vacated the building.
b. Did everyone vacate the building?
c. Everyone vacate the building!
d. Kim always wins.
e. Does Kim always win?
f. Always wear white!

As we will see subsequently, a good candidate for this role are situation types. These, as we observed in section 3., are not conflated with propositions in the situation theoretic universe.

Ginzburg & Sag (2000) set out to construct an ontology that appropriately distinguishes these entities and yet retains the features of the ST ontology discussed earlier. The ontology, dubbed a *Situational Universe with Abstract Entities* (SU+AE), was developed in line with the strategy of Barwise and Perry’s (1). This was implemented on two levels, one within a universe of type-based feature structures (Carpenter 1992). This universe underpinned grammatical analysis, using Head Driven Phrase Structure Grammar (HPSG). A denotational semantics was also developed in the Axiom of Foundation with Atoms (AFA)–based framework of Seligman & Moss (1997). In what follows, I restrict attention to the latter.

A semantic universe is identified with a relational structure $S$ of the form $[A, S_1, \ldots, S_m; R_1, \ldots, R_m]$. Here $A$ – sometimes notated also as $|S|$ – is the universe of the structure. From the class of relations we single out the $S_1, \ldots, S_m$ which are called the *structural relations*, as they are to capture the structure of certain elements in the domain. Each $S_i$ can be thought of as providing a condition that defines a single structured object in terms of a list of $n$ objects $x_1, \ldots, x_n$.

Situations and situation types serve as the ‘basic building blocks’ from which the requisite abstract entities of the ontology are constructed:

- Propositions are structurally determined by a situation and a situation type. (See discussion in section 3.)
- Intuitively, each outcome is a specification of a situation which is futurate relative to some other given situation. Given this, outcomes are structurally determined by a situation and a situation type abstract whose temporal argument is abstracted away, thereby allowing specification of fulfilledness conditions.
- Possibilities, a subclass of which constitutes the universe’s facts, are structurally determined by a proposition. This reflects the tight link between propositions and possibilities. As Ginzburg & Sag (2000) explain, there is no obvious priority between possibilities and propositions: one could develop an ontology where propositions are built out of possibilities.

An additional assumption made is that the semantic universe is closed under simultaneous abstraction. Simultaneous abstraction, originally defined by Aczel & Lunnon (1991), is a semantic operation akin to $\lambda$-abstraction with one significant extension: abstraction is over sets of elements, including the empty set. Moreover, abstraction (including over the empty set) is potent – the body out of which abstraction occurs is distinct from the abstract. The assumption about closure under simultaneous abstraction is akin to the common type theoretic assumption about closure under functional type formation.
Putting this together, and simplifying somewhat, an SU+AE is an extensional relational structure of the following kind:

\[(A, \text{Possibility}, \text{Proposition}, \text{Outcome}, \text{Fact}, \text{True}, \text{Fulfill}, \rightarrow_{\text{prop}})\]

Let me gloss the key notions involved here: A is a lambda-situation structure (\(\lambda\)-SITSTR). That is, a situation structure closed under simultaneous abstraction. A situation structure (SITSTR) is a universe which supports a basic set theoretic structure. It contains among its entities a class of spatio-temporally located situations and a class of situation types. Proposition, Possibility, and Outcome are sorts whose elements represent, respectively, the propositions, possibilities, and outcomes of the universe. Those possibilities that are factual, as determined by the predicate Fact, will constitute the facts of the universe. Analogously, there will be properties True and Fulfill, which capture the notions of truth and fulfilledness for propositions and outcomes; \(\rightarrow_{\text{prop}}\) is a notion of entailment defined for propositions.

What about questions? Their existence follows without further stipulation, once one adopts Ginzburg and Sag’s assumption that they are propositional abstracts: the universe contains propositions, it is closed under simultaneous abstraction, hence it contains questions. Assuming the identification of questions with propositional abstracts is descriptively adequate, this is an instance of an explanatorily satisfying piece of ontological engineering. On the other hand, one would hope that the existing explication of facts within SU+AEs could be improved on, for instance by uncovering additional internal structure such entities possess.

To conclude this section, I point to two examples (from Ginzburg & Sag 2000) of linguistic phenomena whose explication relies strongly on properties of SU+AEs. The first concerns the distribution of in situ wh-phrases. In declarative clause-types, which in the absence of a wh-phrase denote propositions, the occurrence of such phrases leads to an ambiguity between two readings, as exemplified in (16a–c): a ‘canonical’ use which expresses a direct query and a use as a reprise query to request clarification of a preceding utterance. In all other clause types, ones which denote outcomes, (16d), questions, (16e), or facts, (16f) – Ginzburg & Sag (2000) argue that exclamative clauses denote facts – the ambiguity does not arise, only a reprise reading is available; a priori one might expect (16d), for instance, to have a reading as a direct question paraphrasable as who should I give the book to? if one could simply abstract over the wh-parameter within an ‘open outcome’:

(16) a. The bagels, you gave to who? (can be used to make a non-reprise query)
   b. You gave the bagels to who? (can be used to make a non-reprise query)
   c. Who talked to who? (can be used to make a non-reprise query)
   d. Give who the book? (can be used only to make a reprise query)
   e. Do I like who? (can be used only to make a reprise query)
   f. What a winner who is? (can be used only to make a reprise query)

(Ginzburg & Sag 2000, example (72), 282)

Given the assumption that questions are exclusively propositional abstracts, it follows without further stipulation what is the clause type out of which non-reprise in situ interrogatives are constructed, namely ones with a propositional denotation. Reprise clauses,
in contrast, can be built from antecedents of any clause type – the antecedent provides an illocutionary proposition whose main relation is the illocutionary force associated with the given clause type.

The second phenomenon concerns the interaction of negation and interrogation: the fact that propositions are constructed from situations and situation types has a consequence that, in contrast to approaches where questions are characterized in terms of exhaustive answerhood conditions (see Groenendijk & Stokhof 1997), positive and negative polar interrogatives are assigned distinct denotations. For instance, (17a) and (17b), due to Hoepelmann (1983), would be assigned the 0-ary abstracts in (17c) and (17d) respectively:

(17) a. Is 2 an even number?
   b. Isn’t 2 an even number?
   c. $\lambda\{ |prop(s, \langle\langle EvenNumber, 2\rangle\rangle)|$
   d. $\lambda\{ |prop(s, \langle\langle EvenNumber, 2\rangle\rangle)|$

This means that the ontology can explicate the distinct presuppositional backgrounds associated with positive and negative polar interrogatives. For instance, Hoepelmann, in arguing for this distinction, suggests that the contexts appropriate for a question like (17a) is likely to be asked by a person recently introduced to the odd/even distinction, whereas (17b) is appropriate in a context where, say, the opaque remarks of a mathematician sow doubt on the previously well-established belief that *two is even*. The latter can be tied to the factuality conditions of negative situation types. As I mentioned in section 2., one axiom associated with negative situation types is the following: if a situation $s$ supports the dual of $\sigma$, then $s$ also supports information which defeasibly entails that $\sigma$ is the case. Hence, wondering about $\lambda\{ |prop(s, \bar{\sigma})|$ involves wondering about whether $s$ has the characteristics that typically involve $\sigma$ being the case, but which – nonetheless, in this case – fail to bring about $\sigma$. These contextual differences give rise in some languages including French and Georgian to distinct words to affirm a positive polar question (*oui, xo*) and a negative polar question (*si, diax*). Nonetheless, given the definitions of answerhood available in this system, positive and negative interrogatives specify identical answerhood relations. Hence, the identity of truth conditions of sentences like (18) can be captured:

(18) a. Kim knows whether Bo left.
   b. Kim knows whether Bo did not leave.

5. A type theoretic ontology for interaction

In previous sections we have observed the gradual evolution of the situation theoretic ontology: from a theory of situations, through a theory of situations and Austinian propositions, to an SU+AE, which includes a variety of abstract entities and is closed under abstraction. This ontology has, as we saw, a wide range of linguistic applications, including perception and attitude complements, definite reference, the Liar, and a rudimentary theory of interaction (for the latter, see Ginzburg 1996).

However, as a new millennium dawned the theory was hamstrung by a number of foundational problems. The logical underpinnings for the theory in terms of non-well-founded set theory, originating in Barwise & Etchemendy (1987), extensively discussed
Theories of sentence semantics in Barwise (1989c), and comprehensively developed in Seligman & Moss (1997), were rather complex. Concretely, simultaneous $\lambda$-abstraction with restrictions is a tool with a variety of uses, including quantification, questions, and the specification of attitudinal states and meanings (for the latter see article 36 (Ginzburg) Situation Semantics). Its complex set theoretic characterization made it difficult to use. Concomitantly, the theory in this form required an auxiliary coding into a distinct formalism (e.g. typed feature structures) for grammatical and computational applications. Neither of these versions of the theory provides an adequate notion of role-dependency that has become standard in recent treatments of anaphora and quantification on which much semantic work has been invested in frameworks such as Discourse Representation Theory and Dynamic Semantics; see Gawron & Peters (1990) for a detailed theory of anaphora and quantification in situation semantics, though one that is not dynamic.

Motivated to a large extent by such concerns, the situation theoretic outlook has been redeveloped using tools from Type Theory with Records (TTR), a framework initiated by Robin Cooper. Ever since Sundholm and Ranta’s pioneering work (Sundholm 1986; Ranta 1994), there has been interest in using constructive type theory (often referred to as Martin-Löf Type Theory) as a framework for semantics (see e.g. Fernando 2001 and Krahmer & Piwek 1999). TTR is a model theoretic outgrowth of constructive type theory. Its provision of entities at both levels of tokens and types allows one to combine aspects of the typed feature structures world and the set theoretic world, enabling its use as a computational grammatical formalism. As we will see, TTR provides the semanticist with a formalism that satisfies the desiderata I mentioned in section 1. Cooper (2006a) has shown that the lion’s share of situation theoretic results can be recast in TTR – the main exception being those results that depend explicitly on the existence of a non-well-founded universe, for instance Barwise and Etchemendy’s account of the Liar; the type theoretic universe is well founded. But one could, according to Cooper (p.c.), recreate non-well-foundedness at the level where witnessing of types occurs. In addition, TTR allows for DRT-oriented or Montogovian treatment of anaphora and quantification. For a computational implementation of TTR, see Cooper (2008); for a closely related framework, the Grammatical Framework see Ranta (2004).

The move to TTR is, however, not primarily a means of capturing and perhaps mildly refining past results, but crucially underpins a theory of conversational interaction on both illocutionary and metacommunicative levels. A side effect of this is, via a theory of generation, an account of attitude reports.

In the remaining space, I will briefly expot the basics of TTR, show its ability to underpin SU+AEs and briefly sketch how this can be used to define basic information states in dialogue. One linguistic application will be provided, one that ties up situations, information states, and meaning: a specification of the meaning of a discourse-bound pronoun.

5.1. Generalizing the situation/situation type relation

The most fundamental notion of TTR is the typing judgement $a : T$ classifying an object $a$ as being of type $T$. This can be seen as a generalization of the situation semantics judgement $s : \sigma$, generalization in that not only situations can figure as subjects of typing judgements. Note that the theory provides the objects and the types, but this form of judgement, as well as other forms are metatheoretical. Examples are given in
(19). (19a–c) are typing judgements that presuppose the existence of types SIT(uation), IND(ividual), REL(ation), whose identity can be amplified. (19d) is the direct analogue of the situation semantics statement $s : \langle\langle\text{RUN}; b, t\rangle\rangle$; here run(b, t) is a proof type, about which more below; ‘proof’ can be equally glossed as ‘observation’ or even ‘situation’, as explained by Ranta (1994); the source of the ‘proof-based’ terminology is constructive type theory’s original use as a foundation for mathematics.

A useful innovation TTR introduces relative to earlier version of type theory are records and record types. A record is an ordered tuple of the form (20), where crucially each successive field can depend on the values of the preceding fields:

$$\begin{align*}
\text{(20)} & \left[ l_1 = k_1, \\
& l_{i+1} = k_{i+1}(l_i) \ldots \\
& l_{i+j} = k_{i+j}(l_1, \ldots, l_{i+j-1}) \right]
\end{align*}$$

Together with records come record types. Technically, a record type is simply an ordered tuple of the form (21), where again each successive type can depend on its predecessor types within the record:

$$\begin{align*}
\text{(21)} & \left[ l_1 : T_1, \\
& l_{i+1} : T_{i+1}(l_i) \ldots \\
& T_{i+j} : T_{i+j}(l_1, \ldots, l_{i+j-1}) \right]
\end{align*}$$

Record types allow us to place constraints on records: the basic typing mechanism assumed is that a record $r$ is of type $RT$ if all the typing constraints imposed by $RT$ are satisfied by $r$. More precisely,

$$\begin{align*}
\text{(22)} & \begin{align*}
[l_1 & = a_1] & [l_1 : T_1] \\
[l_2 & = a_2] & [l_2 : T_2(l_1)] \\
& \ldots & \ldots \\
[l_n & = a_n] & [l_n : T_n(l_1, l_2, \ldots, l_{n-1})]
\end{align*}
\end{align*}$$

iff $a_1 : T_1, a_2 : T_2(a_1), \ldots, a_n : T_n(a_1, a_2, \ldots, a_{n-1})$

5.2. Recreating SU+AEs in TTR

Ginzburg (2005b) shows how to recreate SU+AEs within the type theoretic universe constructed in Cooper (2006a). As with SU+AEs, one can recognize here the sitsemian
strategy Barwise and Perry allude to in (1). The universe is connected to the real world via a model which assigns witnesses to the basic types and sets of witnesses to the proof types depending on their r-ity. From these beginnings, arise structured objects via type construction which allows for a recursive building up of the type theoretic universe. Ranta (1994) and Cooper (2006a) list a dozen such constructors. Here, apart from the afore mentioned record typing construction, I will list only a small number that are necessary for the tasks to be performed here:

\[(23)\]

- a. Function types: if \(T_1\) and \(T_2\) are types, then so is \((T_1 \rightarrow T_2)\), the type of functions from elements of type \(T_1\) to elements of type \(T_2\).
- b. The type of lists: if \(T\) is a type, then \([T]\), the type of lists each of whose members is of type \(T\), is also a type. \([a_1, ..., a_n] : [T]\) iff for all \(i\), \(a_i : T\).
- c. The unique type: if \(T\) is a type and \(x : T\), then \(Tx\) is a type. \(a : T_x\) iff \(a = x\).

5.2.1. Abstraction

Function types allow one to model abstraction. As Cooper points out, although abstraction in TTR works in a deceptively familiar ‘type theoretic’ way, the existence of record typing yields a rich notion of abstraction. It is simultaneous and restricted, i.e. it allows for multiple entities to be abstracted over simultaneously while encoding restrictions, and allows for vacuous abstraction. As an illustration of abstraction in TTR, consider a mental state that Pierre can be assumed to possess (see section 3. and Cooper 2006a, where this example is discussed in detail). (24a), a function mapping records into record types, represents the internal type, whereas (24b) represents a possible external setting for this type. The internal type is a perfectly consistent type, external incoherence is captured by the fact that applying the internal type to the setting yields a contradiction.

\[(24)\]

- (a) \(r\): \([x : \text{Ind}, c1 : \text{Named}(x,'Londres'), y : \text{Ind}, c2 : \text{Named}(y,'London')]\)
- (b) \(x = \text{london}\)
  \(c1 = \text{Name}(\text{london}, 'Londres')\)
  \(y = \text{london}\)
  \(c2 = \text{Name}(\text{london}, 'Londres')\)

See also article 36 Situation Semantics for the use of this sort of abstraction in the specification of the meaning/content relationship.

5.2.2. Situations

Cooper (2006a) proposes that situations (in the sense of Situation Theory) be modelled as records. Situation types are then directly accommodated as record types. The type of a situation with a woman riding a bicycle would then be the one in (25a). A record of this type (a witness for this type) would be as in (25b), where the required corresponding typing judgements are given in (25c):
In particular, given an identification of utterances with speech events, this enables us to have simultaneous access to utterances and utterance types (or signs). These are important ingredients for a theory of metacommunicative interaction, as discussed in article 36 Situation Semantics.

In a series of recent papers (e.g. Fernando 2007a, 2007b), Tim Fernando has provided a type theoretic account of the internal make up of situations. Events and situations are represented by strings of temporally ordered observations, on the basis of which the events and situations are recognized. This allows a number of important temporal constructions to be derived, including Allen’s basic interval relations Allen (1983) and Kamp’s event structures Kamp (1979). Observations are generalized to temporal propositions, leading to event-types that classify event-instances.

5.2.3. Propositions

There are two obvious ways to develop an account of propositions in TTR, implicitly Austinian or explicitly so. Cooper (2006a) develops the former in which a proposition \( p \) is taken to be a record type. A witness for this type is a situation as e.g. (25b). On this strategy, a witness is not directly included in the semantic representation. Ginzburg (2005b) develops an explicitly Austinian approach. The type of propositions is the record type (26a). The correspondence with the situation semantics conception is quite direct. We can define truth conditions as in (26b).

\[
\text{(26) a. } \text{Prop} =_{df} \begin{bmatrix}
\text{sit} : \text{Record} \\
\text{sit-type} : \text{RecType}
\end{bmatrix}
\]

\[
\text{b. } \text{A proposition } p = \begin{bmatrix}
\text{sit} = s_0 \\
\text{sit-type} = ST_0
\end{bmatrix} \text{ is true iff } s_0 : ST_0
\]

TTR actually provides very fine-grained entities and so does not run into the problems that beset traditional semantic approaches with respect to logical omniscience and various other puzzles. In fact, as Cooper (2006a) discusses, this can be too much of a good thing, given that record types distinct only by their labelling are distinguished. Cooper
goes on to offer a criterion of type individuation of record types using $\Sigma$-types, where the corresponding 'labels' function as bound variables.

Ginzburg (2005a) shows how to formulate a theory of questions as propositional abstracts in TTR, while using the standard TTR notion of abstraction. In this way, a possible criticism of the approach of Ginzburg & Sag (2000), that they use an *ad hoc* and complex notion of abstraction, can be circumvented. Similarly, Ginzburg (2005b) shows how to explicate outcomes within TTR.

5.3. Ontology in interaction

The most active area in the application of TTR to the description of NL is in the area of dialogue. Larsson (2002) and Cooper (2006b) showed how to decompose interaction protocols, such as those specified situation theoretically in Ginzburg (1996), by using TTR to describe update rules on the information states of dialogue participants. This was extended by Ginzburg (2010) to cover a variety of illocutionary moves, metacommunicative interaction (see article 36 (Ginzburg) Situation Semantics for some discussion) and conversational genres. Fernández (2006) uses TTR to develop a wide coverage of the range of non-sentential utterances that occur in conversation.

In these works, information states are assumed to consist of a public and unpublicized part. For current purposes we restrict attention to the public part, also known as each participant’s dialogue gameboard (DGB). Each DGB is a record of the type given in (27) – the *spkr, addr* fields allow one to track turn ownership, *Facts* represents conversationally shared assumptions, *Pending* and *Moves* represent respectively moves that are in the process of/have been grounded, *QUD* tracks the questions currently under discussion:

\[
\begin{align*}
\text{(27)} & \quad \begin{array}{l}
\text{spkr} : \text{Ind} \\
\text{addr} : \text{Ind} \\
\text{c-utt} : \text{addressing}(\text{spkr}, \text{addr}) \\
\text{Facts} : \text{Set(Prop)} \\
\text{Pending} : \text{list(LocProp)} \\
\text{Moves} : \text{list(LocProp)} \\
\text{QUD} : \text{poset(Question)}
\end{array}
\end{align*}
\]

We call a mapping that indicates how one DGB can be modified by conversationally related action a *conversational rule*, and the types specifying its domain and its range respectively the *preconditions* and the *effects*. Here I exemplify the use of TTR to give a partial characterization of the meaning of pronouns in dialogue, a task that links assertion acceptance, situations, and meaning.

The main challenge for a theory of meaning for pronouns is of course how to characterize their antecedency conditions; here I restrict attention to intersentential cases, see Ginzburg (2010) for an extension of this account to intra-sentential cases. Dialogue takes us away quite quickly from certain received ideas on this score: antecedents can arise from queries (28a), from partially understood or even disfluent utterances ((28b,c) respectively). Moreover, as (28d) illustrates, where ‘he’ cannot refer to ‘Jake’, the shelf life of an antecedent is potentially quite short. Although the data is subtle, a plausible assumption is that for non-referential NPs anaphora are not generally possible from
within a query (polar or wh) (Groenendijk 1998), or from an assertion that has been rejected (e.g. (28e,f)).

(28) a. A: Did John phone? B: He’s out of contact in Daghestan.
    b. A: Did John phone? B: Is he someone with a booming bass voice?
    c. Peter was, well he was fired.
    d. A: Jake hit Bill. / B: No, he patted him on the back. / A: Ah. Is Bill going to the party tomorrow? /B: No. / A(5): Is he/Jake?
    e. A: Do you own an apartment? B: Yes. A: Where is it located?
    f. A: Do you own an apartment? B: No. A: #Where might you buy it?

This means, naturally enough, that witnesses to non-referential NPs can only emerge in a context where the corresponding assertion has been accepted. A natural move to make in light of this is to postulate a witnessing process as a side effect of assertion acceptance, a consequence of which will be the emergence of referents for non-referential NPs. For uniformity’s sake, we can assume that these witnesses get incorporated into the contextual parameters (\(c\text{-params}\)) of that utterance, which in any case includes (witnesses for) the referential NPs. This means that \(c\text{-params}\) serves uniformly as the locus for witnesses of ‘discourse anaphora’. The rule of incorporating non-referential witnesses in \(c\text{-params}\) is actually simply a minor add on to the rule that underwrites assertion acceptance (see Ginzburg 2010, chapter 4) – the rule underpinning the utterance of acceptances – it can be viewed as providing for a witness for situation/event anaphora since this is what gets directly introduced into \(c\text{-params}\). In cases where the witness is a record (essentially when the proposition is positive), NP witnesses will emerge. In (29) the preconditions involve the fact that the speaker’s latest move is an assertion of a proposition whose type is T1. The effects change the speaker/addressee roles (since the asserted to becomes the accepter) and adds a record \(w\), including a witness for T1, to the contextual parameters.

(29) Accept move:

\[
\text{preconds : } \left[ \begin{array}{l}
\text{spkr : In d}
\text{addr : In d}
\text{p = } \left[ \begin{array}{l}
\text{sit = sit 1}
\text{sit-type = T 1}
\end{array} \right] : \text{Prop}
\end{array} \right]
\text{LatestMove}^{\text{content}} = \text{Assert (spkr, addr, p) : IlocProp}
\text{effects : } \left[ \begin{array}{l}
\text{spkr = preconds.addr : Ind}
\text{addr = preconds.spkr : Ind}
\text{w = preconds.LatestMove.c-params} \cup \left[ \begin{array}{l}
\text{sit = sit 1}
\end{array} \right] : \text{Rec}
\text{Moves = m1 \oplus preconds.Moves : list(Lo cProp)}
\text{m1}^{\text{content}} = \text{Accept(spkr, addr, p) : IlocProp}
\text{m0.c-param = w : Rec}
\end{array} \right]
\]

We can now state the meaning of a singular pronoun somewhat schematically as follows: it is a word whose contextual parameters include an antecedent, which is to be sought from among the constituents of an active move; the pronoun is identical in reference to
this antecedent and agrees with it. Space precludes a careful characterization of what it means to be active, but given the data we saw above it is a composite property determined by QUD – essentially being specific to an element of QUD – and Pending. See article 36 (Ginzburg) Situation Semantics for the justification for including reference to an utterance’s constituents in grammatical representation. In (30), I provide a lexical entry in the style of HPSG that captures this specification: here \( m \) represents the active move and \( a \) the antecedent; the final condition on \( c\text{-params} \) requires that within \( m \)'s contextual parameters is one whose index is identical to that of \( a \)'s content:

\[
(30) \begin{align*}
\text{PHON:}\{\text{she}\} \\
\quad \begin{cases}
\text{m: LocProp} \\
\text{a: Sign} \\
\text{c-params:} \\
\quad \text{c1: member(a, m.constits)} \\
\quad \text{c2: ActiveMove(m)} \\
\quad \text{m.sit.c-params: [a.e-params.index = a.cont.index : Ind]} \\
\end{cases}
\end{align*}
\]

\[
\begin{align*}
\text{head: N} \\
\text{ana : +} \\
\text{cat = } \begin{cases}
\text{agr = c-params.m.cat.agr:} \\
\quad \text{num = sg : Number} \\
\quad \text{gen = fem : Gender} \\
\quad \text{pers = third : Person} \\
\end{cases} \\
\text{cont: [index = a.cont.index : Ind]} \\
\end{align*}
\]

6. Conclusions

Situation semantics initiated an ontology–oriented approach to semantics: the aim being to develop means of representing the external and internal reality of agents in a cognitively tractable way. The initial emphasis was on situations, based in part on evidence from the naked infinitival construction. Situations, parts of the world, have proved to be of significant importance to a variety of phenomena ranging from the domains associated with NP use to negation and, one way or the other, play a significant role in the very act of asserting. The theory of situations subsequently lead to a theory of propositions (Austinian propositions), structured objects constructed from situations and situation types: Austinian propositions are significantly more fine-grained than possible worlds propositions, but coarse grained enough to pass translation and paraphrase criteria. They also have a potential construal in terms of differingcoarsely grained memory traces.

The technique of individuating abstract entities as structured objects enables the theory to scale up: by integrating questions, outcomes and facts into the ontology, Situation Theory was able to underpin a rudimentary theory of illocutionary interaction (entities such as questions, propositions and outcomes serve as the descriptive content of queries, assertions and requests) and a theory of complementation for attitudinal predicates.
A recent development has been to recast the theory in type theoretic terms, concretely using the formalism of Type Theory with Records. Type Theory with Records has many similar characteristics to situation theory – an ontology – oriented approach, computational tractability, structured objects. This enables most of the results situation theory achieved to be maintained. On the other hand, Type Theory with Records brings with it a more transparent formalism and the existence of dependent types allows both dynamic semantic and unification grammar techniques to be utilized. Indeed, all these can be combined to construct a theory of illocutionary and metacommunicative interaction, one of the key areas of development for semantics in the early 21st century.

7. References


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