Simplifying the Mapping from Referring Expression to Referent in a Conceptual Semantics of Reference

Jerry Ball (Jerry.Ball@mesa.afmc.af.mil)
Air Force Research Laboratory

Abstract

In Jackendoff's Conceptual Semantics, reference to objects, situations, places, directions, times, manners, and measures is supported, but reference is limited to instances of these conceptual categories. This paper proposes an extension of Jackendoff's referential types along an orthogonal dimension of reference which is cognitively motivated in suggesting the possibility of referring to types, prototypes and exemplars in addition to instances, as well as classes and collections of all referential types and vacuous instances and collections. The paper also introduces a bi-partite distinction between a situation model and the mental universe which helps to explain apparent non-referential uses of referring expressions. The primary motivation for expanding the ontology of referential types and distinguishing the situation model from the mental universe is to simplify the mapping from linguistic expressions to corresponding representations of referential meaning. The viability of this approach hinges on adoption of the mentalist semantics of Jackendoff. There is no direct reference to actual objects in the external world.

Keywords: referring expression; Conceptual Semantics

Introduction

In Jackendoff's *Conceptual Semantics* (Jackendoff, 1983, 1990, 2002, 2007), reference to places, directions, times, manners, and measures in addition to situations and objects is supported, but reference is limited to tokens or instances of these conceptual categories, adhering to the basic notion that reference is to individuals. This paper proposes an extension of Jackendoff's referential types along an orthogonal dimension of reference which is cognitively motivated in suggesting the possibility of referring to types, prototypes and exemplars in addition to instances. Reference to classes and collections of referential types and vacuous instances and collections is also considered.

The primary motivation for expanding the ontology of referential types is to simplify the mapping from referring expressions to corresponding representations of referential meaning. Hobbs (2003) pursues a similar strategy in arguing for logical representations that are as close to English as possible. Jackendoff's (1983, p. 13-14) *grammatical constraint* makes a related claim:

> …one should prefer a semantic theory that explains otherwise arbitrary generalizations about the syntax and the lexicon…a theory's deviations from efficient encoding must be vigorously justified, for *what appears to be an irregular relationship between syntax and semantics may turn out merely to be a bad theory of one or the other* (italics added)

Taking the grammatical constraint seriously, we assume that if a linguistic expression has the grammatical form of a referring expression, then it is a referring expression. For example, a nominal like "a man" which contains the referential marker "a", indicates that the expression can be used to refer. Unless there is a very strong reason to assume that any use of this referring expression is non-referential, it is assumed to refer. Further, the referential marker "a" indicates reference to a single referent as does the head noun "man" (i.e. both are grammatically singular). This expression cannot be used to refer to multiple individuals.

Where other approaches argue for the non-referential use of referring expressions or for a complicated mapping from referring expression to possible referents (see discussion below), it is argued instead that referring expressions may refer to something other than an individual, and that the notion of reference is complicated by a secondary relationship between the referents in a situation model and objects in the mental universe. By expanding the ontology of referential types to include types, prototypes and exemplars, and classes and collections of these, it is possible to retain a simplified mapping from referring expression to referent—one which is consistent with the grammatical features of the referring expression. By introducing a bi-partite relationship between a situation model and the mental universe it is possible to explain apparent non-referential uses of referring expressions. The viability of this approach hinges on adoption of the mentalist semantics of Jackendoff. Reference is to mental encodings of external experience and these encodings can provide alternative construals of reality. There is no direct reference to actual objects in the external world.

Theoretical Background

Ball (2007) presents a linguistic theory of the grammatical encoding of referential and relational meaning which is implemented in a computational cognitive model of language comprehension (Ball, Heiberg & Silber, 2007; Ball et al., 2010) within the ACT-R cognitive architecture (Anderson, 2007). The basic structure and function of nominals and clauses is bi-polar with a *specifier* functioning as the locus of the *referential pole* and a *head* functioning as the locus of the *relational pole*—where relational pole encompasses objects (noun, proper noun, pronoun) and relations (verb, adjective, preposition, adverb). If the head of the relational pole is a relation, one or more *complements* or *arguments* may be associated with the relation. *Modifiers* may surround the specifier and head and may be

preferentially attracted to one pole or the other. A specifier and head (or reference point, specifier and head) combine to form a *referring expression*. A determiner functioning as an *object specifier* combines with a head to form an *object referring expression* or *nominal* (ORE → Obj-Spec Obj-Head). A possessive nominal (e.g. "John's" in "John's book") or possessive pronoun (e.g. "his" in "his book") functioning as a combined reference point and specifier may also combine with a head to form an object referring expression (ORE → Ref-Pt/Obj-Spec Obj-Head). In this case the object referring expression contains two referring expressions: 1) the reference point, and 2) the referring expression as a whole.

Ball (2010) extends the theory of referential and relational meaning to a consideration of grammatical features like definiteness, number, animacy, gender and case in object referring expressions. These features provide important grammatical cues for determining the referents of object referring expressions.

The referring expressions in a text instantiate and refer to objects, situations, locations, etc. in a s*ituation model* which is a representation of the evolving meaning of the text. The term "situation model" originates in the research of van Dijk & Kintsch (1983). Originally a situation model was viewed as a collection of propositions extracted from a text and elaborated with additional propositions introduced by schemas activated by the text and resulting from inference processes operating over the text. However, situation models have evolved away from being purely propositional (or relational) representations towards encoding referential, spatial, imaginal and even motor aspects of meaning (cf. Zwann and Radvansky 1998). We view the situation model as the cognitive locus of Jackendoff's Conceptual Semantics. Jackendoff has adopted similar extensions in his recent work (Jackendoff, 2002, 2007).

A situation model is a mental scratchpad for maintaining information about the referents of the referring expressions in a text. However, referents can also be implicit in the text, inferred from background knowledge or encoded from the environment. The situation model is constructed in the context of a *mental universe*. The mental universe is the experience of the real world filtered through the perceptual and cognitive apparatus of an individual over the course of a lifetime. Like situation models, the mental universe may be full of counterfactual objects and situations. An individual may have a long history of experience of unicorns, both perceptual (e.g. from movies and picture books) and linguistic, despite the fact that unicorns only exist as figments of imagination in objective reality. The mental universe may also have well established and distinct referents for the morning star and the evening star, despite the fact that these referents map to the same planet in objective reality.

The combination of the mental universe and the situation model provide the basic sources for grounding the meaning of referring expressions. A referring expression may be bound to a referent in the situation model which may or may not be ground in the mental universe. If the referent is ground in the mental universe then the individual has personal experience of the referent. If the referent is not ground in the mental universe, then the individual has only limited information about the referent and it may appear that the referring expression is non-referential. But as Lyons (1977) notes, allowing referring expressions to be non-referential is problematic for co-reference. "Two expressions cannot have the same reference, if one of them is not a referring expression at all" (Ibid, 191). In "John's murderer, whoever he is…", "he" co-refers with "John's murderer". The attributive use of a referring expression like "John's murderer" is a type of reference which instantiates a referent into the situation model that is not grounded in the mental universe, but which supports co-reference.

The ontology of referential types presented in this paper follows from basic principles of *Cognitive Linguistics* (cf. Langacker, 1987; Lakoff, 1987) and *Cognitive Psychology* (Rosch, 1975; Collins and Quillian, 1969). There is extensive empirical evidence supporting the existence of conceptual categories corresponding to types, prototypes and exemplars. This paper takes the small step of suggesting that such conceptual categories can be referred to by linguistic expressions and explores the consequences.

The representation of referents in the situation model parallels the representation of referring expressions. Both are represented in ACT-R as chunks—i.e. frames with collections of slot-value pairs. Chunks are organized into an inheritance hierarchy which supports default inheritance and a distinction between chunk type and chunk instance. The value of a slot may be a chunk, supporting complex representations of structure needed for linguistic and Conceptual Semantic representation. With respect to object referring expressions which are the focus of this paper, a chunk representing an object referring expression is bound to a corresponding referent via a matching value in an index slot. Depending on the object referring expression, situation model and mental universe, the referent may be an instance, type, prototype, exemplar, class or collection.

An Expanded Ontology of Referential Types

First Order Predicate Calculus (FOPC) is typically grounded in a model theoretic semantics with an ontology limited to atomic individuals. The model consists of a domain and a set of individuals in that domain and nothing else. Typically these individuals are assumed to correspond to objects (or individuals) in the real world being modeled. In FOPC, a relation is modeled in terms of the set of individuals (for 1-ary relations or properties) or set of ordered sets of individuals (for n-ary relations, n>1) for which the relation is true. A relation with its arguments bound to individuals in the domain is either true or false of those individuals and it is said that the reference of the proposition is one of the values true or false.

Situation Semantics (Barwise and Perry, 1983) extends FOPC by allowing situations to be individuals. Not only are situations true or false of sets of individuals in the domain

being modeled, but they are themselves individuals in the domain. We may say that situations have "first-class" status in situation semantics, whereas they are a second-order (or derived) notion in standard FOPC.

Situation Semantics is a step in the right direction. Whereas it might make reasonable sense to suggest that a predicate like "dog" denotes the set (or class) of individuals that are dogs (although psychologically humans cannot quantify over such a large set), it makes little sense to suggest that the predicate "run" denotes the set of all individuals who run, or that "kick" denotes the set of ordered sets of kickers and kickees, as is typical in FOPC treatments with a set-theoretic model limited to individuals that are essentially objects of various types (and sets of such individuals). (It is this sleight of hand in FOPC that collapses the distinction between nouns and verbs, treating both as predicates corresponding to sets of individuals.) It is much more reasonable to suggest that "run" denotes the set of all running events and that "kick" denotes the set of all kicking events. And if "run" denotes a set of running events and "kick" a set of kicking events, then allowing "run" to be used in an expression that refers to an instance of a running event, and allowing "kick" to be used in an expression that refers to an instance of a kicking event, follows quite naturally and is cognitively plausible. However, Situation Semantics stops short. What is needed is a referential ontology which supports a mapping from the types of referring expressions which are linguistically attested to the types of referents which are cognitively motivated.

With an ontology of referential types limited to individuals and sets of individuals, it is often assumed that a referring expression like "a car" in an expression like "a car is a vehicle" quantifies over the set of all individuals for which the predicate "car" is true (i.e. the set or class of objects of type "car"). In FOPC, this can be represented as

$$\forall x \, (\text{car}(x) \rightarrow \text{vehicle}(x))$$

However, from a grammatical perspective, "a car" is clearly singular, and from a cognitive perspective, quantifying over all individuals is cognitively implausible. The need to quantify over all individuals in the FOPC representation of the linguistic expression stems from the limited ontology available in FOPC for representing the meaning of indefinite referring expressions. Only the universal and existential quantifiers—which fail to capture the full range of quantification in natural language—are available.

Similarly, one FOPC representation for the expression "every man owns a car" is given by

$$\forall x \, (\exists y \, (\text{man}(x) \text{ and } \text{car}(y) \rightarrow \text{own}(x,y)))$$

However, in English "every man" is grammatically singular, and a mapping to the universal quantifier is problematic. Johnson-Laird (1983) introduced mental models as a way of overcoming the limitations of quantification in FOPC (among other things). He suggests that the expression "a car" in the sentence "every man owns a car" maps to some representative subset of cars. This representative subset of cars corresponds to the representative subset of individuals referred to by "every man", plus a subset of cars that are not owned. He (1983, p. 421) represents this as

man → car
man → car
(car)

But if "every man" and "a car" are singular and not plural, then "every man" does not refer to multiple men and "a car" does not refer to multiple cars. Johnson-Laird's treatment is cognitively plausible, but inconsistent with the grammatical form of the referring expressions. From a perspective which assumes that the number feature of a referring expression corresponds closely to the number feature of the referent of the expression, there are several cognitively motivated referents for expressions like "every man" and "a car" which do not violate the singular status of the linguistic expressions:

- Type
- Prototype/Exemplar
- Indefinite/Definite Instance

"A car" may refer to a type of object, namely the type of object that is a car. "A car" may also refer to a prototype that represents what is common to most cars, or it may refer to an exemplar which is an instance that is a representative car. Further, "a car" may refer to an indefinite instance with the determiner "a" marking the indefinite status of the referent of "a car". Note that "indefinite instance" is used here as a referential type and not a type of referring expression. In all but a few cases, the type of the referring expression is an *indefinite, singular object referring expression* when grammatically marked by the determiner "a" and a singular head noun ("a few cases" being a notable exception where "a" combines with a plural head noun). Given the occurrence of the indefinite, singular determiner "a" and the singular noun "car" in this expression, "a car" cannot be used to refer to a definite instance of a car, or to a class or collection, but all the other referential types are potential referents of indefinite, singular object referring expressions. Likewise, "every man" may refer to a representative but indefinite, singular instance of a man as is suggested by the singular status of "every man".

Reference to Definite and Indefinite Instances. The determiner "the" marks reference to definite instances. Consider the definite object referring expression "the car". This definite expression indicates that there is already a referent in the situation model that is being referred to or that there is a salient "car" object in the mental universe that is being referred to and this object should be instantiated into the situation model. For a more complex example, consider:

A car is in the driveway. The car is red.

In the first sentence, the expression "a car" is indefinite and instantiates a new referent into the situation model—one that is not (known to be) ground in the mental universe. In the second sentence, the expression "the car" is definite and refers to the referent instantiated into the situation model by "a car". Note that this referent is ungrounded in the sense that it has not been identified with any object in the mental universe, although it could be (e.g. "Oh, it's your car"). It is the mental universe which ultimately grounds referents. In the first sentence, the expression "the driveway" is definite. In this case, the definiteness of "the driveway" indicates there is (or should be) a salient object in the mental universe that should be instantiated into the situation model. There are three primary types of definite reference: 1) reference to an existing referent in the situation model which is grounded in the mental universe, 2) reference to an existing referent in the situation model which is ungrounded in the mental universe, and 3) reference to a object in the mental universe which is not in the situation model, but is (or should be) salient. There are two primary types of indefinite reference: 1) reference to an object which is being introduced and should be instantiated into the situation model—this object is not known to correspond to any object in the mental universe, and 2) reference to a generic instance or type which exists in the mental universe and should be instantiated into the situation model.

Reference to Types. Type hierarchies are common in systems of knowledge representation and making types first class objects allows expressions like "a sedan is a (type of) car" or "a (type of) car I like is a sedan" to be represented as relating two types "a sedan" and "a car". "A sedan" and "a car" refer to *instances of a type*. The suggested reference to a type rather than a class of instances is based on the singular status of these referring expressions (i.e. "a sedan" vs. "all sedans"). A type is a reified class. From a referential perspective, the type is atomic with no subparts and singular reference is appropriate. An instance is added to the situation model which is grounded in a type in the mental universe. From a relational perspective, "is" establishes a relationship of equality between the two arguments "a sedan" and "a car". However, from a referential perspective, there are two basic possibilities: 1) both "a sedan" and "a car" may refer to types of objects which are equated, or 2) the occurrence of "a car" within the context of "is" suppresses the normal referential behavior of "a car" such that "is a car"—a *predicate nominal*—is treated as a non-referential expression which is ascribed to the subject "a sedan". The typical treatment of predicate nominals suggests that they are non-referential (cf. Jackendoff, 2002). In a sentence like "John is a fool", "is a fool" is treated as a predicate nominal that says something about the individual that "John" refers to and this sentence is often considered synonymous with "John is foolish". From the perspective of the grammatical constraint, there is a problem with this treatment. Grammatically, "a fool" has the form of an indefinite, singular object referring expression and all object referring expressions are capable of referring, regardless of context. In the case of a predicate nominal, the referent of the embedded object referring expression, if it is identified, is the same as the referent of the subject—they are co-referential. The assumption that "is a fool" is non-referential rests on the availability of a referring expression "John", the referent of which the predicate nominal "is a fool" is predicated. In the absence of a separate referring expression, it is unclear how to treat the predicate nominal. For example, in "I wonder who is a fool", if "who" is non-referential as Huddleston & Pullum (2002, p. 401) suggest, then what does "is a fool" get predicated of? An obvious suggestion is that "who" functions as an unbound variable (or variable bound via a lambda expression) which instantiates a referent whose grounding is yet to be determined, but which supports predication of "is a fool" and can be referred to subsequently as in the follow up "he better be careful". In fact, it may turn out that nobody is a fool since "wonder" is non-factive (i.e. doesn't entail the existence of its complement). Or it may be the case that the hearer can provide the grounding as in "It's John". In general, Huddleston & Pullum discuss a range of "non-referential" object referring expressions (they prefer to use the term NP) in which there is no object in the real world to which the expressions refer, overlooking the possibility of a more flexible notion of reference within a situation model embedded in a mental universe.

In Jackendoff (2002), types are treated as lacking an indexical feature. While this treatment is attractive in providing a simple distinction between types and tokens (i.e. tokens have an indexical feature, types don't), the lack of an indexical feature implies an inability to refer to types. Yet, Jackendoff acknowledges the existence of NPs which describe types. These NPs are necessarily non-referential. When an NP occurs as a predicate nominal and functions as a kind (or type) as in "a professor" in "John is a professor", this approach coheres. There is an object in the situation model to which the expression refers. But what happens when an NP describing a type occurs as the subject or object as in "A new kind of car is passing by" or "He wants a special kind of dog"? If the object referring expressions don't refer, then it is unclear how the situation model can represent the meaning of these expressions. At a minimum, Jackendoff needs to allow reference to generic instances and argue that apparent references to types are really generic instance references. However, since there is strong evidence that types exist as mental constructs (cf. Collins & Qullian, 1969), we see no good reason to preclude reference to them.

Reference to Generic Instances. The plural variant of the expression "a sedan is a car" is "sedans are cars". This variant suggests a representation based on a collection of generic instances rather than a type.

The generic instance category generalizes over prototypes and exemplars. It is difficult to distinguish reference to prototypes from reference to exemplars since they have much in common. A prototype may be viewed as a washed

out exemplar (some cognitive approaches treat prototype and exemplar as essentially synonymous). It is a washed out exemplar in that it is a generalization over the experience of particular instances of the type. In this respect, a prototype is more like a type than an instance, making the distinction between types and instances less clear cut than is typically assumed. The use of specific lexical items may help to make the distinction. Consider the sentence "the prototypical car is a sedan". If the expression "the prototypical car" actually picks out a prototype for a referent, and the expression "a sedan" picks out a type, then equating a prototype with a type has the effect of defining the prototype to be of a particular type.

Allen (1986) discusses the semantics of generic NPs noting that "there is no marking for the generic within NP morphology" and that generics have "to be inferred from context". Grammatically a singular object referring expression is either definite or indefinite. If the referent of the expression is a prototype or exemplar, then the reference is generic. In the expression "the sedan is a car" where there is no existing referent in the situation model for "the sedan" to refer to, "the sedan" presumably picks out a generic instance or type.

The motivation for distinguishing prototypes and exemplars is a cognitive one, although there is disagreement within the cognitive community as to whether or not both notions are needed. It may be sufficient to distinguish generic instances from types in the situation model without distinguishing prototypes and exemplars.

Reference to Classes, Collections and Masses. Classes, collections and masses complicate reference in interesting ways. Classes and types are two sides of the same coin. The type is atomic and has no subparts. However, the elements of a class are salient and a plural nominal is used to refer to classes as in "all men". Collections are also referred to by plural nominals as in "the men/all the men" where "the men/all the men" refers to some salient collection of men, and not to the entire class. In these expressions, the noun head "men" denotes the type, and the specifier and plural grammatical feature determine the nature of the referring expression (i.e. class or collection). Masses differ from classes and collections in that the elements of a mass are not salient. Singular nominals are used to refer to masses.

Mass and plural nouns, but not singular count nouns, may function as referring expressions without separate specification. In "rice is good for you", "rice" does not refer to any specific instance of rice and in "books are fun to read", "books" does not refer to any specific collection of books. Both expressions are indefinite. They refer to something non-specific: a type or generic instance for "rice" and a generic collection for "books". Reference to a specific mass or collection requires a definite determiner as in "the rice is ready" and "the books are fun to read".

The use of a plural nominal to refer to a class or collection suggests that the members of the class or collection are cognitively salient and may be separately represented. This opens up the possibility of either referring to the class or collection as a whole or referring to the elements of the class or collection. However, for cognitive reasons having to do with the limited capacity of humans to attend to multiple chunks of information (e.g. Miller, 1956), it is assumed that any linguistic expression may only introduce a small number of referents into a situation model (cf. Johnson-Laird, 1983). In the "sedans are cars" example, the instantiation of a sedan collection and two generic instances of a sedan, and a car collection and two generic instances of a car is the minimal number consistent with the plurality of the object referring expressions. Given these referents, it is possible to refer to the collections as a whole, and it is also possible to pair the members of one collection with the members of the other collection. These alternatives correspond to the *collective* and *distributive* readings discussed in Lyons (1977). Lyons presents the example "those books cost $5" which is ambiguous between a distributive—each book is $5—and collective—all the books are $5—reading. Distributive and collective readings involve inferential processes operating over collections and instances which are not part of the grammatically encoded meaning. However, addition of "each" to "those books cost $5 each" imposes a distributive reading.

We can now see that Johnson-Laird's representation of "every man owns a car" corresponds closely to a distributive reading (constrained to a small number of referents). We are also in a better position to consider the representation of "every man". Although expressions with "every" are singular, suggesting selection of an arbitrary instance of a collection, in "Everyone left. They went to eat.", subsequent references are plural. Further, "Everyone left. He went to eat" is infelicitous. There are two implications of these examples: 1) "every" instantiates or references a collection in the situation model, and 2) the arbitrary referent of "every" is not salient for subsequent reference. Even referring expressions with singular "a" as in "Everyone owns a car. They are indispensable." support subsequent plural reference, although in this case "Everyone owns a car. It is indispensable." is also felicitous. This may result from the flipping of the type/class coin. Subsequent singular reference is to the type (or generic instance), subsequent plural reference is to the class.

Reference to Vacuous Instances and Collections. The empty set is a useful notion in set theory. The null symbol (or empty list) is a useful symbol in the Lisp programming language. In both set theory and Lisp, these are actual objects that can be referred to and manipulated. The grammatical and lexical structure of English strongly suggests the possibility of referring to a corresponding empty or vacuous object whose existence is taken for granted. Yet Martinich (1985, p. 3) argues that the existence of nothing is an "absurd view" which rests on "a misunderstanding of how language works". However, not only does grammar suggest the existence of objects

corresponding to nothing, but it suggests that nothingness comes in lots of different types and collections. Consider

Nothing
No one, nobody
Nowhere, Never
No man, No dog
No men, No dogs

It is true that a logical representation for expressions like "no man" which requires quantifying over every individual in the model makes little practical sense

$$\forall x (\sim man(x))$$

but this is taken to be a problem for the logical representation of the meaning of negative expressions, rather than as a criticism of negative referring expressions in language. Allowing negative object referring expressions to refer to empty or vacuous objects and collections in the situation model which do not map to any objects or collections in the mental universe is perhaps the clearest demonstration of how to simplify the mapping from referring expression to referent, relative to other approaches.

Summary and Conclusions

This paper presents and supports an expanded ontology of referential types consistent with Jackendoff's Conceptual Semantics, basic principles of cognitive linguistics and empirical evidence from cognitive psychology. By expanding the ontology of referential types and introducing a distinction between situation model and mental universe, it is possible to simplify the mapping from referring expression to referent, relative to approaches with a more limited ontology and single semantic space.

We propose a bi-partite semantic space consisting of a situation model and mental universe that explains apparent non-referential uses of referring expressions, along with the existence of two partial orderings:

Universal (e.g., $\forall x$) >
Class (e.g., $\forall x$ (man(x)) or "all men") >
Collection (e.g. "some/the/all the men") >
Mass (e.g. "mankind") >
Instance (e.g. $\exists x$ (man(x)) or "a/the man") >
Null (e.g. "no man")

Type > Prototype > Exemplar > Token (Individual)

The partial orderings are motivated by the linguistic expression of referring expressions, cognitive theory and a computational interest in simplifying the mapping from referring expressions to corresponding objects and situations. The partial orderings are not definitive. They capture important aspects of the mapping from referring expressions to referents, but there are more dimensions of meaning involved in this mapping than these two orderings can accommodate.

References

Allen, K. (1986). *Linguistic Meaning*. London: Routledge & Kegan Paul.

Anderson, J. (2007). *How Can the Human Mind Occur in the Physical Universe?* NY: Oxford University Press.

Ball, J. (2007). A Bi-Polar Theory of Nominal and Clause Structure and Function. *Annual Review of Cognitive Linguistics*, 27-54. Amsterdam: John Benjamins.

Ball, J. (2010). Projecting Grammatical Features in Nominals: Cognitive Processing Theory & Computational Implementation. *Proceedings of the 19th Annual Conference on Behavior Representation in Modeling and Simulation*.

Ball, J., Heiberg, A. & Silber, R. (2007). Toward a Large-Scale Model of Language Comprehension in ACT-R 6. *Proceedings of the 8th International Conference on Cognitive Modeling*, 173-179. Edited by R. Lewis, T. Polk & J. Laird. NY: Psychology Press.

Ball, J., Freiman, M., Rodgers, S. & Myers, C. (2010). Toward a Functional Model of Human Language Processing. *Proceedings of the 32nd Conference of the Cognitive Science Society.*

Barwise, J. & J. Perry (1983). *Situations and Attitudes.*Cambridge, MA: The MIT Press.

Collins, A. & M. Quillian (1969). "Retrieval time from semantic memory." *Journal of Verbal Learning and Verbal Behavior*, 8, pp. 240-248.

Hobbs, J. R. (2003). Discourse and inference. Retrieved from http://www.isi.edu/~hobbs/disinf-tc.html

Huddleston, R. & Pullum, G. (2002). *The Cambridge Grammar of the English Language*. Cambridge, UK: Cambridge University Press.

Jackendoff, R. 1983. *Semantics and Cognition*. Cambridge, MA: The MIT Press,

Jackendoff, R. (1991). *Semantic Structures*. Cambridge, MA: The MIT Press.

Jackendoff, R. (2002). *Foundations of Language.* Oxford University Press, New York, NY.

Jackendoff, R. (2007). *Language, Consciousness, Culture, Essays on Mental Structure.* Cambridge, MA: The MIT Press.

Johnson-Laird, P. (1983). *Mental Models*. Cambridge, MA: Harvard University Press.

Kintsch, W. 1998. *Comprehension, a Paradigm for Cognition*. New York, NY: Cambridge University Press.

Langacker, R. (1987). Foundations of Cognitive Grammar, Volume 1, Theoretical Prerequisites. Stanford, CA: Stanford University Press.

Lakoff, G. 1987. *Women, Fire and Dangerous Things*. Chicago: The University of Chicago Press.

Lyons, J. (1977). *Semantics*, Volumes 1 & 2. Cambridge, England: Cambridge University Press

Martinich, A (ed) (1985). *The Philosophy of Language.* New York: Oxford University Press.

Miller, G. A. (1956). "The Magical Number Seven, Plus or Minus Two." *Psychological Review*, 63, pp. 81-94.

Rosch, E. (1975). "Cognitive Representations of Semantic Categories." *Journal of Experimental Psychology: General*, 104, pp. 192-233.

Van Dijk, T. and Kintsch, W. (1983). *Strategies of discourse comprehension*. New York: Academic Press.

Zwann, R., and Radvansky, G. (1998). Siutation models in language comprehension and memory. *Psychological Bulletin*, 123, 162-185.