Introduction

JEANETTE K. GUNDEL AND NANCY HEDBERG

This volume grew out of a conference on “Discourse Processing: Reference”, which was held in Vancouver, British Columbia, Canada in February 2003 and was co-sponsored by the Cognitive Science Program of Simon Fraser University and the Cognitive Systems Program of the University of British Columbia. The conference was the twelfth in a series of “Vancouver Studies in Cognitive Science” conferences. Jeanette Gundel, who was guest coordinator of the conference, chose the theme and invited the speakers. We owe a great debt of gratitude to Martin Hahn, of Simon Fraser University’s Philosophy Department for helping to organize the conference.

Some of the speakers at that conference are not represented here (Jennifer Arnold, David Beaver, David Braun, Craig Chambers, and Ron Zacharski) since they did not submit their papers for inclusion in the volume. Andrew Kehler’s paper was not presented at the conference, as he was unable to attend. The volume also includes papers from researchers who were not speakers at the conference (Alan Garnham and Wind Cowles; Sungryong Koh, Tony Sanford, Charles Clifton, Jr. and Eugene Dawdiak; and Massimo Poesio).

The Study of Reference as Cognitive Science

Reference and reference production and understanding is an essential feature of human cognition. It comprises the ability to think of and represent objects (both real and
imagined/fictional), to indicate to others which of these objects we are talking about, and to
determine what others are talking about when they use a (pro)nominal expression. The subject of
reference is one of the best examples of an area of study that Cognitive Science as an
interdisciplinary science excels in exploring. It has been the focus of study in virtually all the
cognitive sciences - philosophy (including philosophy of language and mind, logic and formal
semantics), theoretical and computational linguistics, and cognitive psychology. It is impossible
to discuss reference without bringing into play perspectives from more than one discipline. The
study of reference in semantics and pragmatics essentially involves linguistics and philosophy;
the study of psychological reference processing involves linguistics as well as psychology, and
the study of computational reference processing involves linguistics and computer science as
well as quite often triggering questions about the psychological reality of the mechanisms
proposed.

Researchers from different disciplines study reference from different perspectives and are
informed by different research traditions. While the participants in this volume were primarily
trained in one of the four represented disciplines—computer science, linguistics, philosophy and
psychology, and use methodologies typical of that discipline, each one of them bridges more than
one discipline in their work and their approach. Thus, Kent Bach and Barbara Abbott apply
primarily philosophical methods and pose traditional philosophical questions, but both are
influenced by linguistics. Conversely, Gregory Ward applies primarily linguistic methods but is
influenced and informed by work in philosophy of language. Andrew Kehler and Maite Taboada
also come from a linguistic perspective but focus their attention on computational algorithms,
while Massimo Poesio comes from a computational perspective but focuses his attention on
linguistic ramifications of a computational algorithm. The team of Sungryong Koh, Anthony
Sanford, Charles Clifton, Jr., and Eugene Dawydiak were primarily trained in psychology and apply experimental methods, but focus on psycholinguistic models that bridge psychology and linguistics. Some of the papers are coauthored by people trained in different disciplines. Thus Wind Cowles, who was trained as a linguist, coauthors with Alan Garnham, a psychologist; and Donna Byron, a computer scientist/computational linguist, coauthors with psycholinguists Michael Tanenhaus and Sarah Brown-Schmidt.

The papers in the volume also employ methodologies characteristic of a number of different cognitive science disciplines. The papers by Abbott, Bach, Ward and Kehler rely primarily on intuitive judgments of the investigators, a methodology characteristic of theoretical linguistics and philosophy of language; the papers by Koh, Sanford, Clifton and Dawydiak, and by Garnham and Cowles employ an experimental methodology characteristic of psychology and psycholinguistics; and the papers by Poesio, Taboada and Byron, Tanenhaus and Brown-Schmidt employ a corpus-analytic methodology that is characteristic of work in natural language processing/computational linguistics as well as linguistics.

Questions about Reference Posed in this Volume

The papers in this volume can be organized according to the primary questions about reference that they attempt to answer. The most general question is ‘what is reference?’ More specific questions are “how is reference resolved?” and “how do speakers/writers select appropriate expressions with which to encode referents?” These latter two questions involve the two complementary sides of the reference processing issue: the interpretation or comprehension side and the generation or production side, respectively. Finally, it can be asked, “What is the appropriate linguistic analysis of different referring forms?”.
What is Reference?

In his paper, “On Referring and Not Referring”, Kent Bach takes a philosophical perspective on basic questions such as “What is reference?”, “what kind of expression can be used to refer”, and “how is reference accomplished?”. Bach agrees with Russell and Strawson that expressions, including singular terms such as definite descriptions, are not linguistically (semantically) referential. He also accepts Strawson's position that referring is something a speaker does, not something an expression does, although he takes a more conservative position about what kinds of expressions can be used to refer and what counts as speaker reference. He proposes that any expression that can be used to refer can also be used non-referentially and that descriptive reference (Donnellan's attributive use) is not genuine reference because to refer to something or to understand a reference to it requires being able to have singular thoughts about it and we cannot have a singular thought about an individual we can “think of” only under a description. Having a singular thought about a referent requires perceiving it, being informed of it, or remembering it, i.e. there must be a representational connection between thought and object. Bach does not however take the more restrictive view associated with Bertrand Russell that limits this connection to personal acquaintance. Among the expressions that cannot be used to refer, Bach includes indefinite specific as well as non-specific uses.

In Bach’s view, definite descriptions, demonstratives, proper names and definite pronouns can all be used referentially, but they can also be used non-referentially, for example, in attributive uses of definite descriptions and when the speaker intends to refer to something but there is no such thing. Bach argues that reference is determined by speaker intentions. Context
does not determine reference. Rather, it is exploited by the audience to ascertain the reference, partly by being so intended.

**How is Reference Resolved?**

Andrew Kehler's paper, “Rethinking the SMASH Approach to Pronoun Interpretation,” is concerned with how reference is resolved and specifically with the interpretation of pronouns. Kehler argues on both empirical and conceptual grounds that the SMASH approach (Search, Match, Select with Heuristics) that has dominated the psychological and computational linguistics literature is incapable of explaining or even adequately describing pronoun interpretation within the human processing mechanism. He argues that the amount of processing that would have to occur in the Search and Match components and the morphologically based preferences of the Select phase is at odds with the fact that pronouns actually facilitate processing. He also discusses examples that cast doubt on the Search and Match paradigm since a pronoun cannot be used felicitously even when it is the only one that satisfies the Match constraints. Kehler suggests that a variety of surface level preferences that have been posited in the literature are either epiphenomenal (e.g. the preference for grammatical role parallelism) or derivative (e.g. the preference for subject assignment) and proposes an account that embeds pronoun interpretation within a larger model of discourse processing. This model takes into account crucial interactions between information structure (including attentional state) and inferential processing mechanisms that underlie the establishment of coherence in discourse. Since the complexity in the data results from these processes and not from pronoun interpretation itself, such an account would explain how pronouns can actually facilitate processing by expressing topic continuance.
Kehler also provides critical overview of Centering Theory, an example of a SMASH account, and shows that it fails to make correct predictions in some cases because the notion of coherence it captures is primarily entity based and because it does not provide an incremental method for pronoun interpretation as the preferred interpretation for a pronoun can't be determined until the whole sentence is processed.

Koh, Sanford, Clifton and Dawydiak, in their chapter, “Good-Enough Representation in Plural and Singular Pronominal Reference: Modulating the Conjunction Cost,” explore the question of how we can resolve anaphoric singular pronouns whose referents were introduced in a conjoined noun phrase. Processing is slower for singular pronouns referring to one of the individuals introduced in a conjoined antecedent NP than for plural pronouns referring to the conjoint referent or for singular pronouns referring to an individual introduced in a separate simple NP. This effect is known as the “conjunction cost.” Koh et al. find that the conjunction cost disappears when the role played by the referent of the singular pronoun is in an action that is construed as being carried out on behalf of the pair (a number-indifferent action). They suggest that the mental representation of the text may fail to distinguish whether one or two individuals carry out the action in such cases.

Koh et al. also touch on the question of selection of form of referring expression in that in number-sensitive cases, the conjunction cost disappears when a proper name is used instead of a pronoun. They suggest that the full NP, unlike the pronoun, cues the shift in discourse theme (topic) that results from the shift from plural to singular reference and so facilitates the shift.

**How do we select forms of referring expressions?**
Byron, Brown-Schmidt and Tanenhaus, in “The Overlapping Distribution of Personal and Demonstrative Pronouns,” explore the question of what governs the choice of personal pronouns such as *it* as opposed to demonstrative pronouns such as *that*. Byron et al. build on the claims of the Givenness Hierarchy of Gundel, Hedberg and Zacharski, which predicts that the referents of personal pronouns must be in the focus of the addressee’s attention, while the referents of demonstrative pronouns may be in the focus of attention but more often are instead merely activated (in working memory). Byron et al. conduct both a corpus study and a psycholinguistic experiment to examine what factors allow a demonstrative pronoun to refer to an already in-focus entity and what factors affect whether a personal pronoun is used to refer to an entity that is not in focus according to syntactic criteria.

For the corpus study, they examined the TRAINS93 corpus, a transcription of a spoken dialogue, problem-solving task. It was found that personal pronouns are typically used for in-focus referents but that factors such as referring to a higher order discourse topic or the global problem-solving task permit personal pronouns to be used for referents that are not the syntactic focus of the preceding utterance. Demonstrative pronouns can be used for in-focus entities when the previous mention was itself a demonstrative and when the referent is a composite entity constructed from heterogeneous parts.

The psycholinguistic experiment used an object-manipulation methodology. It was found that a personal pronoun was most often interpreted as referring to the previously mentioned direct object referent but was quite often instead interpreted as referring to the composite created by the previous instruction when the task had been to place the first object on top of the second object rather than beside it. Byron et al hypothesize that in this case the structure of the task resulted in retention of attention on the composite, thus placing the composite in focus.
Demonstrative pronouns were more often interpreted as referring to the composite, but were often interpreted as referring to the direct object entity instead. This latter finding is clearly in line with Givenness Hierarchy predictions, since demonstrative pronouns are predicted to be useable when the referent is in focus as well as when it is merely activated.

Maite Taboada, in “Reference, Centers and Transitions in Spoken Spanish,” focuses on the question of how choice of form is determined by transition types as specified in Centering Theory (Grosz, Josh and Weinstein 1995, inter alia.) Taboada examines two corpora of spoken dialogue in Spanish, and reports on her analysis of almost 1,500 utterances, which she classified according to transition type: Continue, Retain, Smooth Shift, Rough Shift, null Backwards-Looking Center (Cb). She found that Continues and Smooth-Shifts are encoded by zero pronouns in the majority of cases, with another one fifth realized as clitics. An interesting contrast arises with written Italian as reported by Di Eugenio 1998, where Smooth Shifts were most often realized as stressed pronouns. Retains were realized as zero pronouns in about a third of the cases and as clitics in another third. There were very few Rough Shifts in the data.

Taboada finally examines transition realizations that are contrary to expectation. Proper names are sometimes repeated in the telephone corpus and full noun phrases and dates are sometimes repeated in the travel-arrangements corpus due perhaps to contrast or to establishment of the referent as mutually known. Taboada concludes that Centering Theory may need to be revised to account for spoken language phenomena, both with regard to Cb realization and with the global structure of conversational discourse.
Massimo Poesio, in “Linguistic Claims Formulated in Terms of Centering: A Re-
examination using Parametric CB-tracking Techniques,” also focuses on the selection of
particular forms of referring expression from a Centering Theory perspective. He reports on the
 GNOME Corpus—a corpus of museum descriptions, pharmaceutical leaflets and tutorial
dialogues, for a total of about 900 finite clauses. He investigates several linguistically interesting
claims, relating e.g. to ‘topic’, in terms of Centering Theory. The first issue is when do we use
this-NPs, both pronominal and determiner. Gundel, Hedberg and Zacharski propose that this-NPs
must be at least ‘activated’ (i.e. in working memory), and Poesio and Modjeska defined a notion
‘Active’ to algorithmically identify this notion of ‘activated’. They conclude from their analysis
of the GNOME corpus that this-NPs are used for Active entities as well as for entities other than
the Cb of the previous utterance.

Poesio also examines the type of transition compared to the form of the subject. He finds
that pronouns (vs. demonstrative or full NP) are by far the most common with Continues and
Smooth Shifts, where the Cb is equal to the Cp (the highest item on the Cf list), and are very rare
with Retain, Rough Shift, Zero or Null Transitions (the latter two being two types of utterances
with no Cb). An intermediate case is the Establishment transition where the current utterance
has a Cb but the previous utterance did not. Establishments thus differ from Continues, which
contradicts the conclusion of previous researchers.

At the level of global discourse structure, Poesio finds that most long-distance pronouns
had already been Cb’s earlier in the discourse. He also finds that continuous transitions
(transitions where there is a Cb in both the current utterance and the previous one) are less likely
than average to occur at discourse segment boundaries, whereas Establishment, Zero and Null
transitions are more likely than average to occur there.
The Garnham and Cowles chapter, “Looking Both Ways: the JANUS Model of Noun Phrase Anaphor Processing,” provides a critical review of the psycholinguistic literature on structural and semantic factors that influence both the production and comprehension of anaphoric expressions, and outlines the basic assumptions of their own JANUS model of coreferential NP anaphor processing, showing how it has been derived from previous models and empirical findings. Garnham and Cowles express agreement with researchers who posit that purely structural strategies such as subject assignment should be regarded as fall-back strategies that are used when other strategies fail. The fundamental assumption of their model is that a proper psychological account of co-referential NP anaphora must take account of both how the anaphor relates back to previous text and what function the anaphor performs in its own clause. JANUS also acknowledges that the type of a coreferential NP anaphor, (e.g. pronoun, full definite NP) may influence how the process of finding the NP takes place. The basic principle of the JANUS model is that anaphoric expressions have two types of functions: those that involve looking backwards to the previous text and those that involve looking forwards to the upcoming text. With respect to looking backward, the JANUS model predicts that a coreferential anaphoric NP should have enough content to avoid indeterminacy of reference, and when this fails other material in the clause is used for disambiguation. Looking forward is looking forward to the consequence of using a particular expression, i.e, how it contributes to signalling the future direction of the text. The authors agree with Almor and others that unnecessary content in an anaphor slows processing, but do not agree that this effect arises through semantic interference in working memory. Rather, they propose that the processing of unnecessary content itself causes problems because the processing system is following functional principles, specifically the
Gricean principle of quantity, that an expression (or in this case an expression along with other material in the clause) should contain no more or less information than necessary. They criticize the Informational Load Hypothesis of Almor and associates as too simplistic in considering only the relative salience of antecedents and relations between an anaphor and its actual antecedent, and note that some types of expression may preferentially seek nonfocused, or non-salient antecedents.

What is the appropriate linguistic analysis of different forms?

In her chapter “Issues in the Semantics and Pragmatics of Definite Descriptions in English”, Barbara Abbott addresses the question of which meanings associated with the English definite article ‘the’ are an essential part of the semantics of this determiner and which are pragmatically derived. She presents arguments supporting the view that uniqueness is part of the conventional meaning of the English definite article, while familiarity is pragmatically derived, and argues that approaches which take familiarity as essential are incorrect.

In “Equatives and Deferred Reference”, Gregory Ward is concerned a special metonymic type of reference where an expression is used to refer to an entity related to, but not directly denoted by, the conventional meaning encoded in the expression. The paper focuses specifically on such ‘deferred reference’ in identity statements such as “I'm the Pad Thai”, which he calls ‘deferred equatives’ Ward argues that deferred equatives constitute a distinct subtype of deferred reference with its own specific properties, and that current theories of deferred reference will have to be revised to take account of this fact. While he agrees with previous researchers that felicitous use of deferred reference requires a contextually licensed correspondence from one
object to another, he claims that such a correspondence applies differently to equatives and non-equatives. He also challenges previous claims that deferred reference involves meaning or sense transfer rather than reference transfer and argues that in deferred equatives the deferred interpretation results in a shift in meaning of the copula alone. He argues that in the case of equatives the pragmatic mapping between set members is explicitly encoded by the two NPs of the equative construction and no reference transfer is involved. For non-equatives, the mapping is implicit and only one of the mapped members is explicitly evoked in the discourse. Since both mapped entities are explicitly evoked within the equative, their meanings remain intact.