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REFERENCE AND EXTENSION

Extension and *reference* are technical terms in the philosophy of language, formal semantics, and pragmatics. We outline their roles in three types of theoretical effort – compositional semantic theories (which make use of both terms), various *theories of reference*, which purport to tell us what it is for a word to have a certain referent, and views that understand reference as something people do with words. The first two are semantic accounts; the last conceives of reference as a matter of language use, so of pragmatics.

Reference and Extension in Compositional Semantics

We begin with the use of reference and extension in compositional semantic theories. In this domain a *referent* is generally a thing that a proper noun "refers to" or "names," and an extension a set of objects to which a predicate applies (the term *denotation* is sometimes used interchangeably with both reference and extension). However, compositional semanticists often generalize one or the other notion so that almost any kind of expression, including a sentence, can be said to have a referent or an extension.

With few exceptions, compositional semantic accounts are versions of **truth conditional semantics** – attempts to specify the meanings of sentences in terms of their truth conditions. Since natural languages allow for infinitely many sentences, the truth conditions of sentences must be specified recursively in terms of the semantic values of their parts, and referents and extensions are semantic values that enable us to do just this. For example, we can specify the truth condition of the sentence "John smokes" in terms of the referents and extensions of its parts as follows: "John smokes" is true if and only if the referent of "John" (namely, John himself) is a member of the extension of "smokes" (the set of things that smoke).

The primary historical source for compositional semantics along these lines is Gottlob Frege's ([1892] 1997) account of *Bedeutung* – often translated as "reference" (also as "denotation"). In it, a referent is assigned to every meaningful expression. Frege assumed that each complex expression is the result of combining a functional expression (such as a predicate) with one or more arguments (such as names) (see PREDICATE AND ARGUMENT). Further, he assumed that the referent of a functional expression *F* is always a function *f,* and that the referent of any expression *X* that *F* accepts as an argument is the sort of object that is among the arguments of *f.* Specifically, if *F* is a functional expression and *X* an expression that *F* accepts as an argument, the referent of *F* is the function that maps the referent of *X* onto the referent of *F(X).* Thus, the referent of a complex expression is always the result of applying the referent of one of its constituents, as a function, to the referents of its other constituents, taken as arguments. The referent of a sentence as a whole is identified with its truth value. Thus, the referent of "Chomsky" is Chomsky, the referent of "is clever" the function that maps each object *x* onto *truth* if *x* is clever and onto *falsehood* otherwise, and the referent (truth value) of "Chomsky is clever" is truth if and only if Chomsky is clever.

It may seem surprising that the referent of a sentence is its truth value, but it should be kept in mind that *reference* is used as a technical concept within compositional semantics. Given the use to which the concept is put, this is not an unnatural assumption: Frege was interested in a compositional semantics that would tell us how the truth values of sentences are determined by the referents of their parts, and all natural languages have fragments in which, when a sentence has *other sentences* as parts, the truth value of the whole depends only on the truth values of the constituent sentences. Fragments of languages in which this is the case, and in which the referent of a complex expression in general depends only on the referents of its parts, are called *extensional.* Thus, in an extensional fragment, expressions having the same referent can be substituted in any sentence without altering its truth value (contexts in which such substitutions preserve truth value are also called extensional). Frege was primarily interested in constructing a semantics for the language of mathematics, which is extensional, and so choosing truth values as referents of sentences was natural. However, natural languages as wholes are not extensional. In contexts involving **PROPOSITIONAL ATTITUDES, MODALITY**, and counterfactuals, the substitution of clauses having the same truth value may alter the truth value of the whole sentence. To account for such contexts, Frege held that each sentence or other expression has, in addition to a referent, another kind of semantic value, which he called the expression's *sense* (*Sinn*). The sense of a sentence is what he called a *thought,* or, in contemporary terms, a **PROPOSITION**. In order to maintain a version of the principle of **COMPOSITIONALITY**, he held that the truth values of nonextensional sentences are determined in part by the senses of their constituents (see SENSE AND REFERENCE).

For various reasons, Frege's approach is now considered antiquated. Most recent work in formal semantics for natural languages is inspired by Alfred Tarski's work on the definability of *TRUTH* for formal languages. Richard Montague (1974) was the first to apply Tarski's work productively to (fragments of) natural languages. Here, *extension* is the preferred term. The extension of a predicate is, again, the set of things to which it applies. Although terminology varies, in this framework, too, one can speak of the extension of almost any expression, including a sentence, so that one identifies a sentence's extension with its truth value. Applying Tarski's approach, the aim is to recursively characterize not only the truth conditions of sentences but also the entailment (logical consequence) for a language using the notion of extension: A sentence S_1 is said to entail a sentence S_2 in language L if and only if there is no assignment of extensions to the semantically simple expressions of L (no "model of L") under which S_1 is true and S_2 false. On this approach, the logical constants differ from other

expressions in that they are not assigned extensions/referents (see LOGIC AND LANGUAGE).

Montague's approach differs notably from Frege's: It does not assign senses to expressions to account for nonextensional contexts. Instead, it employs the tools of **POSSIBLE WORLDS SEMANTICS** to this end. One can, however, within Montague's framework define objects corresponding roughly to Frege's senses: The sense of an expression could be thought to correspond to the function that maps each possible world onto the extension that the expression has in that world. Such functions are often called *intensions* (see INTENSION AND EXTENSION).

Theories of Reference, New and Old

The second set of theories (often called theories of reference) in which the terms *reference* and *extension* are found appear in the works of philosophers of language who aim to describe and explain the word–world relations that compositional semantic theories of the sort discussed previously take for granted.

In this area, too, a classical source is Frege. According to Frege, a word has a specific referent because its users associate it with a particular sense – something like a conceptual representation of its referent. Applied to proper names, his view was that a name, say, "George W. Bush," is associated by its users with a certain descriptive condition, say, *being the 43d president of the United States*, and that its referent is that object (if any) which uniquely satisfies this condition.

Another view, the so-called new theory of reference (in vogue since the 1970s), maintains that at least some expressions do not have senses, but simply refer. Proper names are paradigm examples. According to the approach, what cements the relation between a name and its referent is not a mediating conceptual representation in the speaker's mind but a causal and historical relationship between the name's user and its referent. The idea, articulated by Kripke (1972), is that a name is introduced by an initial "baptism," which involves a causal interaction between a speaker and the referent itself, and reference for all other speakers is preserved in chains of communication in which each speaker intends to use the name to refer to the same object as those from which he or she acquired the name. Extending Kripke's view in ways suggested by Kripke himself, Hilary Putnam (1975) proposed baptism + history as an account of how **NATURAL KIND TERMS** come to have and maintain their extensions (see ESSENTIALISM AND MEANING).

Reference as Action

The third view we discuss maintains that reference depends essentially on individual speakers (and possibly interpreters) with variable interests: An appropriate slogan might be "Words don't refer; people do." One root of this view is found in the work of the later Ludwig Wittgenstein, another in Descartes. Those who defend it point out that it is difficult to find cases of uniform word–world relationships in the use of natural languages. They grant that the practices of mathematicians display uniformity, but these practices aside, reference varies with time, context, speaker's interests, and so on. They also grant that some who offer theories of reference, such as Kripke (1972), acknowledge a role for speaker intentions. But Kripke and others incorrectly assume that ordinary speakers desire to maintain uniformity – to ensure "rigidity" in reference. In fact, speakers – paraphrasing Wittgenstein – play all sorts of games with language.

In taking reference as a form of action and treating *refer* as a verb, we come closest to the commonsense idea of a person "referring to" or "talking about" an object. Critical work on Bertrand Russell's analysis of **DEFINITE DESCRIPTIONS** by P. F. Strawson (1950) and Keith Donnellan (1966), as well as H. Paul Grice's work on the semantics/pragmatics distinction, inspired a distinction between *speaker's reference* and *semantic reference*, the latter being central to both compositional semantics and theories of reference of the sorts considered in the previous section. The speaker's reference of an expression, on an occasion, is whatever object that speaker uses the expression to pick out, typically in order to assert (query, etc.) something about that object. You may use the phrase "the man drinking a martini" to refer to a certain person, although the person you have in mind is, unbeknownst to you, drinking water: He is not, then, the semantic referent of the phrase.

Some writers hold that semantic reference either does not exist (Strawson 1950 can be read this way), or – if it is to sustain theoretical investigation – must be reconceived (Chomsky). Chomsky points out that natural language use (not in-house use of the symbols of mathematics or natural science, where practitioners constrain their actions) displays "creativity," where this is thought of in terms not only of the uncaused production of novel expressions but also of their free use for any number of purposes ("appropriateness"). Because referring is a form of free action and cannot sustain naturalistic study, Chomsky proposes the elimination of the semantic study of natural languages as usually conceived (offering theories of word–world relationships), placing the study of reference in a part of pragmatics that resists theoretical investigation, and placing the study of what he calls "meaning" (a psycholinguistic version of Fregean senses) in syntax broadly conceived as the study of the intrinsic properties of the mind/brain. The study of meaning – semantics reconceived – becomes a psycholinguistic enterprise focusing on the natures of mind-internal elements, such as lexical items, their "semantic features," and the computations in which they figure. Chomsky (2000, 38 f) points out that this kind of study might employ a theoretical device called "relation R," construed as a postulated relationship between theoretically defined expressions and objects in some introduced, stipulated domain. Relation R is not reference "outside the head" that is not apt for naturalistic study. Relation R and the domain D are, rather, construed to be part of syntax – theoretical devices aiding the naturalistic study of syntax conceived as "language in the head." The members of D could be stipulated to be semantic values. This might allow Chomsky to absorb the insights of Montague and other developing theories within **FORMAL SEMANTICS** into syntax. It would also emphasize a view Chomsky maintains for other reasons: Semantic compositionality is syntactic computation. Whether absorbing formal semantic accounts of compositionality in this way suits the intuitions and aims of those who want their semantic efforts to provide explications of truth conditions is another matter.

– James McGilvray and Juhani Yli-Vakkuri

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REFERENCE TRACKING

Reference tracking, or **ANAPHORA** resolution, concerns how language users track who or what the speaker is referring to in discourse. Because everyday language use generally concerns who does what to whom, reference tracking is important in studying human language and cognition.

Anaphora devices include noun phrases (NPs), pronouns, and zero anaphora, whose identities depend on their antecedents in discourse. In the example "Isabel went to China, and this volunteer/she helped with midwifery training," "This volunteer" is an NP that refers back to its antecedent Isabel. It could be replaced by the pronoun *she* or by an empty slot (zero anaphora) as in the sentence "Isabel went to China and ____ helped with midwifery training."

Pronouns and zero anaphora give less explicit information than full NPs. Still, the reader/hearer benefits from the efficiency of these devices in conveying information that has been introduced/given in the prior discourse or can be accessed/inferred from the context. These devices are crucial for global cohesion and local coherence in discourse. Experimental studies find that without a specific need, replacing a pronoun with an NP for given information may hinder understanding.

A discourse topic provides a basic means for tracking the identity of a pronoun or zero anaphora because the topic tends to recur as given information continuously. Cross-linguistic studies find that people can track the identity of a pronoun or zero anaphora even when its referent is not in the immediately preceding clause but in the prior context. Therefore, although language production may be linear due to human physical limitations, language processing and reference tracking are hierarchical cognitive processes.

Reference tracking requires the hearer to make inferences from world knowledge about likely events, especially for languages that have no **MORPHOLOGICAL** markings (Chinese) yet allow abundant zero anaphora, as in "He grew only one plant, but ___ blossomed well." Many languages make reference tracking easier with specific grammatical markings, such as agreement

morphology: subject-verb **AGREEMENT**, **PERSON**, **NUMBER**, and gender (see GENDER MARKING agreement (French, German, and Turkish); the switch-reference system (Amele); or topic/subject markers (Japanese). Discourse analysis (see DISCOURSE ANALYSIS [LINGUISTIC]) finds that reference usage follows the constraints of information flow: The grammatical subject of a transitive clause tends to be coded with a pronoun in English, or zero anaphora in Chinese or Japanese, to present given or accessible information (*the light subject constraint*), for instance, "He" in the example, whereas the grammatical object tends to be an NP carrying new information (e.g., one plant). This allows easy processing of accessible information early in an utterance, while the rest of the utterance introduces the new referent, thus facilitating reference tracking and discourse processing.

Experimental studies find that the discourse pattern of a language engenders specific reference tracking strategies in its native speakers. Therefore, speakers of different languages may develop different cognitive strategies to track reference during discourse processes.

– Liang Tao

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REGISTER

Speakers of a language use different words and grammatical structures in different communicative situations. For example, we do not use the same words and structures to write an academic term paper that we would use when talking to a close friend about weekend plans.

Researchers study the language used in a particular situation under the rubric of *register*: a language variety defined by its situational characteristics, including the setting, interactiveness, the channel (or mode) of communication, the production and processing circumstances, the purposes of communication, and the topic.

Although registers are defined in situational terms, they can also be described in terms of their typical linguistic characteristics; most linguistic features are functional and, therefore, they tend to occur in registers with certain situational characteristics. For example, first and second person pronouns (*I* and *you*) are especially common in conversation. Speakers in conversation talk a lot about themselves, and so they commonly use the pronoun *I*. These speakers also interact directly with another person, often using the pronoun *you*.

There are many studies that describe the characteristics of a particular register, such as sports announcer talk (Ferguson 1983), note taking (Janda 1985), classified advertising (Bruthiaux 1996), and scientific writing (Halliday 1988). Other researchers