The study of meaning raises several perplexing issues. Perhaps the most obvious question you can ask about meaning is the most difficult to answer: What is it? Everyone, of course, has an idea about what people mean when they speak, but where does this idea come from, and how can it be analyzed formally?

For semanticists who study linguistic meaning, two notions have proven to be central to grappling with this question: reference, and truth. It is clear that one of the things that we use language to do is to refer to people, objects and events in our surroundings. These people, objects and events constitute part of the meaning of the expressions that are used to refer to them, though how this is accomplished is far from straightforward. Similarly, we use language to make statements that we and others can judge to be true or false. Understanding this aspect of language is a necessary prerequisite to understanding meaning, making truth as well an important component of meaning. Of course, there are many other things that we do with language beyond referring and making true and false statements — questioning, commanding and hypothesizing, for example — though it is fair to say that there could be no formal understanding of meaning without an understanding of reference and truth to ground it in.

**Saturated and unsaturated meanings**

Much of our formal understanding of meaning came from the German mathematician Gottlob Frege. Frege was concerned with the question of how to assign meanings to individual words in such a way that these meanings could be combined or put together into meanings for phrases and sentences. This combining he called composition, and a semantics that works in this fashion is called a compositional semantics. The general form of the theory he proposed contains lexical entries assigning basic meanings to all words in a language plus a very general procedure for combining two or more meanings into a third meaning. This approach to semantics is shared by virtually all theories of semantics being pursued today.

Central to Frege’s approach to semantics is a distinction between **saturated** meanings and **unsaturated** meanings. Saturated meanings are those that are in some sense complete by themselves. The meanings of names like “George Washington” and
of sentences like “George Washington chopped down a cherry tree” are two common examples. Unsaturated meanings, in contrast, are incomplete, requiring something more for completion. Examples include verbs like “chopped”, verb phrases like “chopped down a cherry tree” and particles like “から”. The distinction between saturated and unsaturated meanings can best be brought out through a simple thought experiment. Suppose I ask you to imagine George Washington, America’s first president. Of course, if you have no knowledge of George Washington this may be a difficult task. However, if you have ever seen his picture on a U.S. 1-dollar bill or on a 25 cent coin and recognize what you saw there to be George Washington, then you will likely have no difficulty in imagining him in some fashion. Your image may be only partial, and it will almost certainly be incorrect in detail. Still, however, given enough of an idea of who George Washington is, you can readily succeed in the task set to you.

Suppose now that I ask you to imagine that George Washington chopped down a cherry tree. Historians may disagree about whether such an event ever actually happened, but this makes no difference in your trying to imagine it. Given, of course, that you can imagine George Washington in the first place, you can readily form an image of him chopping down a cherry tree. Once again, the image may be vague in many respects – you may not know, for instance, what kind of cherry tree was involved. Similarly, it may be incomplete in other respects – whether there were cherries in the tree, how old the tree was, where the tree was growing, what season it was, etc. Finally, what you imagine could be completely unrelated to reality – perhaps George Washington never chopped down a single cherry tree in his entire life. Still, you have no problem once again in succeeding in the task at hand of trying to imagine the event posed to you.

All of this may strike you as painfully obvious, and hardly worth taking the time and effort to spell out. However, not all expressions of language can be imagined in this way. For example, suppose you are asked to imagine “へ”. Not a full sentence using the particle, but just “へ” itself. Or “から”. Or even “chopped down a cherry tree”, without any understood subject. All of these tasks are impossible to accomplish. Of course, you could fill in some missing information and imagine someone going to somewhere, someone coming from somewhere, or that someone chopped down a cherry tree, and then you would have no problem forming the necessary image. But imagining these things without the added someones, somewheres, comings and goings is
something that simply can’t be done.

The difference just illustrated is one way of viewing Frege’s distinction between saturated and unsaturated meanings. The saturated meanings are the ones that can readily be imagined. The unsaturated ones are all the rest. Looked at from this perspective, saturated meanings are in one sense more basic than unsaturated meanings. They have a completeness to them that unsaturated meanings lack. This is a somewhat surprising consequence, of course, when you consider the fact that complex expressions like declarative sentences have saturated meanings while simple one-word predicates have unsaturated meanings. However, from a psychological perspective this consequence is perhaps easier to accept. We seem to have little difficulty in perceiving events in their entirety, as if they are single entities, though the predicates that are used to describe these events do not describe perceivable sub-parts. We can, for instance, easily perceive a man running, but we are helpless at trying to perceive his running without perceiving him as well. If we take our perceptions to form the basis for meaning, it will follow that the simplest kinds of meanings will be of a kind that corresponds to what we can most easily perceive.

**Concepts and Referents**

The difference between saturated and unsaturated meanings gives us part of the answer to our original question of what meanings are, but clearly it does not give us the whole answer. For example, it does not tell us what the difference is between distinct saturated expressions, for example what makes the expressions “George Washington,” “Abraham Lincoln” and “the first US president” different from one another. To give us these differences it is very tempting to appeal to the notion of a concept. We associate the name “George Washington” with one concept, the name “Abraham Lincoln” with a second, and the phrase “the first US president” with yet a third. Furthermore, from an intuitive perspective, it would seem sensible to identify these associated concepts as the meanings of the phrases in question.

Despite the initial appeal of this idea, however, there are several reasons why concepts by themselves do not work well as meanings. I will look at only one of them here: identity statements. An identity statement is a statement of the form “a = b”, or more colloquially “aはbだ”. The main problem these statements pose is that it is difficult to see how to analyze the concept of identity as relating two other concepts.
Take for example the mathematical equation $2+4 = (2+7) / ((2+4) / 4)$. Is the concept associated with $2+4$ identical to the concept associated with $(2+7) / ((2+4) / 4)$? This doesn’t seem right. For one, it is easily possible to imagine someone understanding the former without understanding the latter. The “=” sign thus cannot identify concepts. If meanings were exhausted by concepts, however, then there would be no other conceivable role that the “=” sign could play. The same kinds of problems arise for natural language identity statements, like “George Washington is the first US president,” where the copula plays the role of the “=” sign in the mathematical example. If the identity were between concepts, then given that this sentence is true it should be impossible to find someone who has the first concept but not the second. Someone who knows George Washington from a 1 dollar bill but doesn’t yet understand what a president is, however, would have just that property. Once again it is clear that identity is not a relation between concepts.

In the mathematical example considered above, a more plausible role for the “=” sign to play would be to identify values. On this view, the value obtained by adding 2 and 4 is identified above with the value obtained by doing the necessary calculations for the right hand side of the equation. Values, however, are very different from concepts. Similarly, it looks more reasonable to say that the natural language identity statement as well gives us a relation between values of a sort, if we take the “values” of the expressions in question here to be the actual people those expressions refer to. If such values need to be appealed to in giving the interpretation of “=”, however, and if semantics is to be done strictly compositionally, it follows that these values have to be at least a part of meaning. In natural language semantics, values of the type considered here are more typically called referents.

The considerations in the above two paragraphs make it look as if values, or referents, are better candidates for the meaning of an expression. However, if we look a little deeper into the relation of identity we see that there are problems with taking meaning to be exhausted by referents as well. In this case, the problems are best illustrated by comparing two different equations: “$a = a$”, and “$a = b$”. Suppose for the sake of argument that the second equation is true. If the semantic meanings of the expressions “$a$” and “$b$” are nothing more than their referents or values, then it follows that “$a$” and “$b$” have identical meanings regardless of their form. If the meaning of the whole sentence is composed out of the meanings of its parts, if follows that both
sentences will have the same meaning. The same carries over to their natural language counterparts as well. Given that “the morning star” and “the evening star” are nothing more than two different names for the planet Venus, it follows that the sentence “The morning star is the evening star” is true. If the identity expressed by this statement is simply between the referents of “the morning star” and “the evening star”, then this sentence should say the exact same thing as the sentence “The morning star is the morning star.” This follows as an inescapable consequence if semantic meaning is identified purely with reference.

The problem that the above examples pose, of course, is obvious. From our individual points of view it is easy for a person to know the second sentence in this last example to be true without knowing the first to be true, which implies that it is easy for a person to assign different meanings to the two expressions being related via the identity relation. However, if meaning equals reference, we are at a loss to explain where this knowledge could come from. The referents of the pieces are, after all, identical, which should make the meanings of the sentences identical as well. If the two sentences have the exact same meanings, however, then there is no possible basis for distinguishing between knowledge of the one and knowledge of the other, which means that it should be impossible to know the one without knowing the other. To put the same point more generally, the two sentences as well as the two equations above naturally have a different cognitive status. However, a theory of meaning that has as a consequence that the meaning of “the morning star” is identical to the meaning of “the evening star”, or that the meaning of “a” is the same as the meaning of “b”, should make this impossible. Since this absurd consequence resulted from our tentative assumption that the meaning of an expression is exhausted by its referent, it follows that this assumption must have been mistaken. While reference may still be an important part of meaning, it cannot be all there is.

Two parts of meaning

The problem just examined was introduced by Frege. The solution he gave to the problem was to analyze meaning as involving two pieces, what he labeled sense and reference. These two pieces are intimately related in that a sense determines, or picks out, a reference. Just as there are many different paths that one can take to get to any location, similarly there are many different senses that one could follow to get to any
reference. To pick out the (abstract) number 6, for example, one could follow the path of adding 2 and 4, or the path of calculating \((2+7) / ((2+4) / 4)\), or any of an infinite number of other paths. Similarly, one can get to George Washington through the sense of the name “George Washington”, through the sense of the expression “the first US president”, or through the senses of an infinite number of other expressions.

Having two pieces to meaning makes it possible, and in fact fairly easy, to assign a role to the “=” sign above, or to the semantic relation of identity in general: an identity statement of the form “a = b” has as its meaning that the sense associated with “a” picks out the same referent as the sense associated with “b”. The statements “a = a” and “a = b” will thus have different meanings, even when both are true. Furthermore, the difference in these meanings leads us to expect the exact difference we find in their cognitive significance. To be told that path “a” leads to the same place that path “a” leads to is uninformative. To be told that path “a” leads to the same place that path “b” leads to, however, gives us information.

While the solution Frege posed does indeed solve the puzzle it was intended to, making sense out of the solution has proved to be as difficult as the original puzzle itself. The main difficulty lies in the question of what a sense is. As a mathematician, Frege was concerned with the question of how we can pass a body of knowledge on from one generation to the next. His answer was that it is necessary to employ a language whose meanings are not dependent on the people using it. Only if this condition is satisfied, he felt, could passing on of knowledge be achieved through language. If the formal semantic basis for a language were grounded in the beliefs and concepts of individuals, then since there is no way of ensuring that two different individuals share either their beliefs or their concepts, there could be no way of ensuring that the knowledge of one person could ever be conveyed via language to another person. To avoid this problem, Frege took a perfect language to be one grounded not in individual beliefs or concepts but rather in objective aspects of the real world. One of these aspects is Frege’s referents, and another is his senses.

While Frege never claimed that natural language attained the perfection of his ideal language, it is clear nevertheless that Frege intended his model of language to apply to natural language. However, the introduction of senses into natural language is problematic in several respects. Unlike referents which include many concrete, perceivable objects, senses are by their nature necessarily abstract, and hence not
perceivable. They do not enter into causal relations with the physical world, and hence cannot be seen, heard, smelled, tasted, felt or otherwise measured. If senses play a central role in semantics, then to account for the fact that people can use language it becomes necessary to posit an additional ability as a primitive of the theory, the ability of people to grasp senses. Such a grasping relation would presumably connect a public sense with a private concept, though how it could possibly do so is left a mystery. Introduction of such a primitive, furthermore, has no justification beyond its role in understanding language, and is in principle incapable of being given any basis in any of the other sciences we know of, including physics, chemistry, biology and psychology. For these reasons alone we should be suspicious of introducing objective, abstract senses into our theory of semantics, let alone of making them one of the central pillars of the theory.

Fortunately, Frege’s puzzle does not force us to accept the details of his solution to the puzzle. We can see the puzzle and its proposed solution as showing us that meaning must consist of at least two separate pieces. In order to analyze identity, it is necessary to make reference to these two pieces: “a=b” means that piece 1 is different for “a” and “b” though they have the same piece 2. While this aspect of the analysis comes directly from Frege, there is no reason why we need to follow Frege in analyzing these pieces as objective aspects of the world. Following in the tradition of generative grammar, pioneered and developed for the past 50+ years by Noam Chomsky, a plausible alternative would be to take language and all of its separate components to be properties of the minds of individual human beings. The notion of a public language would then be something like the notion of race – useful for making some kinds of classification but only characterizable in terms of generalizing over more primitive properties of individuals. Within such an internalist framework for analyzing natural language, identifying the pieces involved in meaning as distinct types of concepts becomes perfectly natural.

This internalized view of meaning comes with its own challenges, the most important of which is to make the resulting theory of meaning one that connects to the real world. When I say that George Washington chopped down a cherry tree, I do not intend my claim to be solely about my own psychological state of mind. I rather intend to convey information about the world, existing independently of my thoughts, beliefs and concepts. This gap can be bridged at least partially by perception, seen as a means
of translating properties of the real world into psychological conceptualizations thereof. However, if the resulting semantics pairs psychological concepts directly with real world objects, it is difficult to see how it could properly be conceived of as a truly internalized view of meaning. Internal means internal to the mind, and there is simply no way that real world objects can qualify as internal in this sense.

If we accept this conclusion, we are virtually forced to interpret both Frege’s senses and his referents in internalist terms, where they can play an explanatory role in a theory of naturally language. While there are many ways of doing this that would maintain the core of Frege’s solution to the identity problem, the most straightforward way is to analyze senses as sets of conceptualized properties, and referents as property-less conceptualized individuals, something akin to the mathematical concept of a point. The idea here is that referents serve only to distinguish distinct objects from one another, while senses serve to attribute properties to those objects. The meaning of a referential expression will then pair the two: it will consist of a set of properties associated with a property-less individual. This view preserves as much as possible of Frege’s original analysis while placing the analysis on a firmer, internalist foundation.

**Sentences**

We have so far only been looking at referring expressions like “George Washington”, the first of our two kinds of expressions having saturated meanings. The other kind, declarative sentences, introduces additional complexities of its own. Given that referring expressions have two different aspects to their meaning, if meanings are to compose, then our natural expectation would be that we can find these same two aspects to meaning in sentences as well. For the first of these two aspects, internalized versions of Frege’s senses, this expectation seems relatively unproblematic. But what about the second aspect of meaning, reference? What could play the role of reference for a sentence?

The traditional answer to this question offered by Frege is that the reference of a sentence is a truth value. When we think of what a sentence means, we generally think of the concept associated with that sentence. However, truth is at least as important. To see this, consider the English sentence “George Washington chopped down a cherry tree,” and imagine a person Taro who claims to understand the sentence. Suppose now that when asked what the world would have to be like in order for the
sentence to be true, Taro is completely unable to give an answer, in English, Japanese or any other language. The obvious conclusion to draw in this situation would be that despite his claims to the contrary, Taro does not in fact understand the sentence. This shows us that understanding a sentence minimally requires knowing under what conditions that sentence will be true.

Frege took considerations like these to indicate that the reference of a sentence is a truth value. This makes for a clear parallel between his treatment of referential expressions like names and that of declarative sentences. Just as referential expressions denote conceptualized properties of individuals and individuals that these properties hold of, so too declarative sentences denote conceptualized properties of truth values and the truth values they hold of, or equivalently conceptualized propositions and the truth values they are taken to have. Support for this view that the reference of a sentence is a truth value comes from the behavior of sentential connectives, like “and”, “or”, and “if”. Consider for illustration the word “and” in the sentence “George Washington chopped down a cherry tree and he admitted it.” This sentence has the general form “p and q”, with p = George Washington chopped down a cherry tree and q = he admitted it. If p is true and q is also true, it follows that the sentence “p and q” is true. If either p or q is false however, or if they are both false, then the sentence “p and q” is false. That is, the word “and” appears to be sensitive to the truth values of two (or more) sentences that it connects, producing a truth value for the resulting sentence that depends exclusively on the truth values it combines. If truth values were not part of the meaning of the sentences that “and” connects, it is difficult to see how “and” could have this property. While this argument does not show that the reference of a sentence MUST be a truth value, it does show that such an analysis is at least plausible, and we will adopt it here.

Unsaturated Meanings and Compositionality
Before turning to an analysis of what unsaturated meanings are, it is worth first considering what unsaturated meanings cannot be. They cannot be the same kinds of things that saturated meanings are. Why not? Because this would give us no way of calculating the meaning of a sentence from the meanings of its parts. Consider a simple sentence such as “John left” for example. We have argued above that a name like “John” will have a set of properties and an individual as its meaning, which we will
designate simply as *john*. The sentence as a whole will likewise have a proposition and a truth value as its meaning. What about “left”? This cannot be similar to either “John” or to “John left” for the following reason: if it were, then the meaning that we derive from combining “left” with “John” would end up as nothing more than a list, similar to *john and left*. This is the best we can do for non-sentences like “John Bill”, or “left fell”. However, *john and left* is clearly not the meaning that we associate with the sentence “John left”. What’s more, it is not easy to see how we could fix this problem by changing the way we combine meanings. If the meanings were of the same type, then there would be no obvious way to get “left” to predicate something of “John” and not vice versa.

The easiest way to overcome this problem is to analyze “left” semantically as a function. Schematically, this function could be represented as “__ left”, where a complete sentence meaning is derived by filling in the blank. More commonly, we can represent the function as a lambda expression, \( \lambda x. x \text{ left} \). We can think of this meaning as derived by abstracting over the subject argument position in a complete sentence. From the sentence “John left”, we abstract over the position occupied by “John”, substituting a variable \( x \) and adding a lambda operator \( \lambda x \). The result is a function that can apply to *john* to yield *john left*, or to *mary* to yield *mary left*, etc. This shows us now exactly how it is that sentence meanings are more basic than predicate meanings: sentence meanings are the starting point from which abstraction applies to generate predicate meanings.

We have now seen the core pieces of a theory of meaning, sense and reference, for three types of expression: sentences, referring expressions such as names, and predicates. The following table summarizes the relations among these that we have looked at.

<table>
<thead>
<tr>
<th>Example</th>
<th><em>John left</em></th>
<th><em>John</em></th>
<th>left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expression type</td>
<td>Sentence</td>
<td>Referring expression</td>
<td>Predicate</td>
</tr>
<tr>
<td>Saturated meaning?</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Sense</td>
<td>( \text{≈ Concept of John leaving} )</td>
<td>( \text{≈ Concept of John} )</td>
<td>( \text{≈ function from individual concept to sentential concept} )</td>
</tr>
<tr>
<td>Reference type</td>
<td>truth value</td>
<td>individual</td>
<td>function from individuals to truth values</td>
</tr>
</tbody>
</table>
First steps toward spelling out the program

In this section we will show how the program outlined above can be worked out for very simple examples. To do so, we assume that semantic interpretation proceeds via a function that takes a syntactic representation as its input and yields a conceptualized sense-reference pair as its output. Within generative grammar, this function can be seen as one that applies at the interface between Logical Form and Conceptual Structure. We will designate this interface function with double brackets, \([\[]\)]\). This function can apply to simple words, to non-branching syntactic categories, or to branching syntactic categories. In the first case, the meaning assigned is that listed in the lexicon. In the second case, the meaning of the daughter is inherited by the mother. In the third case, the meaning of one of the expressions applies to the other as a function applying to an argument. To see how this works, consider the basic lexical entries needed to calculate the interpretation of the sentence “John left”, given below:

\[[\text{John}] = john\]
\[[\text{left}] = \lambda x. x\ left\]

Assuming that the sentence “John left” has the following syntactic structure,

\[[S [NP\ John] [VP\ left] ]\]

the interpretation of the sentence as a whole can be calculated as follows:

\[[[S [NP\ John] [VP\ left] ]]] =
[[[VP\ left]] ([[NP\ John]]) =
[[left]] ([[John]]) =
[\lambda x. x\ left]\ (john) =
john\ left\]

The final result is again to be taken as a combination of a concept and a truth value, with the concept taken to be a property of the truth value. In a typical assertion, the truth value will be True, and the property of truth that is asserted is that the proposition that John left hold of it. More informally, the concept associated with the sentence “John left” is asserted to correspond with some state of affairs that actually holds in the world.
The Universality of Semantics

There are many ways in which languages differ from one another. They differ in their vocabulary, the sounds they employ and the structures they can generate. They differ in the concepts they choose to encode lexically as well. However, they do not appear to differ in their basic semantics. In particular, the need to analyze meanings as having two parts, playing the roles of Frege’s sense and reference, is a universal aspect of all human language. Since this aspect of language is one that is never explicitly taught, it must come from the language learner himself. Such core parts of semantics thus give us a direct view into the constraints that the brain imposes on one aspect of our understanding the world we live in, namely language.

Evidence that all languages share universal constraints has been growing in all areas of linguistic research, of course. Semantics is in this respect no different from other aspects of language. The main research program in all areas of theoretical linguistics has been to identify the universal aspects of language as well as the range of variation, and to develop theories that predict these observations. This is the standard approach to all scientific fields of inquiry. Looking forward, linguistic science can be seen as setting constraints on a future science of the brain aimed at determining how the brain computes what it does. That science is today still in its infancy, limited by technology as well as by the complexity of the project. However, as it advances, the universals of language can’t help but take on an increasingly greater importance.

Conclusion

The semantics outlined above is very basic, and still somewhat limited in what it can handle. Furthermore, we have only used the simplest of sentences to illustrate how this semantics works. Extending the analysis to cover transitive predicates like “見る “, quantifiers like “すべて” and “ほとんど”, descriptions like “来た人” and other linguistic phenomena is straightforward, though somewhat of a challenge for the student of semantics. Rather than attempt a hasty explanation of such complex phenomena, I refer the reader to Heim and Kratzer’s Semantics in Generative Grammar, where these and many more phenomena are dealt with in detail. As can be seen more clearly there, with the simple apparatus we have constructed it is possible to interpret an infinite number of sentences by assigning appropriate meanings to lexical items and appropriate structures to sentences. The system is very flexible in that it can be adapted to a wide
range of grammatical theories without major modification. But most importantly, the system helps to shed some light on what has proven to be a highly complex question, the question What is meaning?

ブックガイド Gottlob Frege: “Uber Sinn und Bedeutung” (Translated into Japanese?). This article spells out the need for both sense and reference, and shows the many roles that sense plays in the interpretation of complex sentences. Noam Chomsky: Knowledge of Language: Its Nature, Origin and Use, Praeger, 1985. (Translated into Japanese?) This book contains some of Chomsky’s most explicit arguments that a proper theory of language needs to be a theory of the internal state of an individual speaker, not a theory of some abstract object outside of the individual speaker. Irene Heim and Angelika Kratzer: Semantics in Generative Grammar, Blackwell, 1997. This graduate level introductory textbook methodically develops the theory of semantics introduced above in detail.