What We've Done So Far

Some of the methods we've been studying regarding language meaning and propositional logic have proven to be unsuccessful upon further understanding of the topic. Often it has been the case that we've presented a method as a solution to a problem, but after further analyzation of the topic, it becomes clear that it's not an ideal solution.

1 Every sentence is a propositional formula.

In topic 1, our original approach was to assign a formula to every sentence of English we came across using propositional logic as a basis. However, while this worked nicely for some of our sentences, it became apparent that there exist some sentences of English which restricted our approach (as in the examples below):

A How are you feeling?

B Please do your homework.

C Very nice!

In example A, it's not possible to map this sentence to a propositional formula, since it's a question with no assignable truth value. In example B, since this is a command sentence, the same restriction applies. And in some examples, like in C, it's difficult to apply a formula being that it's simply an exclamation and not a proposition – it has no truth value.

2 The logical operators (¬, ∧, ∨, →, ↔) do not map neatly onto English.

In topic 2, our initial plan was built on the idea that we could use the above logical operators to represent *any* English proposition. However, when we look at certain example sentences, we see that there's still some ambiguity that the logical operators are unable to nullify, as in example D below:

D It is not the case that it is Tuesday and I have money.

Example D can be written in propositional logic using the formula: $\neg p \wedge q$. This could mean one of two things: either, *'It is not the case that it is Tuesday and also, I have money,'* or *'It is not the case that the following holds: it is Tuesday and I have money.'* Since we don't know the intention of the original sentence, it's hard for us to assign logical operators which will cover all possible meanings of the sentence. We could avoid this problem through the use of parentheses – specifically, $(\neg p) \wedge q$ or $\neg (p \wedge q)$ – but being that we don't know the intended meaning of the sentence, it could change the meaning if we add them.

3 Propositions are not enough; we also need predicates.

In topic 3, our focus moved from the use of propositions only, to the incorporation of predicates. Since propositions alone were too broad a unit, we needed to introduce smaller building blocks of meaning units: predicates. (An example of a predicate is '*human*(Gary)' which equates to the English sentence, 'Gary is human.')

When we were restricted solely to propositions, we couldn't narrow our focus down to the meaning of words like *human* and *mortal.* These words can be thought of as 'properties,' and the words in the parentheses following are referred to at the predicate's 'arguments.' Now, through the mingling of predicates and propositional logic, we can more accurately represent sentence meaning, as in example E below:

E If Gary is human, then Gary is mortal.

Using a mix of propositional logic operators and predicates, example E can be represented as:

human(Gary) → *mortal*(Gary)

4 The meaning of a sentence is computed over its D-structure.

Topic 4 covers a problem of ambiguity that arose with our study of meaning via sentence trees. Before the introduction of D-structure, our assumption was that sentence meaning can be derived from the syntactic organization of a sentence using syntax trees. However, we quickly ran into the problem of ambiguity in certain sentences.

F John showed Bill Mary.

G Mary, John showed Bill.

In example F, there is no problem of ambiguity. The sentence can only mean exactly what it says: "John showed Bill Mary." In sentence G, however, there are two possible interpretations: 1) "Mary was shown to Bill by John." and 2) "Bill was shown to Mary by John." The syntax trees for each of these two possible meanings is different. So, which one is correct? The ambiguity arises through our use of their S-structures (surface structures), which are the sentence trees used as the basis for pronunciation. With the introduction of D-structures (deep structures), we can safely compute the meaning of a sentence while avoiding the complications of natural language syntax, since they are unique to each meaning.

748 words