

Sentence Evaluation with Predicates

As we've seen, simple sentences of English can be analyzed using predicate formulas, and depending on the structure of the sentence (e.g. number of adjectives, whether a relative clause is included, etc.), the structure of its predicate counterpart will change accordingly. Specifically, the addition of a relative clause, for example, will change the way nouns in the sentence are represented using arbitrary variables like x and y .

1 John is old.

In a sentence such as Example 1, the most basic of the predicate templates, we've demonstrated that it can be evaluated (in this case) simply to $\text{old}(\text{John})$. The adjective, old, accepts the subject of the sentence, John, as an argument to be modified.

2 An old man.

Example 2, however, is slightly different from Example 1 in that it contains an instance of an adjective directly describing some arbitrary man, 'man'. In this case, we need to add a variable, x , in order to link two predicates that modify the same subject, and we need to make use of the logical operator, \wedge . This evaluates to $\text{old}(x) \wedge \text{man}(x)$.

3 An old, wise man.

Example 3 can be described as a slight extension of the case in Example 2. In Example 2, we had an instance of two predicates that modified the same subject (which we assigned to a variable, x). In this new case, there are two adjectives that describe some arbitrary man. Intuitively, we can extend our predicate formula with another logical operator (\wedge) and we're left with $\text{old}(x) \wedge \text{wise}(x) \wedge \text{man}(x)$. Again, all three predicates in our formula modify our subject, x .

4 A man that is old.

In Example 4, we see the addition of a relative clause by the use of the word 'that'. What this means for our predicate evaluation is that we need to add a second variable while keeping our original x . The second variable will refer to the same subject in the sentence, which signals that there is a relative clause. The noun phrase of this sentence remains $\text{man}(x)$. What changes, however, is the second half of the sentence containing the adjective phrase. We can use another arbitrary variable, y , and use it as the argument for the adjective, old. This leaves us with $\text{man}(x) \wedge \text{old}(y)$. This, however, isn't complete; we need to add something to the formula that lets us know that the two variables, x and y , refer to the same subject. Straightforwardly, this sentence evaluates to $\text{man}(x) \wedge \text{old}(y) \wedge (x = y)$.

These fundamental examples of predicate formulas for sentences with adjectives don't solve a problem that arises with certain adjectives – 'old' being one of these cases. An adjective such as 'old' will convey a

meaning that varies with the noun it describes. Crucially, an old pastry is not nearly as old as an old man. Regardless, the same adjective, 'old', is used without any issue of misunderstanding to a native speaker of English. In our predicate evaluations, we can try to mitigate this problem by adding an argument in the adjective's parentheses. Now, there will be two arguments, whereas previously there was only one (the variable, x).

To recycle and modify Example 2, we can use the new predicate formula $\text{old}(x, \text{man}) \wedge \text{man}(x)$. What changed here is the addition of the second argument, 'man', in the predicate $\text{old}()$. Now, the reader is able to understand that x is old with respect to 'man', and not old with respect to anything else, like a pastry. In the case of a pastry, we can simply switch the predicates and arguments while maintaining the structure: $\text{old}(x, \text{pastry}) \wedge \text{pastry}(x)$ which is equivalent to 'an old pastry'.

These guidelines provide the foundation for analyzing simple sentences of English with adjectives and relative clauses using predicate formulas.

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