

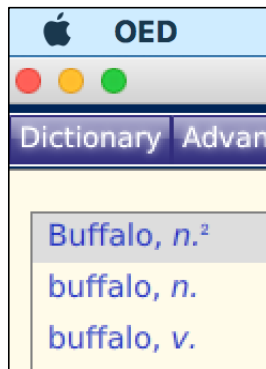
# Generative AI and Language Understanding: Part 7

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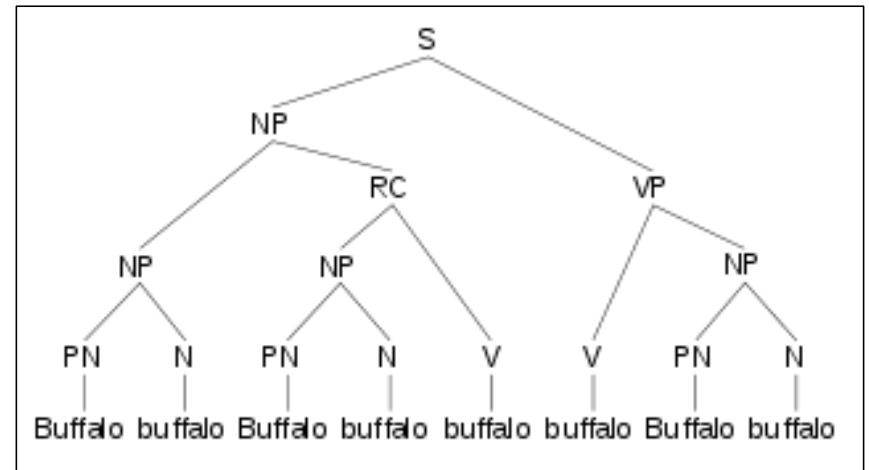
# The famous Buffalo sentence

- Wikipedia page:

- [https://en.wikipedia.org/wiki/Buffalo\\_buffalo\\_Buffalo\\_buffalo\\_buffalo\\_buffalo\\_Buffalo\\_buffalo](https://en.wikipedia.org/wiki/Buffalo_buffalo_Buffalo_buffalo_buffalo_buffalo_Buffalo_buffalo)



- Parse:



S = sentence, NP = noun phrase, RC = relative clause  
VP = verb phrase, PN = proper noun, N = noun, V = verb

# The famous Buffalo sentence

- Word Senses for *buffalo*

[< *Buffalo*, the name of a city in New York State, where the recipe was developed in 1964 at the Anchor Bar.]

'**buffalo**, *v. N. Amer. slang.*

[f. the n.]

*trans.* To overpower, overawe, or constrain by superior force or influence; to outwit, perplex. So '**buffaloed** *ppl. a.*

**1903** *Cincinnati Enquirer* 9 May 13/1 Buffaloed—Bluffed. **1904** *N.Y. Even. Post* 25 Oct. 10 All the rest [of the newspapers] were what we used to term in the Southwest 'buffaloed' by the McKinley myth—that is, silenced by the fear of incurring the resentment of a people taught to regard McKinley as a saint. **1910** W. M. RAINE *B. O'Connor* 77 O'Connor admitted that he was 'buffaloed' when he attempted an analysis of his unusual feeling. **1947** E. A. McCOURT *Flaming Hour* 118 Jerry Potts himself would have been buffaloed.

**buffalo**, *n.*

('bʌfələʊ)

Forms: 6 **bufalo**, (7 **buffolo**, **boufaleau**, **-alo**, 7–8 **buffelo**, 8 **bufolo**), 7– **buffalo**. *pl.* **buffaloes**.

[a. It. *buffalo* (Florio), *bufalo*, *bufolo* (Baretti), or Pg. *búfalo*:—vulgar L. \**būfalus*, a. Gr. βούβαλος (whence in literary L. *būbalus*), properly denoting a kind of antelope, but applied to a wild ox. Cf. **BUFFLE**, **BUFF** *n.*<sup>2</sup> The early quotations suggest that the word originally came into English from Portuguese.]

**1.** The name of several species of Oxen; esp. **a.** *Bos bubalus*, originally a native of India, inhabiting most of Asia, southern Europe, and northern Africa. It is tamed in India, Italy, and elsewhere. **b.** *B. caffer*, the Cape Buffalo of S. Africa. **c.** Applied in popular unscientific use to the American **BISON**.

**a.** **1588** PARKE tr. *Mendoza's China* 181 They doo plough and till their ground with kine, Bufalos, and bulles. **1665** *Voy. E. India* 359 They have a Beast very large, having a smooth thick skin without hair, called a Buffelo, which gives good milk; the flesh of them is like Beef. **1682**

# The famous Buffalo sentence

*See also ChatGPT-4 response in later slides*



**You**

Buffalo buffalo Buffalo buffalo buffalo buffalo Buffalo buffalo. Can you tell me what happened in the previous sentence?



**ChatGPT**

Certainly! The sentence "Buffalo buffalo Buffalo buffalo buffalo buffalo Buffalo buffalo" is an example of a wordplay-based sentence in English. It is often used as an illustration of how homonyms and homophones can be combined to create a grammatically correct, albeit confusing, sentence.

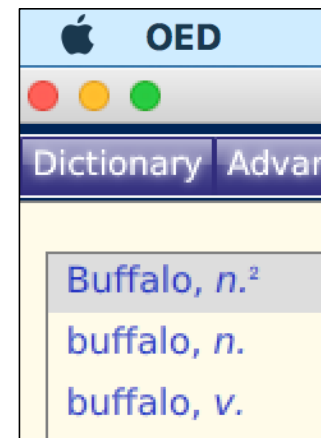
# The famous Buffalo sentence

Let's break it down:

1. Buffalo (capitalized) refers to the city of Buffalo, New York.
2. buffalo (lowercase) can refer to the animal.

Now, let's substitute these meanings into the sentence:

"Buffalo buffalo Buffalo buffalo buffalo buffalo Buffalo buffalo."



# The famous Buffalo sentence

- ChatGPT's answer is incomplete, it doesn't really know how to parse.

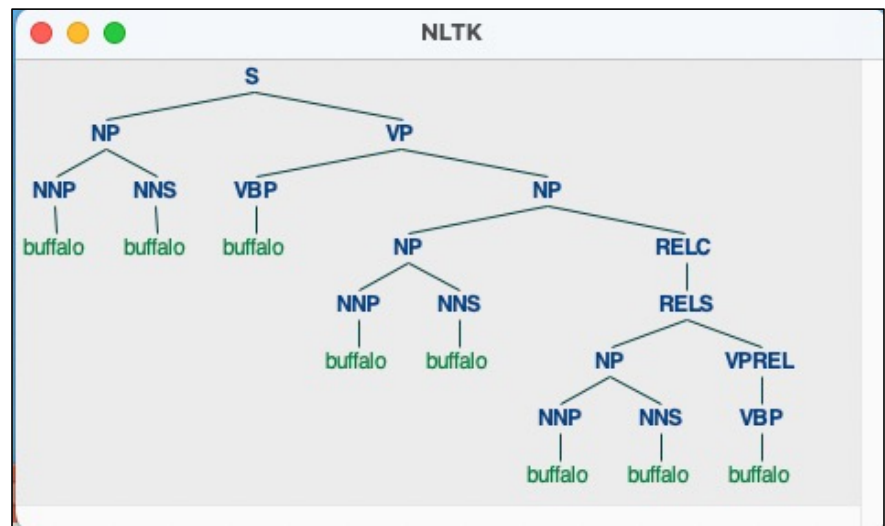
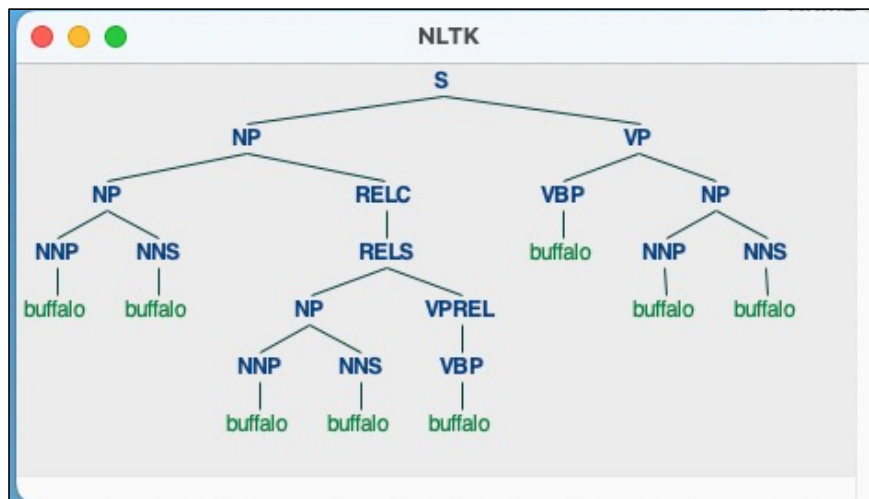
1. Buffalo buffalo (Buffalo bison) that Buffalo buffalo buffalo (that Buffalo bison bully),
2. Buffalo buffalo Buffalo buffalo buffalo (Buffalo bison from Buffalo, New York, bully),
3. Buffalo buffalo Buffalo buffalo buffalo buffalo Buffalo buffalo. (Buffalo bison from Buffalo, New York, that Buffalo bison bully, themselves bully Buffalo bison).

So, the sentence is saying that buffalo from Buffalo, New York, who are buffaloes by other buffalo from Buffalo, New York, buffalo other buffalo from Buffalo, New York. It's a play on the meanings of "buffalo" as both a proper noun and a verb.

Why? See next slide

# The famous Buffalo sentence

- ChatGPT's answer: the relativized subject reading
- But if it knew parsing, it would also know the relativized object reading



# The famous Buffalo sentence

- Python nltk code:

```
1 S -> NP VP
2 NP -> NNP NNS
3 VP -> VBP NP
4 VP -> VBD NP
5 NNP -> 'Buffalo'
6 NNS -> 'buffalo'
7 VBP -> 'buffalo'
8 VBD -> 'buffaloed'
9 NP -> NP RELC
10 RELC -> REL RELS
11 RELC -> RELS
12 REL -> 'that'
13 RELS -> NP VPREL
14 VPREL -> VBP
15 VPREL -> VBD
```

buffalo.txt

- Python interpreter:

```
>>> import nltk
>>> f = open('buffalo.txt','r')
>>> raw = f.read()
>>> raw
"S -> NP VP\nNP -> NNP NNS\nVP -> VBP NP\nVP -> VBD NP\nNNP -> 'Buffalo'\nNNS -> 'buffalo'\nVBP -> 'buffalo'\nVBD -> 'buffaloed'\nNP -> NP RELC\nRELC -> REL RELS\nRELC -> RELS\nREL -> 'that'\nRELS -> NP VPREL\nVPREL -> VBP\nVPREL -> VBD\n"
>>> cfg = nltk.CFG.fromstring(raw)
>>> p = nltk.ChartParser(cfg)
>>> for t in p.parse(['buffalo'] * 8):
...     t.draw()
... 
```



# The famous Buffalo sentence

- To verify that ChatGPT has no knowledge of the Buffalo sentence syntax, we can try a longer sentence.

SA

**You**

Buffalo buffalo buffalo buffalo buffalo buffalo buffalo buffalo buffalo buffalo buffalo buffalo. Can you tell me what happened in the previous sentence?

# The famous Buffalo sentence

- We have added three more *buffalo* words to the sentence.



**ChatGPT**

Certainly! The sentence "Buffalo buffalo buffalo buffalo buffalo buffalo buffalo buffalo buffalo buffalo buffalo" is another example of a wordplay-based sentence in English, similar to the previous one. This sentence uses the word "buffalo" as a noun, a verb, and a modifier. Let's break it down:

# The famous Buffalo sentence

1. Buffalo buffalo (Buffalo bison) buffalo (buffalo) that Buffalo buffalo (Buffalo bison) buffalo (buffalo) buffalo (buffalo) buffalo (buffalo) buffalo (buffalo) buffalo (buffalo) buffalo (buffalo) buffalo (buffalo).

In simpler terms, the sentence is saying that buffalo from Buffalo, New York, who are buffaloes by other buffalo from Buffalo, New York, buffalo yet other buffalo from Buffalo, New York. It's a play on the meanings of "buffalo" as both a proper noun and a verb, creating a complex string of buffalo-related actions.



Incorrect!  
Same response as for  
the 8 *buffalo*  
sentence.

# ChatGPT-4

ChatGPT 4 ▾



You

Buffalo buffalo Buffalo buffalo buffalo buffalo Buffalo buffalo. Can you tell me what happened in the previous sentence?



ChatGPT

The sentence "Buffalo buffalo Buffalo buffalo buffalo buffalo Buffalo buffalo" is a grammatically correct sentence in American English. Here's a breakdown of what's happening in this sentence:

1. **"Buffalo"**: This can refer to three things in the sentence:
  - The city of Buffalo, New York.
  - The animal, commonly known as a buffalo in North America (more accurately called a bison).
  - The verb "to buffalo", which means to bully, confuse, deceive, or intimidate.
2. **Structure of the Sentence**: The sentence uses all three meanings of "Buffalo". A simplified way to understand it is by adding punctuation and synonyms: "Buffalo bison [that] Buffalo bison bully, [themselves] bully Buffalo bison."
3. **Translation**: Essentially, it means that the bison from Buffalo (the city), who are bullied by other bison from Buffalo, in turn, bully other bison in the city.

This sentence is often used as an example in linguistic studies to demonstrate lexical ambiguity and the complexity of sentence construction in the English language.



# ChatGPT-4

ChatGPT 4 ▾



You

Is the Buffalo sentence structurally ambiguous?



ChatGPT

Yes, the "Buffalo buffalo Buffalo buffalo buffalo buffalo Buffalo buffalo" sentence is an example of structural ambiguity. Structural ambiguity arises when a sentence can be parsed in more than one way due to its syntactic structure. In this sentence, the repetition and multiple meanings of the word "Buffalo" allow for different interpretations of how the words relate to each other grammatically.

The main source of ambiguity stems from the word "buffalo" serving as a noun (referring to the animal, or more specifically, the bison), a proper noun (referring to the city of Buffalo, New York), and a verb (meaning to bully or confuse). The lack of punctuation and the unusual repetition make it challenging to immediately discern the intended grammatical structure.

The sentence can be understood correctly by parsing it as follows: "[Buffalo buffalo] [Buffalo buffalo buffalo] buffalo [Buffalo buffalo]." Here, the first and last "Buffalo buffalo" refer to bison from Buffalo, the second "Buffalo buffalo" acts as a modifier to describe which bison are being buffaloes (bullied), and the verb "buffalo" in the middle describes the action. However, because of its repetitive and unconventional structure, it's structurally ambiguous and can initially seem nonsensical or confusing.

