The GB-wocky [an annotated version]

Luke Swartz

'Twas lemma[1], and the Turing Test[2]
Did parse[3] and recurse[4] in the stack[5];
All merge sort[6] were the qualias[7]
And the SYN-SEM-STRUC[8] hack.

"Beware the GB[9]-wock, my son!
The X-bar[10] nodes, the words that trace[11]!
Beware the CFG[12], and shun
The nativist[13] base case[14]!"

He took his (char *)[15] sword in hand;
Long time the lexeme[16] foe he sought—

So rested he by the depth-first[17] tree,
And stood awhile in thought.

And, as in dative[18] thought he stood,
The GB-wock, with eyes of flame,
Came priming[19] through the dualist[20] wood,
And compiled[21] as it came!

One two! One two! And through and through
The (char *) blade went neural net[22]!
He left it dead, and with its HEAD[23]
He went truth-tabling[24] back.

"And hast thou slain the GB-wock?
Come to my arms, my big-O[25] boy!
O BST[26]! NP[27]! Tarski[28]!"
He dir-graphed[29] in his joy.

'Twas lemma, and the Turing Test
Did parse and recurse in the stack;
All merge sort were the qualias
And the SYN-SEM-STRUC hack.

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[1] An "auxiliary proposition," or a sub-proof within a larger proof

[2] Alan Turing famously proposed a game, now called the "Turing Test," in which people try to determine whether they are talking with a computer or a human, as a test of Artificial Intelligence.

[3] To parse means to resolve a sentence according to a certain grammar; humans parse sentences in natural languages, and computer compilers parse expressions in programming languages

[4] Recursion is a means of programming (similar to mathematical induction) where a problem's sub-problems are smaller versions of the original problem; in practice, this involves a function/procedure "calling itself"

[5] In computer science, the stack is where local variables are kept; "stacks" are also used in "push down automata," a kind of finite state machine.

[6] Merge-sort is an algorithm for sorting a list (say, an array) using a comparison function, which involves splitting it up into halves recursively, and then merging the tiny pieces into a sorted whole.

[7] A qualia is "what it's like" to experience something. Various philosophers dispute whether they exist or not.

[8] The SYN-SEM-STRUC is a feature in the simplified version of HPSG (Head Phrase Structure Grammar) taught in Ling 120.

[9] GB is Government and Binding, the latest syntax theory from the Chomsky/MIT school; many Stanford linguists are skeptical about GB as a theory, as it is not particularly data-driven. We don't really learn about it in Sym Sys, but it sounds—perhaps fittingly—like "jabber."

[10] X-bar theory is another Chomsky/MIT theory we don't really study so much at Stanford; it argues that each grammatical type (such as verbs, determiners, prepositions, etc.) constructs phrases in essentially the same way.

[11] "Traces" are another feature of transformational grammars in the Chomsky/MIT school, where phrases move from one place in the sentence to another, thus having a different "surface" structure from the "deep" structure; they leave "traces" in their wake. Interesting fact: Tom Wasow's dissertation at MIT was the first place traces were proposed, although today he's highly skeptical of them and says he "never really liked traces"!

[12] Context-Free Grammar; a grammar in which consists of rules A→B, where B can consist of some combination of other rules (like A) and literals; A can be replaced by B no matter what context it appears in, hence the name "context-free."

[13] Nativists argue that human language acquisition largely depends on innate features of the brain, not general learning capabilities. Steven Pinker's *The Language Instinct* is a great introduction to nativist arguments.

[14] The base case in induction or recursion is what tells one when to stop recursing, lest one be caught in an infinite loop!

[15] (char *) in C is a pointer to a variable of type char, which is another name for a string.

[16] A lexeme is a "linguistically meaningful unit" in the lexicon (or vocabulary) of a language. In English, lexeme is more or less a synonym for "word," although meaningful parts of words (like "anti-" in "antichrist") are also lexemes.

[17] Given a tree (an abstract data structure used in discrete math and computer science), one can visit every node in one of two simple ways: depth first (going down to the deepest layer first) or breadth-first (going through each layer in turn).

[18] The dative case is used in sentences like "Kim gave Pat the book," meaning (roughly) "Kim gave the book to Pat."

[19] Priming is a psychological theory that when one is exposed to a certain kind of stimulus, one is more likely to respond to similar stimuli.

[20] Dualists believe in dualism, or that the mind and body are separate entities. Also, the Stanford undergraduate philosophy journal is called *The Dualist*.

[21] Compiling in computer science is translating a programming language into a machine (or assembly) language that the computer's microprocessor can directly execute.

[22] Neural nets are structures used in Artificial Intelligence for machine learning, whose connections are modeled (somewhat) on the connections between neurons in the brain.

[23] HEAD is another feature structure in HPSG.

[24] Truth tables are enumerations of the possible truth values of a proposition in logic. For example, a truth table for one Boolean variable X would be either T or F.

[25] big-O is a way of representing the "asymptotic run time" of an algorithm; that is, how long it takes to run the algorithm in terms of the input size (n) for very large n.

[26] Binary search tree; a data structure where each parent node is greater than its left sub-branch and less than its right sub-branch.

[27] Both Noun Phrase (a phrase with a noun as its head) and Nondeterministic Polynomial (as in NP-complete, meaning that the problem can be solved by a nondeterministic Turing machine in polynomial time).

[28] Alfred Tarski was a famous logician, made famous to Stanford students by the program Tarski's World in *Language, Proof, and Logic*.

[29] A directed graph is one in which each edge between nodes is directed (i.e. it "has an arrow" pointing one way or another).