So, is (+ 1 2) a list of three things or code to add two numbers?

So, is (+12) a list of three things or code to add two numbers?

Both!

Lisp

Program and data are identical in Lisp

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Lisp compilers and interpreters are usually written in Lisp In fact, in many Lisps there is a function called eval that takes some Lisp code (a list) and evaluates it

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(print (eval (read)))
in a loop
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Not least you can change or provide an alternative definition of eval

Think about this: Lisp is a language that allows you to change the way it works

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As it runs

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But don't! Most people have problems writing programs when they think they understand what an expression means: if that changes underfoot you have no chance

You could even redefine ${\tt read}$ to allow a different syntax to Lisp: see Rlisp

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Many ideas are first tried out in Lisp before being moved into a newly designed language

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It's a matter of context: if you ask eval to evaluate it, it's code; else it's a list

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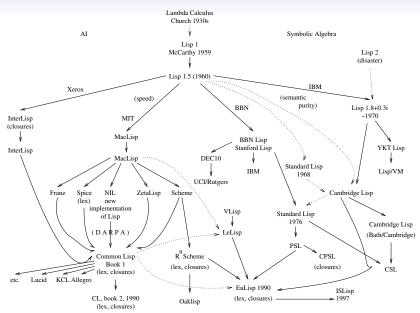
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With Lisp there's all kinds of variation



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These are superficial differences

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Lisps come in all kinds of shapes and sizes: but they are all Lisps

There are in fact more than a few standards for Lisp

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The two widely used ones are

- Common Lisp
- Scheme

Standards

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Roughly speaking, Common Lisp is the union of all the features of all the Lisps: no vendor wanted their special features to be left out

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This was version 1, as documented in the book "Common Lisp: The Language" (CLtL1)

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The Java standard is now larger...

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To be included in Scheme, a feature must be essential and not implementable in terms of existing features

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R6RS includes (not to universal acclaim) specifications of library functions, so is longer, but the basic language part is just 90 pages long

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The large is "focused on the practical needs of mainstream software development", and is closer to R6RS

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In Scheme, a continuation is a first class object, meaning a program can manipulate its own flow of control programmatically

Continuations can be used to implement other, more understandable, things, like non-local jumps and parallel execution

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But the idea is that continuations replace a collection of other concepts; and allow the implementation of new and different concepts

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The book "Structure and Interpretation of Computer Programs" by Abelson and Sussman should be read by all Computer Scientists

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Just as there are many C compilers and a few Java compilers, there are many different implementations of Common Lisp and Scheme

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Reality is never so neat

Lisp

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There might be

• bugs in the implementation

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- things not defined or not clear in the standard
- things deliberately left undefined in the standard (e.g., size
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 assumption that an int is 4 bytes)
- deliberate features in the implementation designed for lock-in by the vendor

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And this applies to all languages, particularly C

Lisp

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Each Level is a subset of the next, so we can pick the size we need

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The standard lives in a modified form as ISLisp, ISO standard ISO/IEC 13816:1997(E)

EuLisp strongly influenced a language called Dylan, developed by Apple

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Dylan was eventually dropped by Apple, but provided impetus to the development of a new language, called Java

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Standard Lisp was eventually eclipsed by Common Lisp

