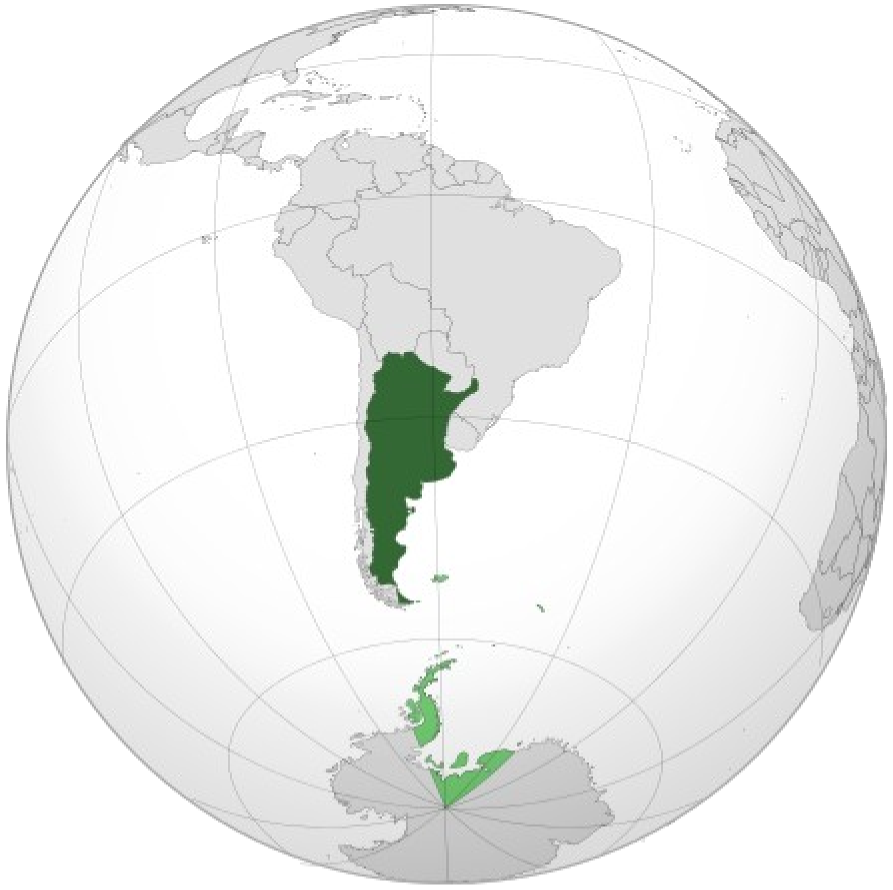
https://www.flickr.com/photos/hyshqa/4939751212/

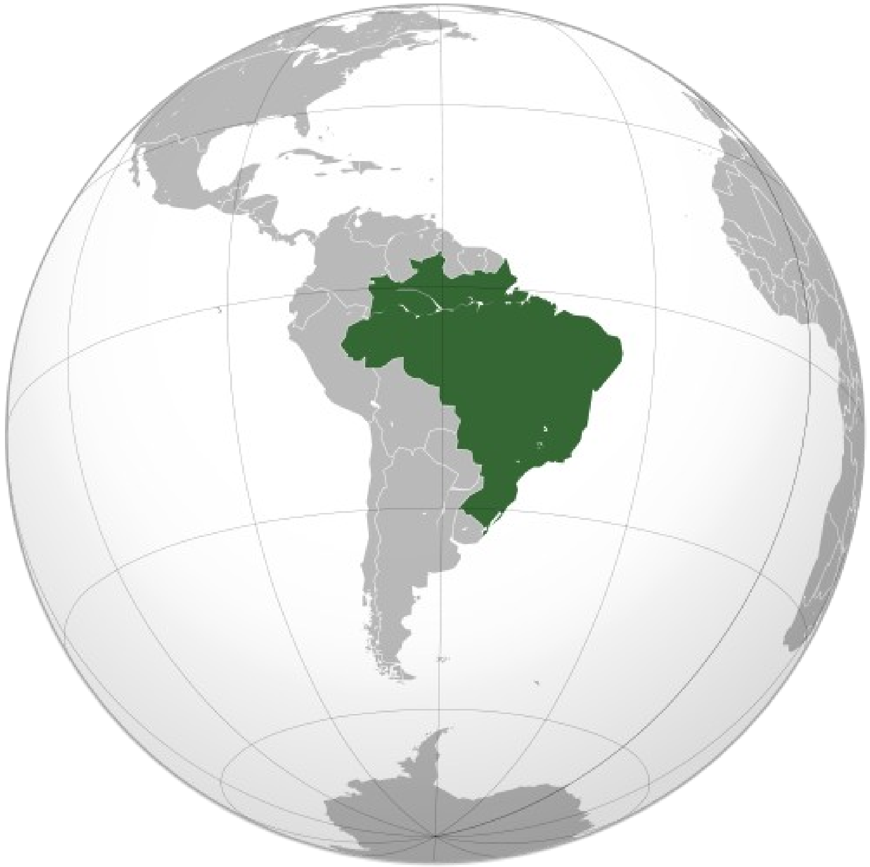
Big Hairy Yaks

Carl Mäsak
GPW 2016-03-10

Before we begin, a correction...

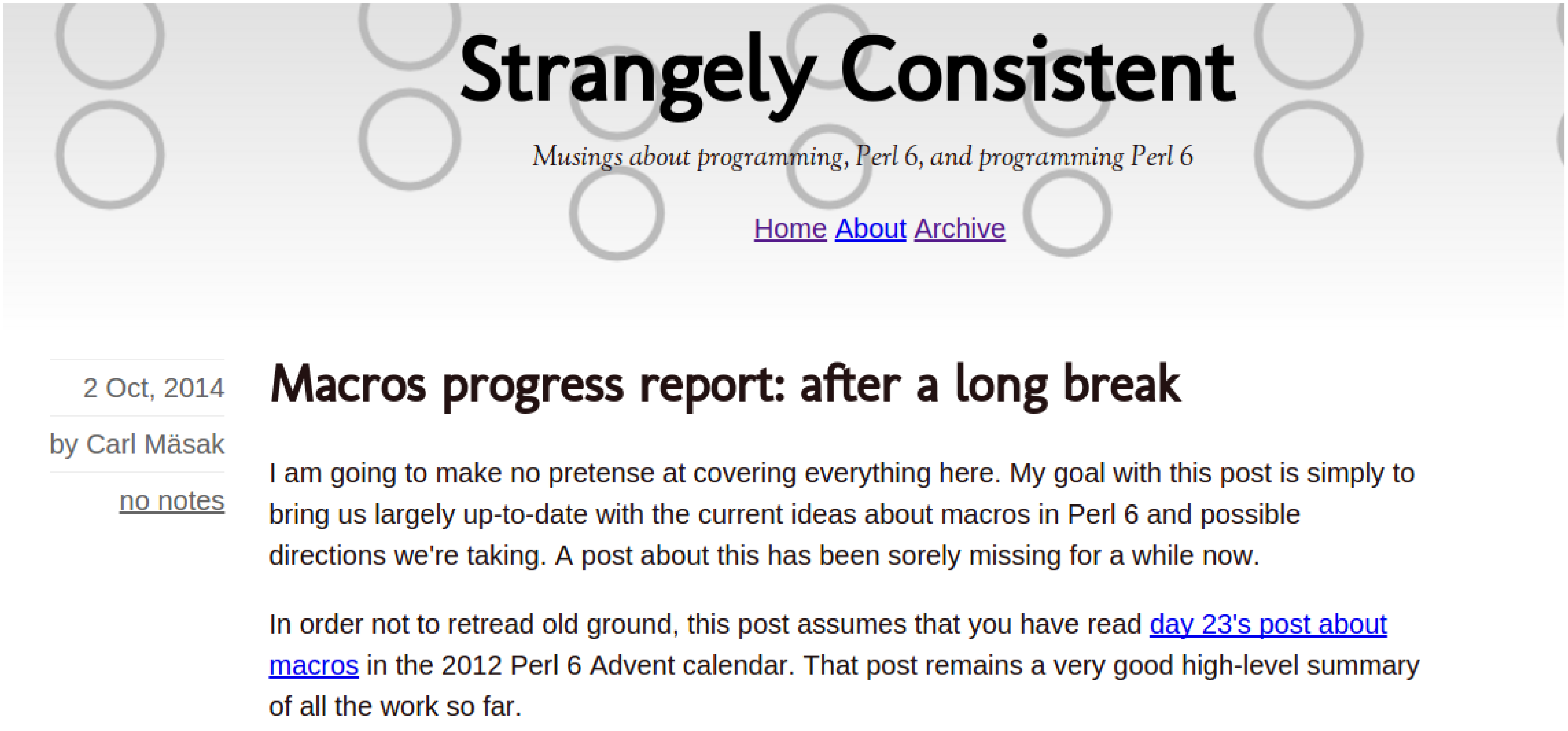


Argentina



Brazil

A little bit of background...



Strangely Consistent

Musings about programming, Perl 6, and programming Perl 6

Home About Archive

2 Oct, 2014

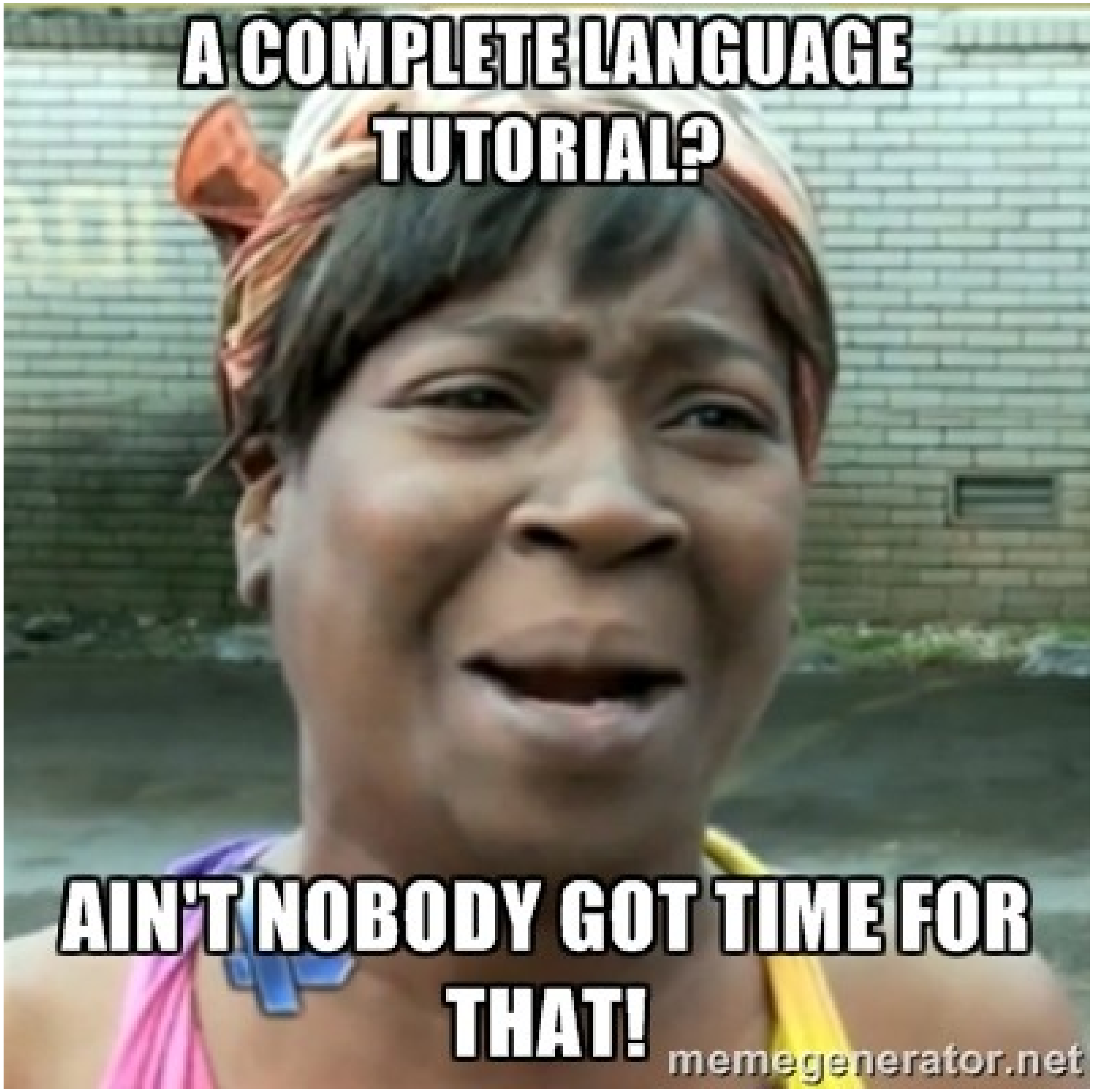
by Carl Mäsak

no notes

Macros progress report: after a long break

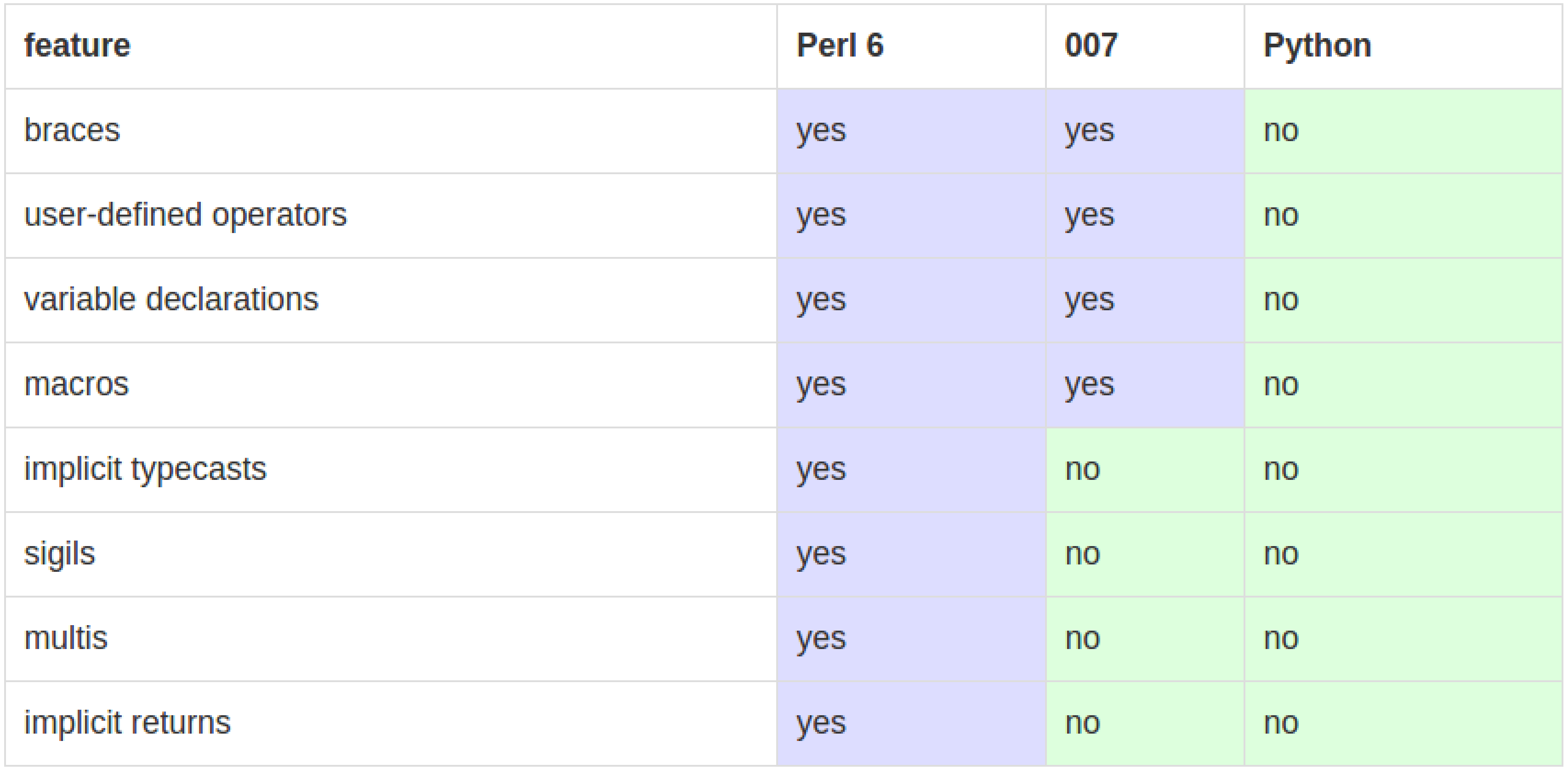
I am going to make no pretense at covering everything here. My goal with this post is simply to bring us largely up-to-date with the current ideas about macros in Perl 6 and possible directions we're taking. A post about this has been sorely missing for a while now.

In order not to retread old ground, this post assumes that you have read day 23's post about macros in the 2012 Perl 6 Advent calendar. That post remains a very good high-level summary of all the work so far.


A COMPLETE LANGUAGE TUTORIAL?
AIN'T NOBODY GOT TIME FOR THAT!
memegenerator.net

Freely borrowing features

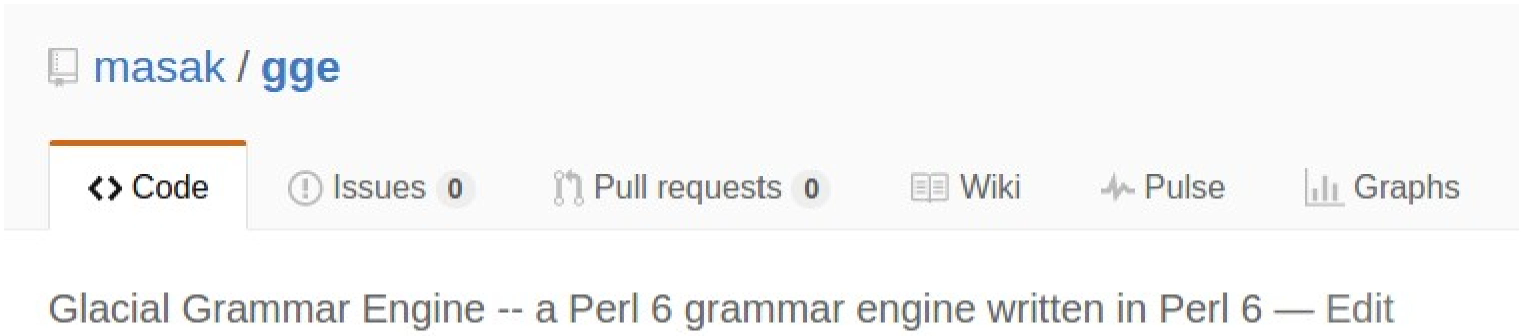
007 looks like a mix of Perl, Python, and JavaScript.



feature	Perl 6	007	Python
braces	yes	yes	no
user-defined operators	yes	yes	no
variable declarations	yes	yes	no
macros	yes	yes	no
implicit typecasts	yes	no	no
sigils	yes	no	no
multis	yes	no	no
implicit returns	yes	no	no

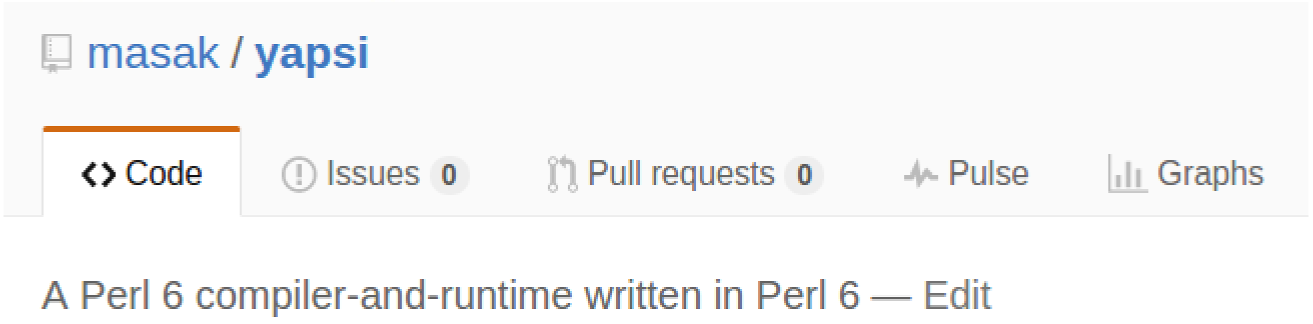
(live demo)

Everything I've done leads up to this


masak / gge

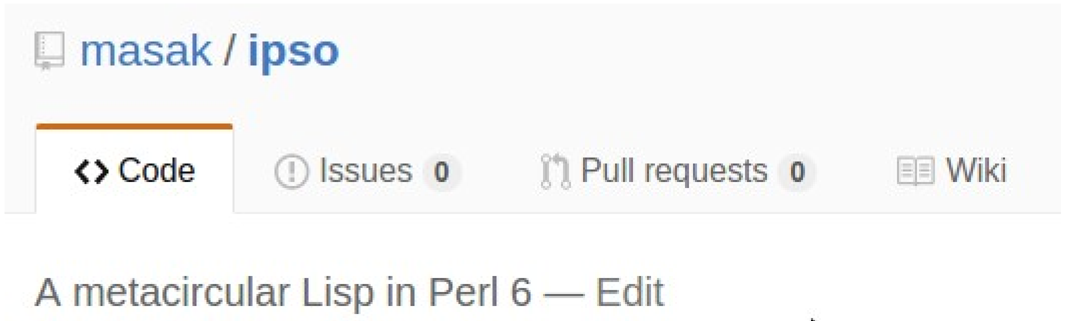
Code | Issues 0 | Pull requests 0 | Wiki | Pulse | Graphs

Glacial Grammar Engine -- a Perl 6 grammar engine written in Perl 6 — Edit


masak / yapsi

Code | Issues 0 | Pull requests 0 | Pulse | Graphs

A Perl 6 compiler-and-runtime written in Perl 6 — Edit

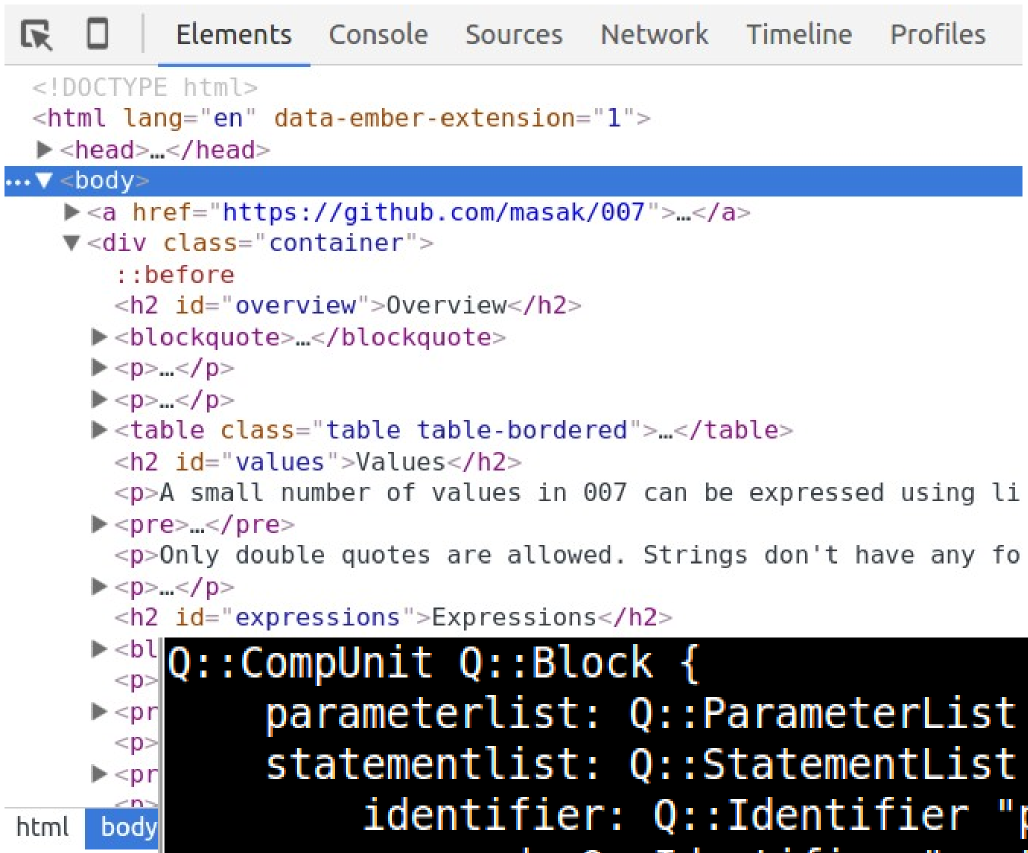

masak / ipso

Code | Issues 0 | Pull requests 0 | Wiki

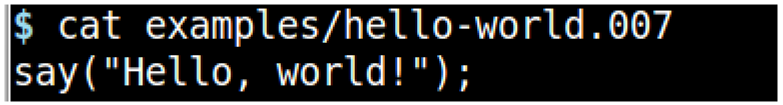
A metacircular Lisp in Perl 6 — Edit

Secret sauce: the AST format

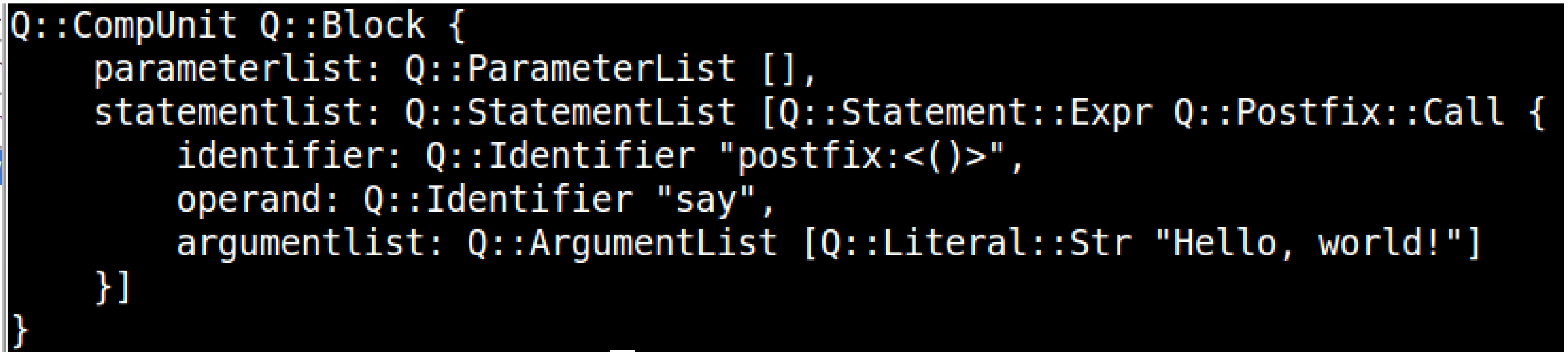
Homoiconic? I *think* so...



```
<!DOCTYPE html>
<html lang="en" data-ember-extension="1">
 ▶<head>…</head>
…▼<body>
   ▶<a href="https://github.com/masak/007">…</a>
   ▼<div class="container">
      ::before
      <h2 id="overview">Overview</h2>
     ▶<blockquote>…</blockquote>
     ▶<p>…</p>
     ▶<p>…</p>
     ▶<table class="table table-bordered">…</table>
      <h2 id="values">Values</h2>
      <p>A small number of values in 007 can be expressed using li
     ▶<pre>…</pre>
      <p>Only double quotes are allowed. Strings don't have any fo
     ▶<p>…</p>
      <h2 id="expressions">Expressions</h2>
     ▶<bl
      <p>
     ▶<pr
      <p>
     ▶<pr
```

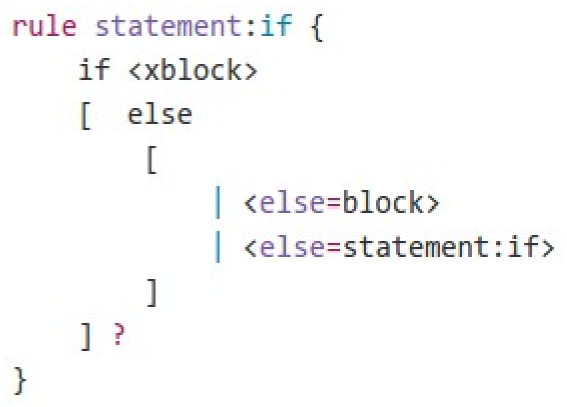


```
$ cat examples/hello-world.007
say("Hello, world!");
```

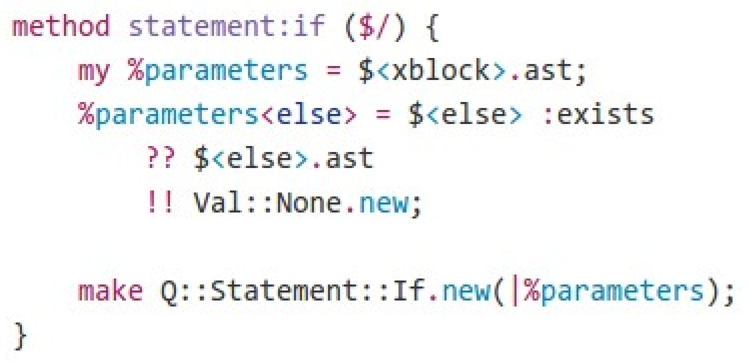


```
Q::CompUnit Q::Block {
    parameterlist: Q::ParameterList [],
    statementlist: Q::StatementList [Q::Statement::Expr Q::Postfix::Call {
        identifier: Q::Identifier "postfix:<()>",
        operand: Q::Identifier "say",
        argumentlist: Q::ArgumentList [Q::Literal::Str "Hello, world!"]
    }]
}
```

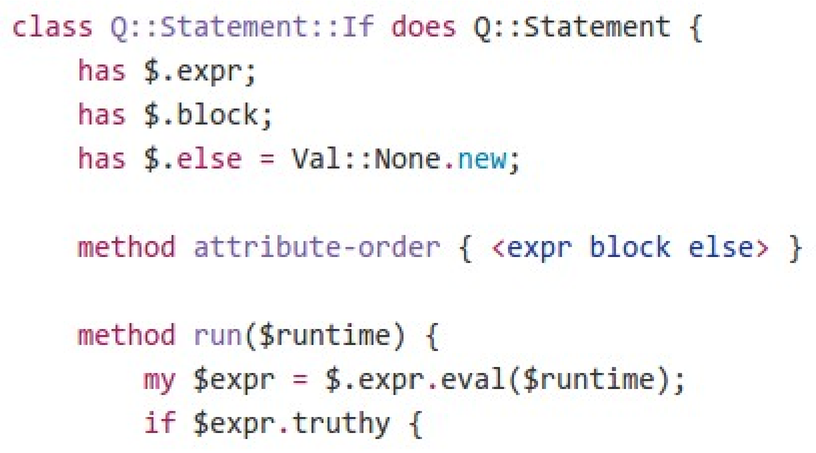
Well-kept secret: this is easy



```
rule statement:if {
    if <xblock>
    [  else
        [
            | <else=block>
            | <else=statement:if>
        ]
    ] ?
}
```

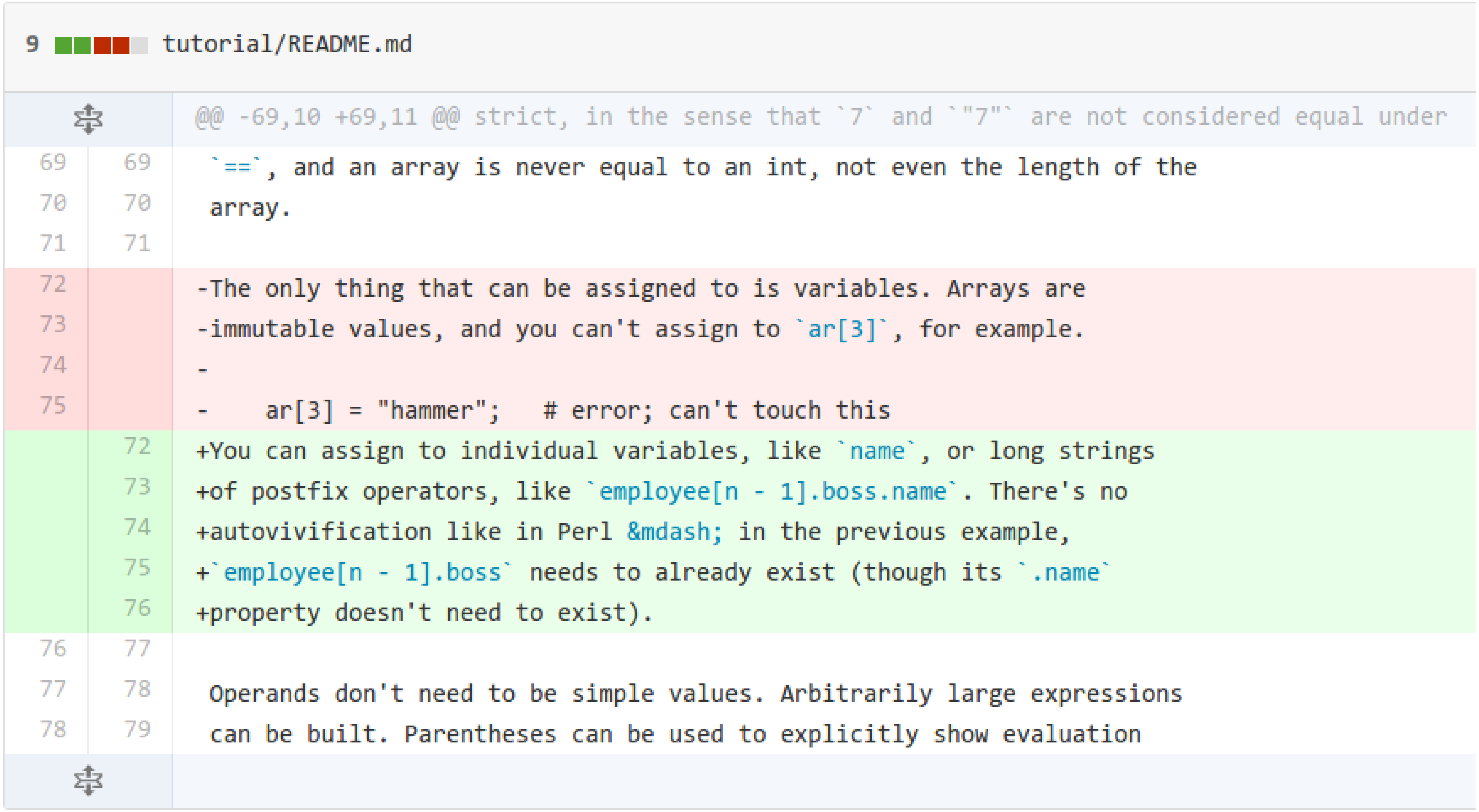


```
method statement:if ($/) {
    my %parameters = $<xblock>.ast;
    %parameters<else> = $<else> :exists
        ?? $<else>.ast
        !! Val::None.new;

    make Q::Statement::If.new(|%parameters);
}
```



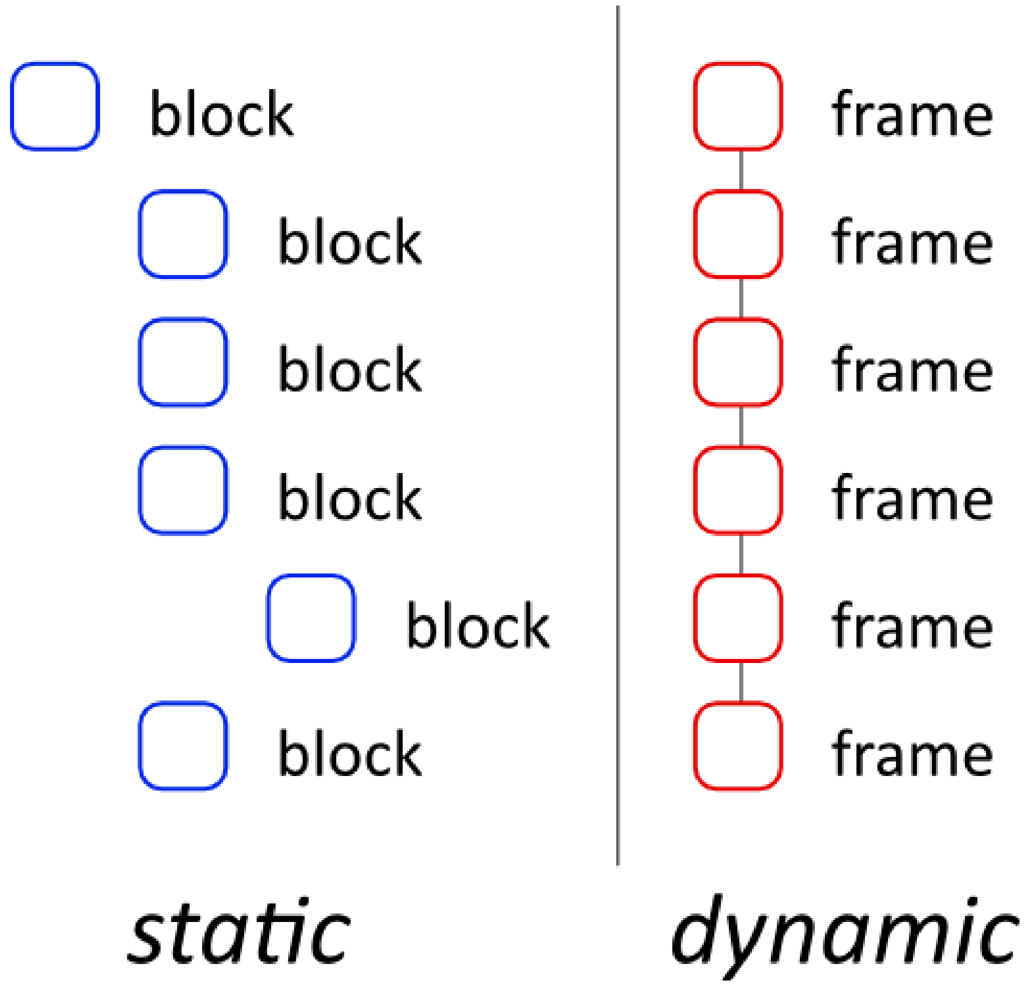
```
class Q::Statement::If does Q::Statement {
    has $.expr;
    has $.block;
    has $.else = Val::None.new;

    method attribute-order { <expr block else> }

    method run($runtime) {
        my $expr = $.expr.eval($runtime);
        if $expr.truthy {
```

Easy: index chains and assignment

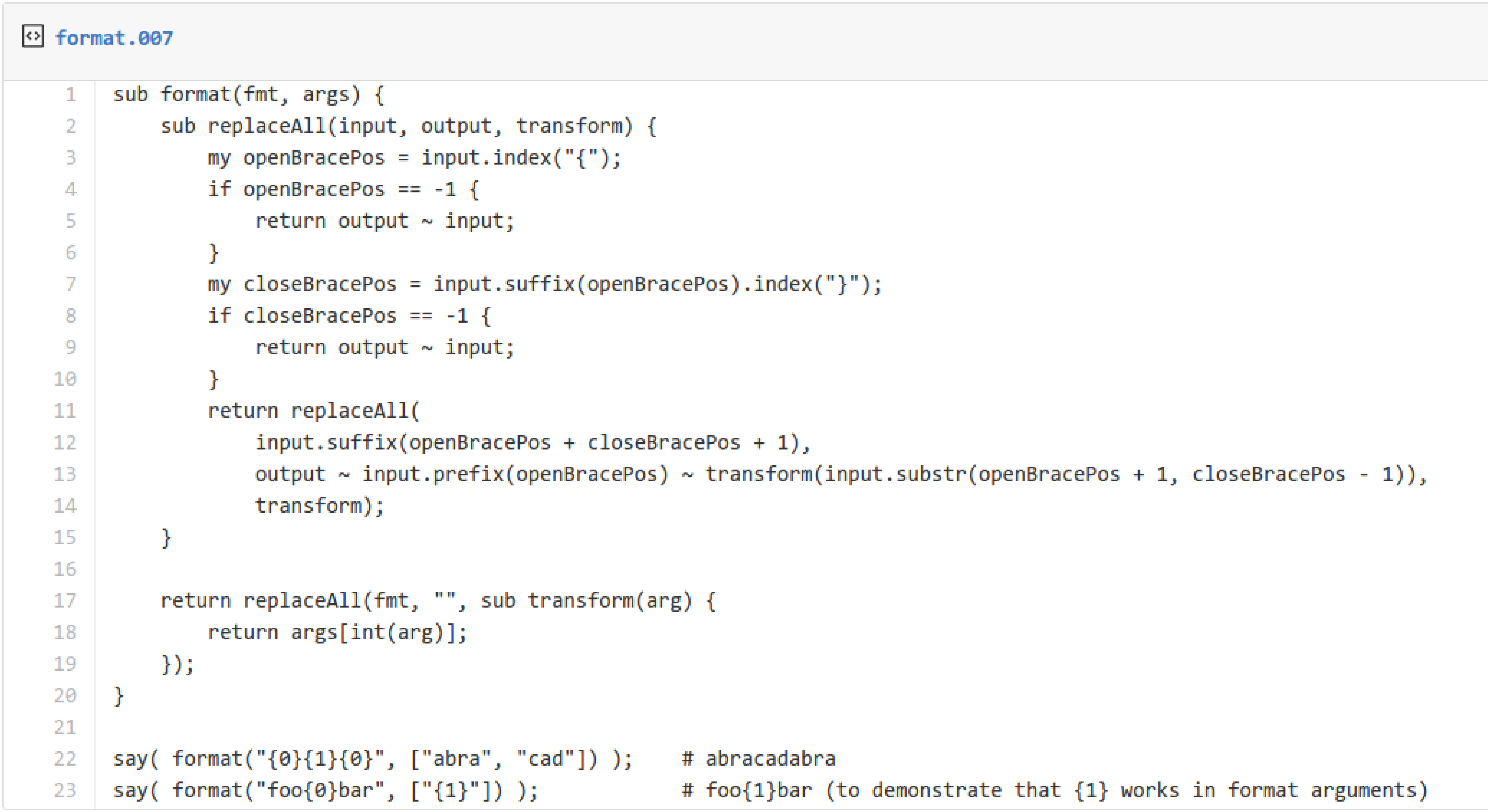


```
9 🟩🟩🟥🟥 tutorial/README.md

@@ -69,10 +69,11 @@ strict, in the sense that `7` and `"7"` are not considered equal under
 `==`, and an array is never equal to an int, not even the length of the
 array.

-The only thing that can be assigned to is variables. Arrays are
-immutable values, and you can't assign to `ar[3]`, for example.
-
-    ar[3] = "hammer";    # error; can't touch this
+You can assign to individual variables, like `name`, or long strings
+of postfix operators, like `employee[n - 1].boss.name`. There's no
+autovivification like in Perl &mdash; in the previous example,
+`employee[n - 1].boss` needs to already exist (though its `.name`
+property doesn't need to exist).

 Operands don't need to be simple values. Arbitrarily large expressions
 can be built. Parentheses can be used to explicitly show evaluation
```

Some less easy things

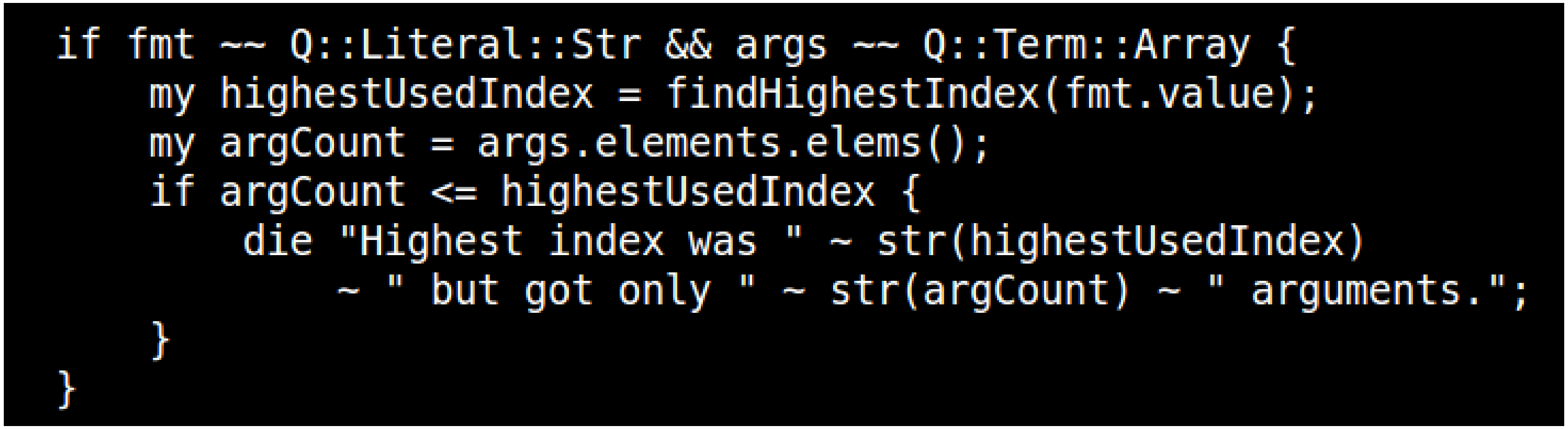


Macros: easy


format.007

```
sub format(fmt, args) {
    sub replaceAll(input, output, transform) {
        my openBracePos = input.index("{");
        if openBracePos == -1 {
            return output ~ input;
        }
        my closeBracePos = input.suffix(openBracePos).index("}");
        if closeBracePos == -1 {
            return output ~ input;
        }
        return replaceAll(
            input.suffix(openBracePos + closeBracePos + 1),
            output ~ input.prefix(openBracePos) ~ transform(input.substr(openBracePos + 1, closeBracePos - 1)),
            transform);
    }

    return replaceAll(fmt, "", sub transform(arg) {
        return args[int(arg)];
    });
}

say( format("{0}{1}{0}", ["abra", "cad"]) );    # abracadabra
say( format("foo{0}bar", ["{1}"]) );            # foo{1}bar (to demonstrate that {1} works in format arguments)
```

Compile-time error checking

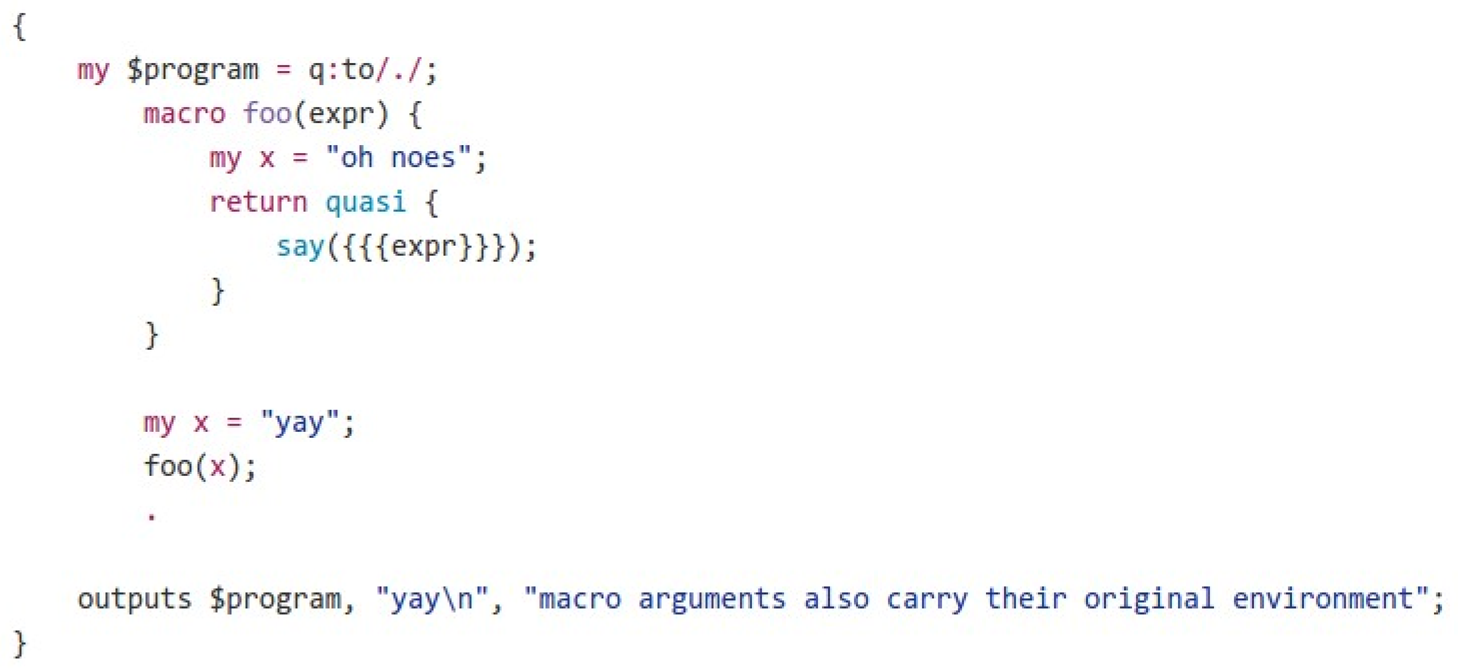


```
if fmt ~~ Q::Literal::Str && args ~~ Q::Term::Array {
    my highestUsedIndex = findHighestIndex(fmt.value);
    my argCount = args.elements.elems();
    if argCount <= highestUsedIndex {
        die "Highest index was " ~ str(highestUsedIndex)
            ~ " but got only " ~ str(argCount) ~ " arguments.";
    }
}
```

Closures

(live demo)

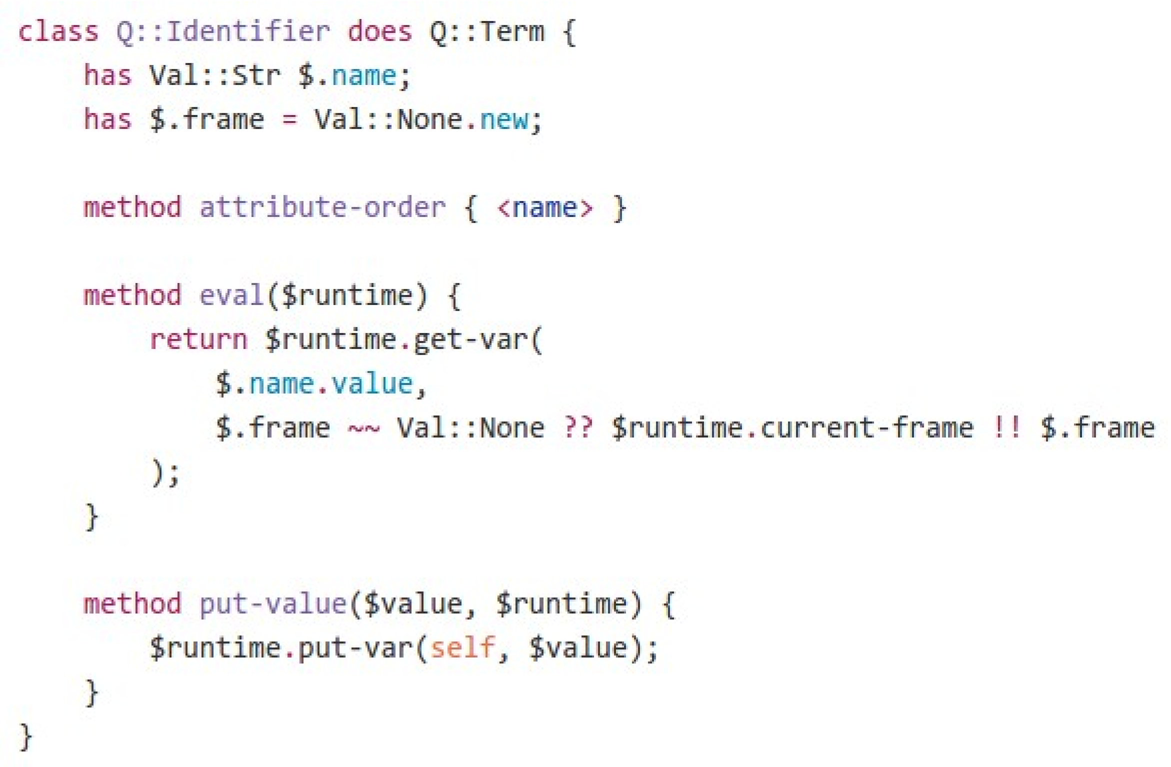
Hygiene



```
{
    my $program = q:to/./;
        macro foo(expr) {
            my x = "oh noes";
            return quasi {
                say({{{expr}}});
            }
        }

        my x = "yay";
        foo(x);
        .

    outputs $program, "yay\n", "macro arguments also carry their original environment";
}
```

This is the case of a variable. Also true for subs, operators, macros...

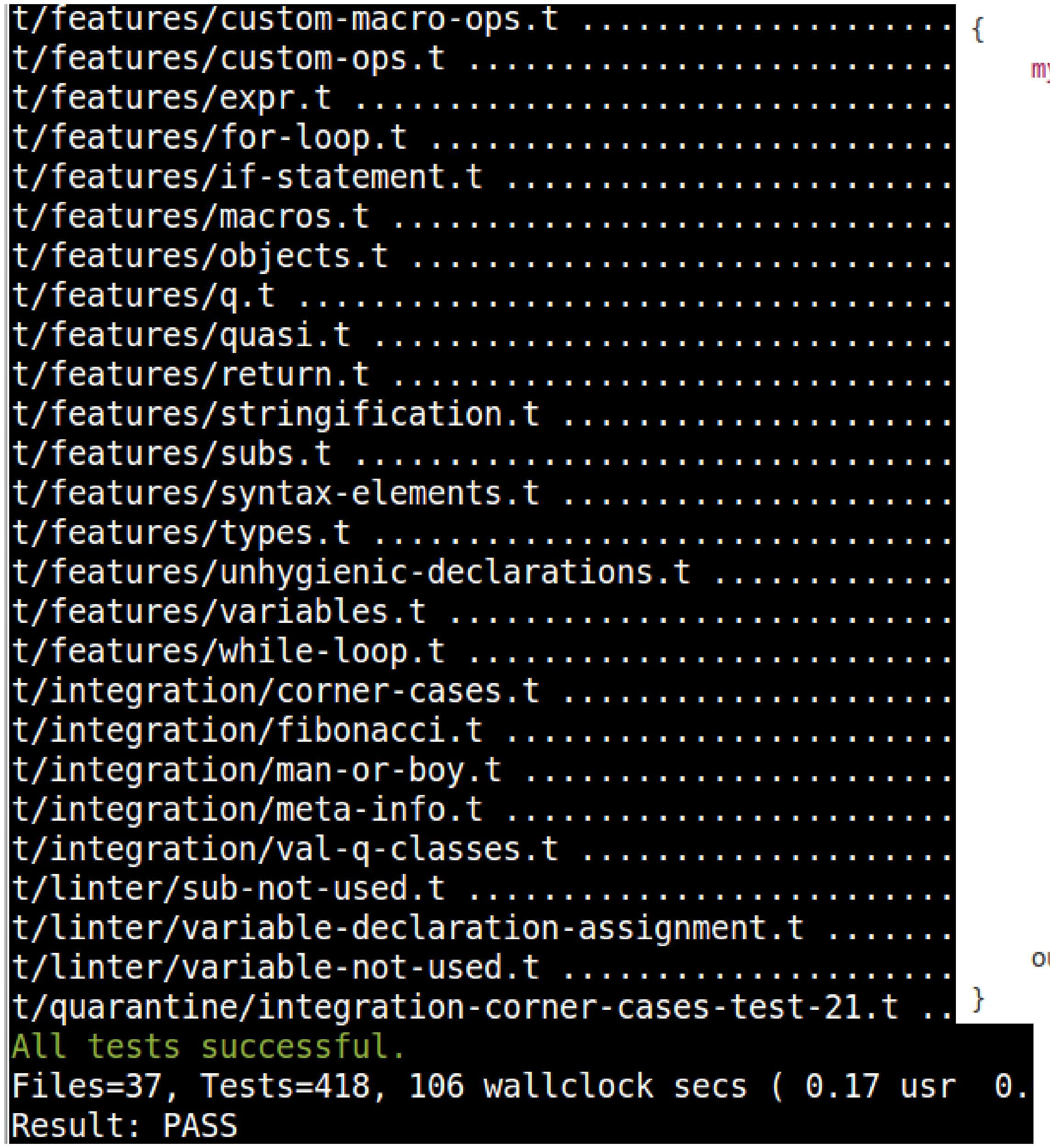
Solution: identifiers with context



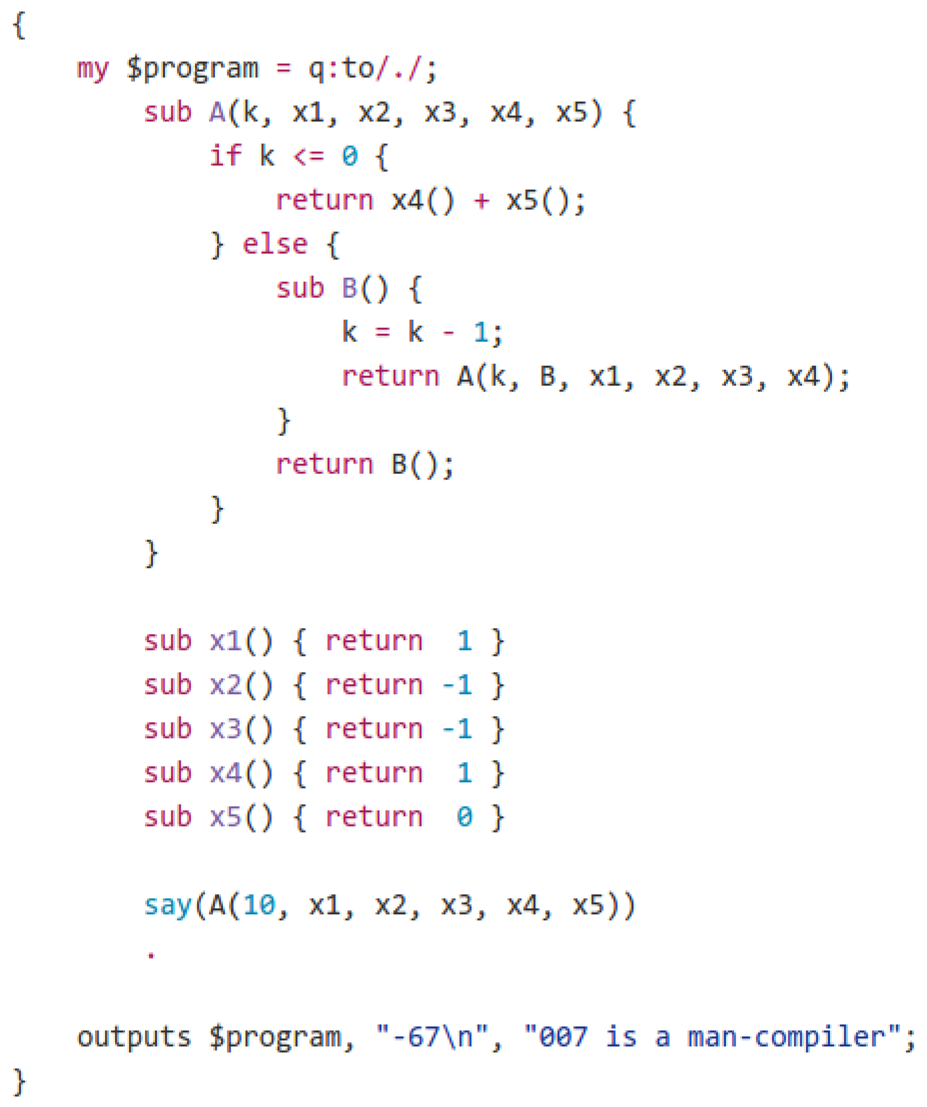
```
class Q::Identifier does Q::Term {
    has Val::Str $.name;
    has $.frame = Val::None.new;

    method attribute-order { <name> }

    method eval($runtime) {
        return $runtime.get-var(
            $.name.value,
            $.frame ~~ Val::None ?? $runtime.current-frame !! $.frame
        );
    }

    method put-value($value, $runtime) {
        $runtime.put-var(self, $value);
    }
}
```

A variable knows the context in which it was created.

Testing



```
t/features/custom-macro-ops.t ......................
t/features/custom-ops.t ............................
t/features/expr.t ..................................
t/features/for-loop.t ..............................
t/features/if-statement.t ..........................
t/features/macros.t ................................
t/features/objects.t ...............................
t/features/q.t .....................................
t/features/quasi.t .................................
t/features/return.t ................................
t/features/stringification.t .......................
t/features/subs.t ..................................
t/features/syntax-elements.t .......................
t/features/types.t .................................
t/features/unhygienic-declarations.t ...............
t/features/variables.t .............................
t/features/while-loop.t ............................
t/integration/corner-cases.t .......................
t/integration/fibonacci.t ..........................
t/integration/man-or-boy.t .........................
t/integration/meta-info.t ..........................
t/integration/val-q-classes.t ......................
t/linter/sub-not-used.t ............................
t/linter/variable-declaration-assignment.t .........
t/linter/variable-not-used.t .......................
t/quarantine/integration-corner-cases-test-21.t ..
All tests successful.
Files=37, Tests=418, 106 wallclock secs ( 0.17 usr  0.
Result: PASS
```

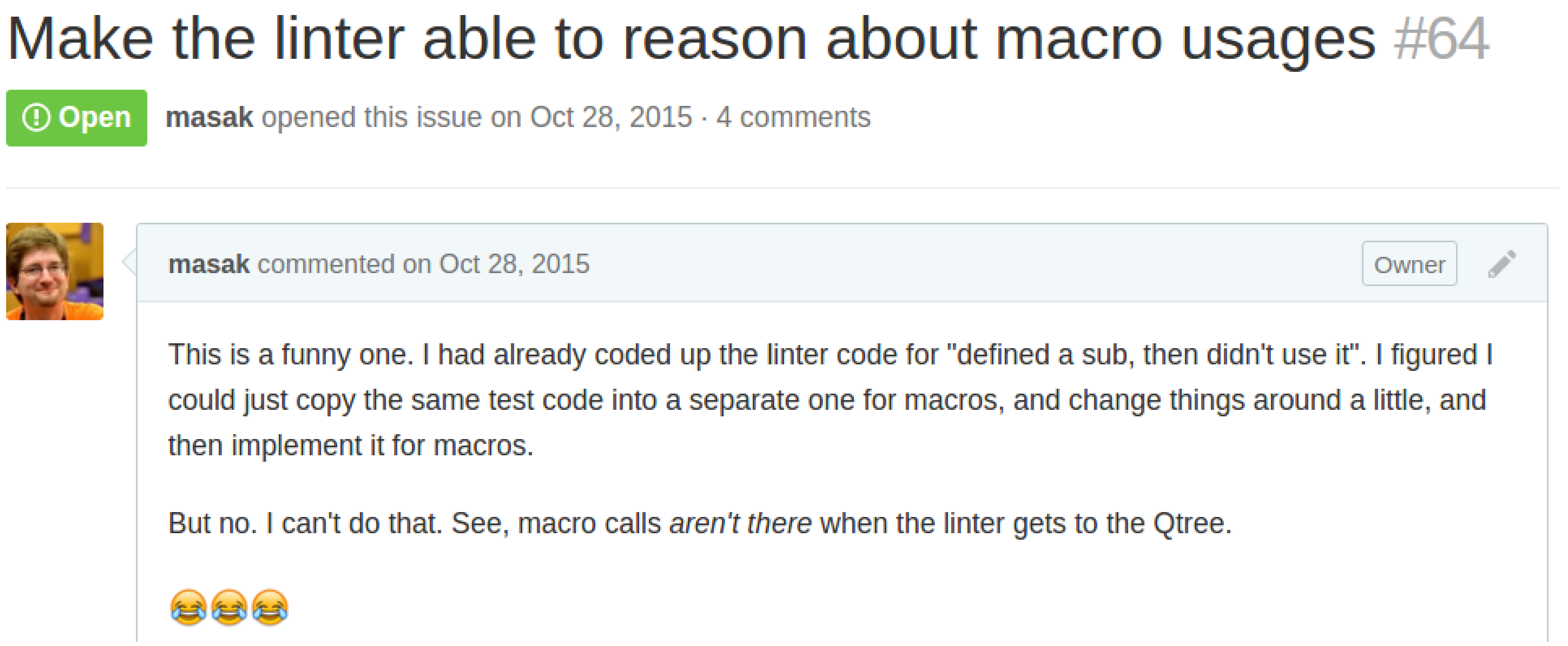


```
{
    my $program = q:to/./;
        sub A(k, x1, x2, x3, x4, x5) {
            if k <= 0 {
                return x4() + x5();
            } else {
                sub B() {
                    k = k - 1;
                    return A(k, B, x1, x2, x3, x4);
                }
                return B();
            }
        }

        sub x1() { return  1 }
        sub x2() { return -1 }
        sub x3() { return -1 }
        sub x4() { return  1 }
        sub x5() { return  0 }

        say(A(10, x1, x2, x3, x4, x5))
        .

    outputs $program, "-67\n", "007 is a man-compiler";
}
```

Tests I didn't expect

```
my @lines-ending-with-ws;
for find(".", /".pm" $/) -> $file {
    for $file.IO.lines.kv -> $i, $line {
        if $line ~~ /\h $/ {
            push @lines-ending-with-ws,
                "$file {$i + 1}: " ~
                $line.subst(/\h* $/, -> $/ { chr(0x2620) x $/.chars });
        }
    }
}

is @lines-ending-with-ws.join("\n"), "", "no whitespace at the end of a line in .pm files";
    my @classes = flat
        qx[perl6 -ne 'say ~$0 if /^class \h+ ("Q::" \S+)/' lib/_007/Q.pm].lines,
        qx[perl6 -ne 'say ~$0 if /^class \h+ ("Val::" \S+)/' lib/_007/Val.pm].lines;

    my @builtins = qx!perl6 -ne 'say ~$0 if /^ \h+ ([Val|Q] "::" <-[,]>+) "," \h* $/' lib/_007/Runtime/Builtins.pm!.lines;

    {
        my $missing-classes = (@builtins (-) @classes).keys.map({ "- $_" }).join("\n");
        is $missing-classes, "", "all built-in types are also classes";
    }

    {
        my $missing-builtins = (@classes (-) @builtins).keys.map({ "- $_" }).join("\n");
        is $missing-builtins, "", "all classes are also built-in types";
    }
```

Realization: raw AST vs cooked



Make the linter able to reason about macro usages #64

Open **masak** opened this issue on Oct 28, 2015 · 4 comments

masak commented on Oct 28, 2015

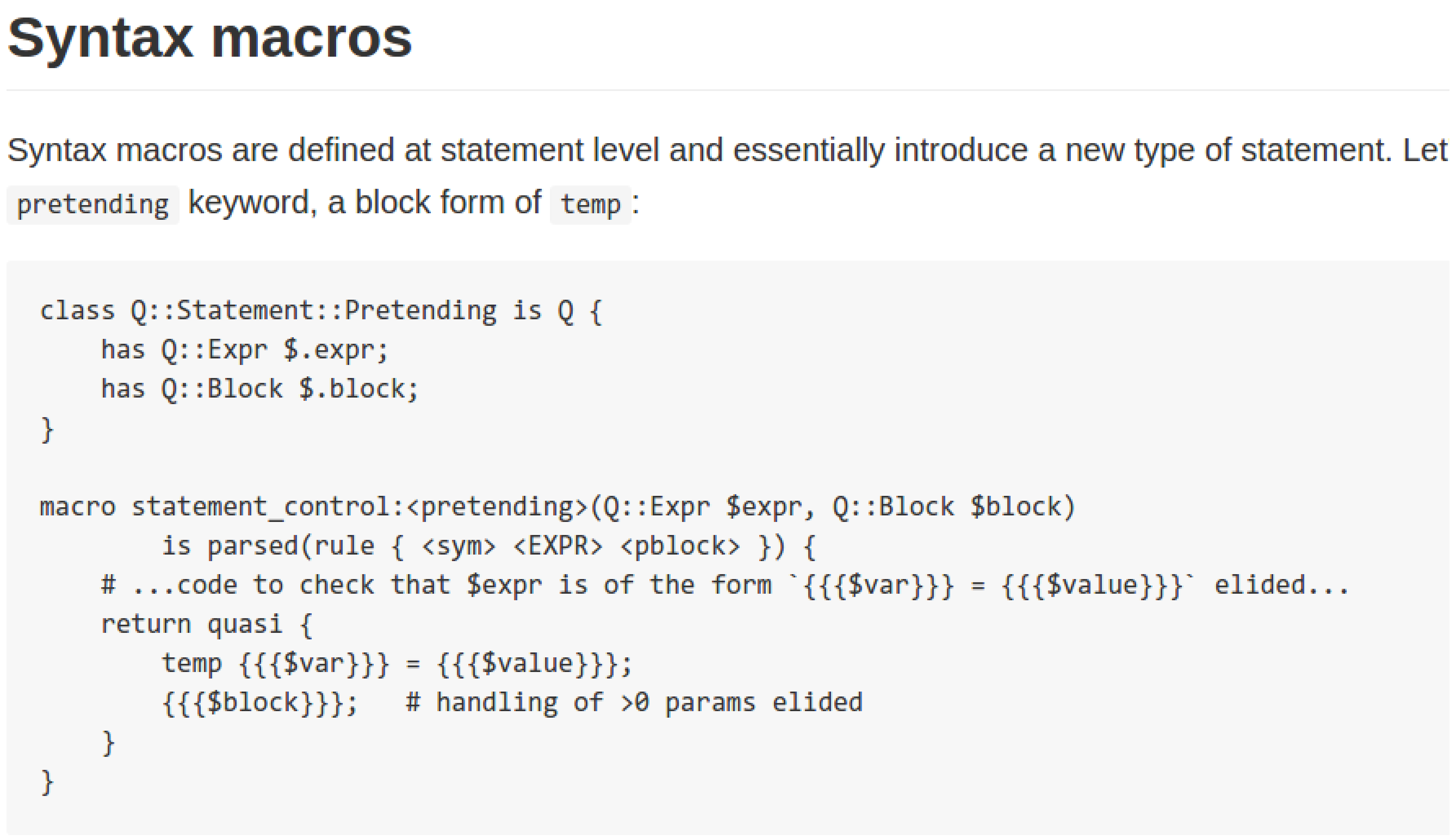
Owner

This is a funny one. I had already coded up the linter code for "defined a sub, then didn't use it". I figured I could just copy the same test code into a separate one for macros, and change things around a little, and then implement it for macros.

But no. I can't do that. See, macro calls *aren't there* when the linter gets to the Qtree.

😂😂😂

Future: syntax macros

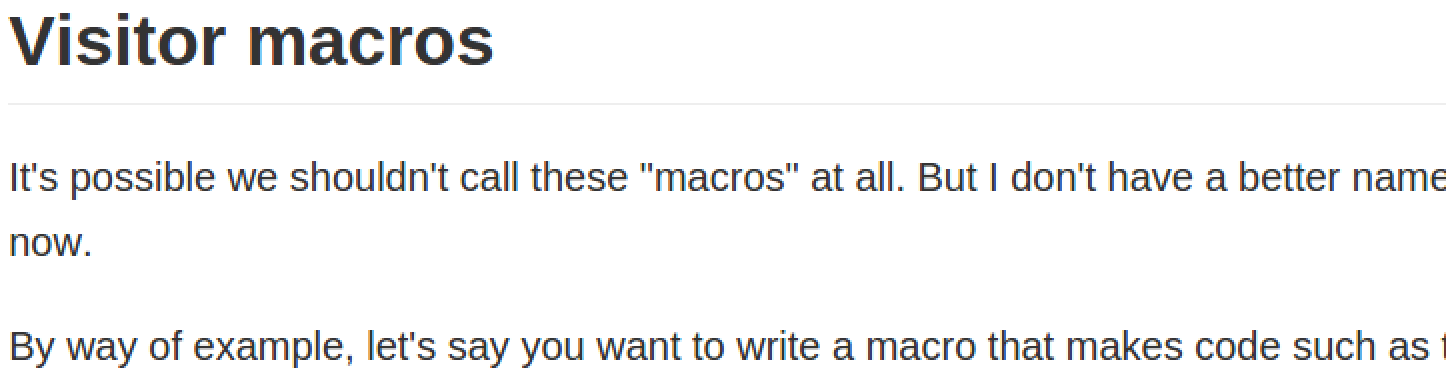


Syntax macros

Syntax macros are defined at statement level and essentially introduce a new type of statement. Let
`pretending` keyword, a block form of `temp`:

```
class Q::Statement::Pretending is Q {
    has Q::Expr $.expr;
    has Q::Block $.block;
}

macro statement_control:<pretending>(Q::Expr $expr, Q::Block $block)
        is parsed(rule { <sym> <EXPR> <pblock> }) {
    # ...code to check that $expr is of the form `{{{$var}}} = {{{$value}}}` elided...
    return quasi {
        temp {{{$var}}} = {{{$value}}};
        {{{$block}}};   # handling of >0 params elided
    }
}
```

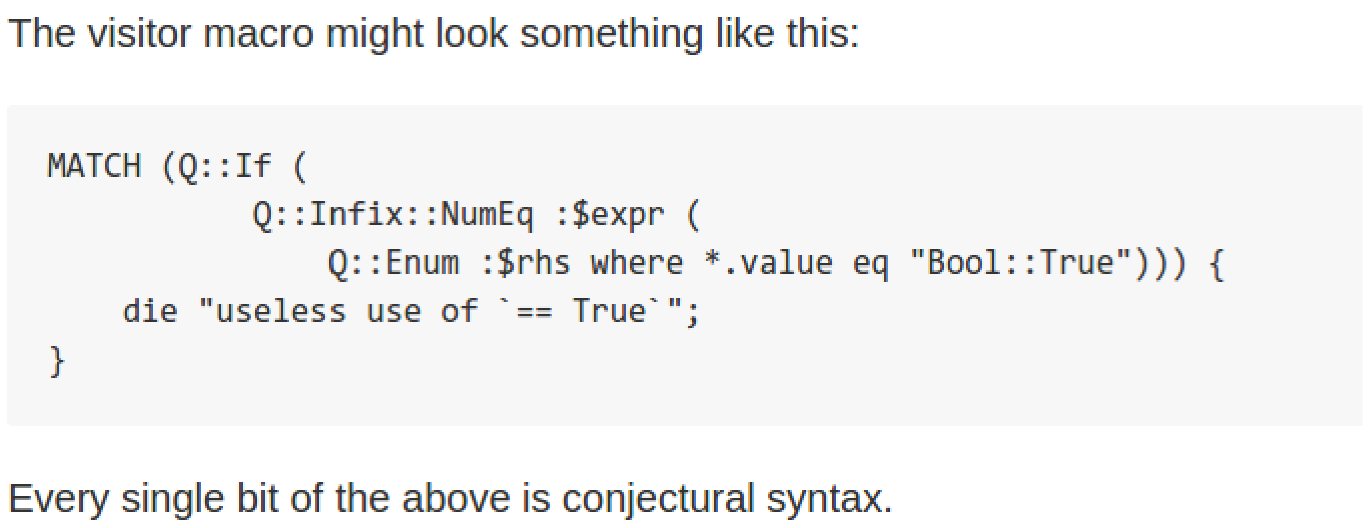
Future: visitor macros



Visitor macros

It's possible we shouldn't call these "macros" at all. But I don't have a better name
now.

By way of example, let's say you want to write a macro that makes code such as



The visitor macro might look something like this:

```
MATCH (Q::If (
           Q::Infix::NumEq :$expr (
               Q::Enum :$rhs where *.value eq "Bool::True"))) {
    die "useless use of `== True`";
}
```

Every single bit of the above is conjectural syntax.

Thank you!

Questions?

`https://github.com/masak/007`

Remember, pull requests
are love <3