

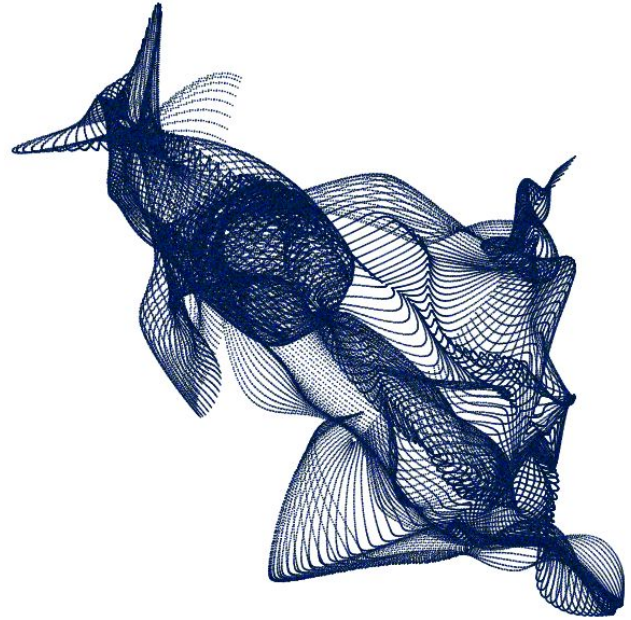


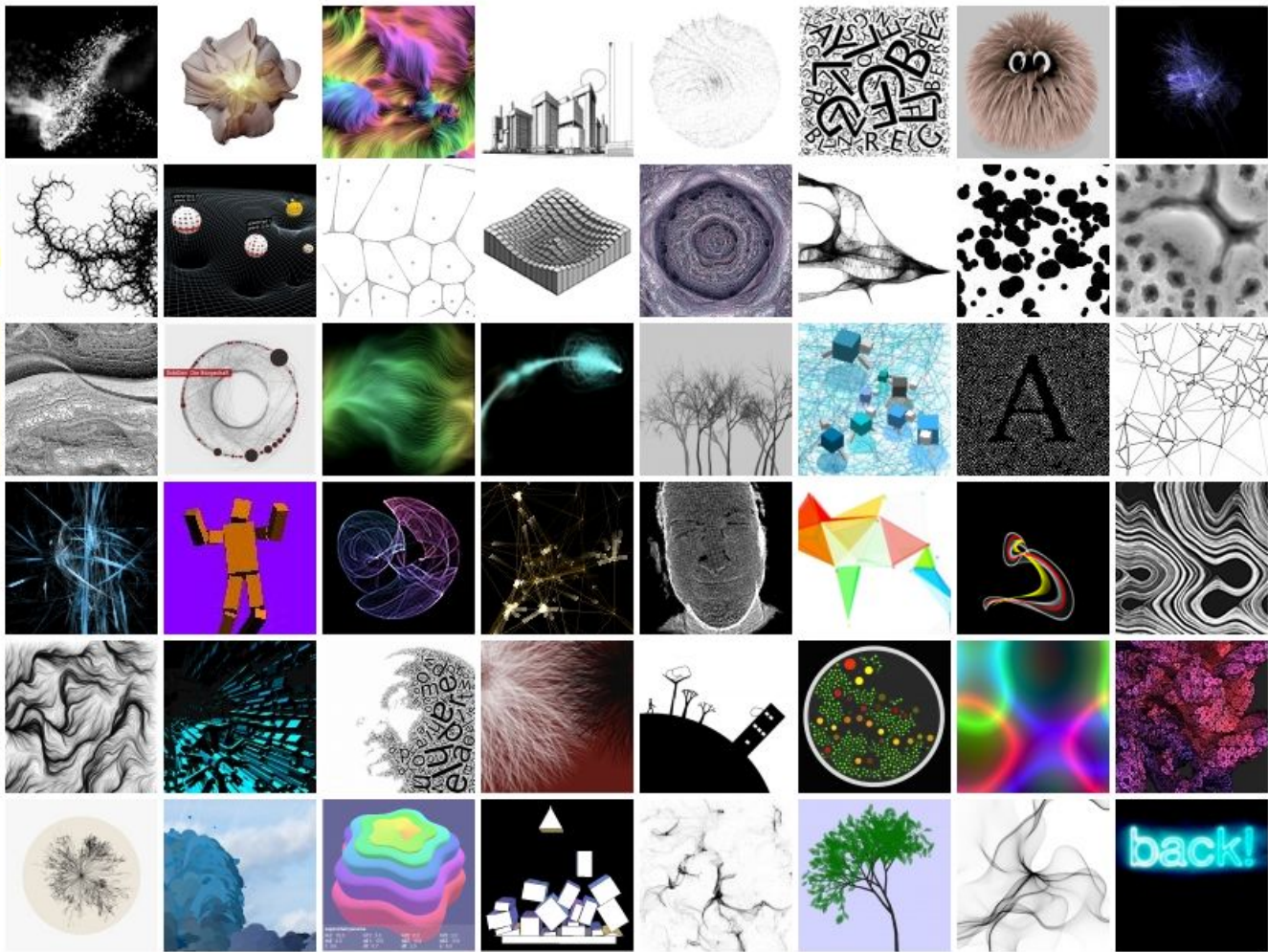
TÉCNICO
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Combining Processing with Racket

Hugo Correia and António Menezes
Leitão

Processing



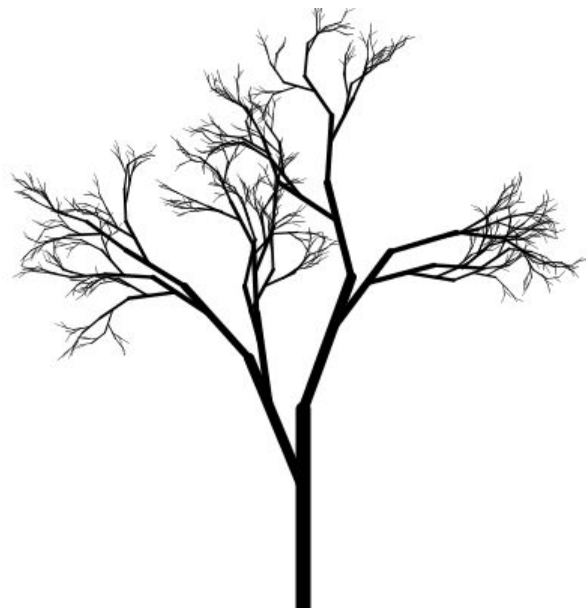


```
cherry_blossom | Processing 2.2.1
File Edit Sketch Tools Help
cherry_blossom
gradientBackground(c1, c2);
branches[0] = new Branch(0, round(random(1, 3)), new
}

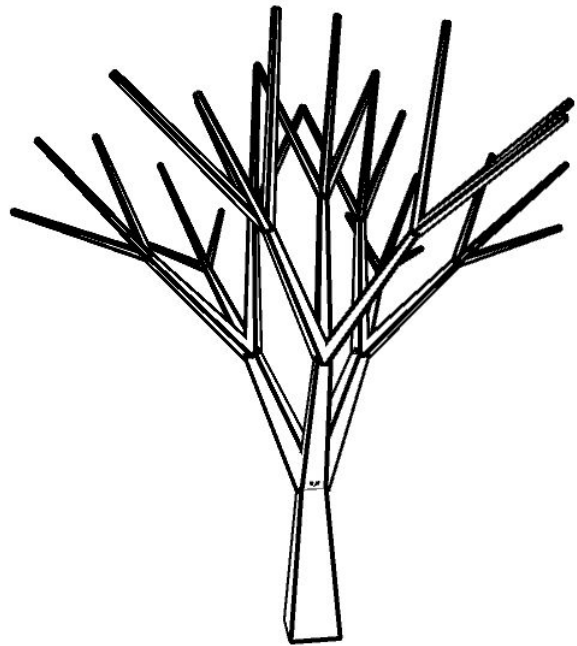
void draw() {
  stroke(#332010);
  fill(0);
  for (int i=0; i<slots; i++) {
    while (branches[i] != null && branches[i].steps > 0) {
      branches[i].drawStep();
    }
    if (nextSlot <= slots - 2) {
      branches[nextSlot] = branches[i].generateChild(0);
      nextSlot += 1;
      branches[nextSlot] = branches[i].generateChild(1);
      nextSlot += 1;
    }
    branches[i].active = false;
  }
  noStroke();
  for (int i=0; i<slots; i++) {
    if (branches[i].active) {
      branches[i].draw();
    }
  }
}
```



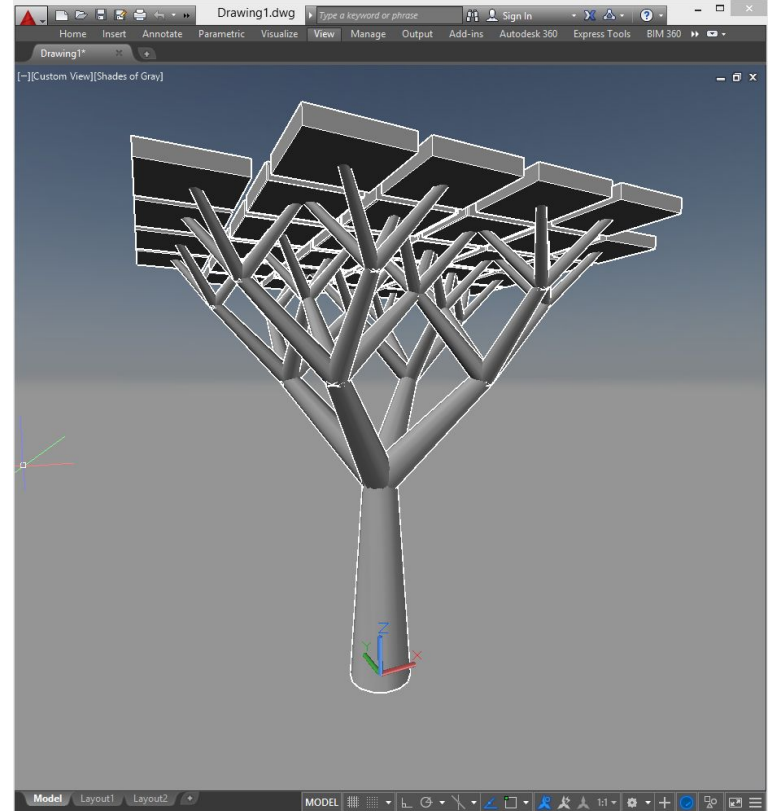
Render in 2D



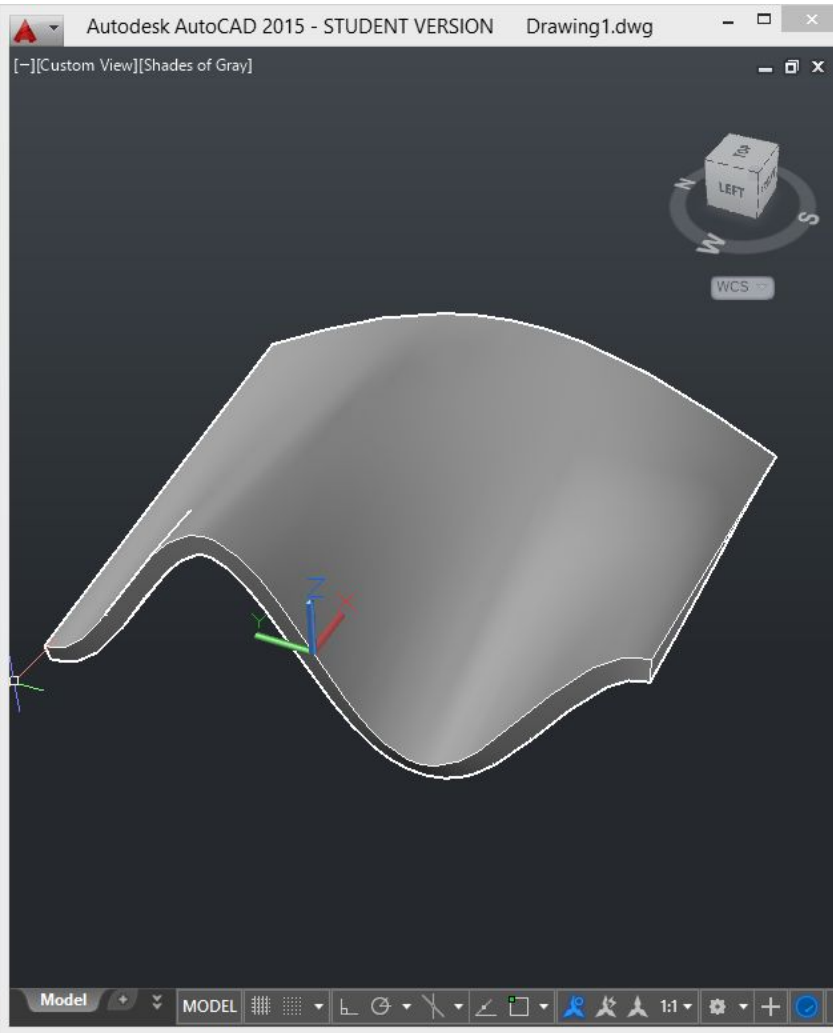
Render in 3D

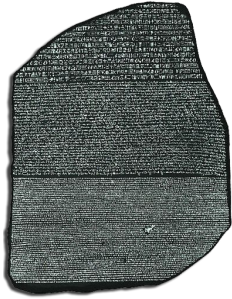


**But not in
Typical CAD Tool**

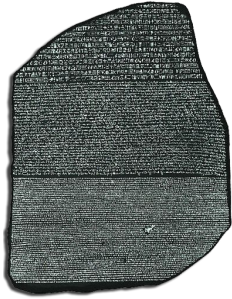


```
loft.rkt - DrRacket
Ficheiro Editar Ver Linguagem Racket Insert Tabs Ajuda
loft.rkt (define ...) Verificar Sintaxe Macro Stepper Correr Parar
#lang racket
(require (planet aml/rosetta))
(backend autocad)
(define (complex-surface)
  (thicken
    (loft
      (list (spline (map-division
                    (lambda (p)
                      (xyz 0 p (sin (* 1.5 p)))
                    -pi pi 100))
            (spline (map-division
                    (lambda (p)
                      (xyz 5 p (cos (* 0.5 p)))
                    -pi pi 100))))
      0.2))
Bemvindo a DrRacket, versão 6.1.1 [3m].
Linguagem: racket; memory limit: 128 MB.
Starting AutoCAD...
> (complex-surface)
#<thicken 3>
>
Determine language from source 6:2 203.56 MB
```





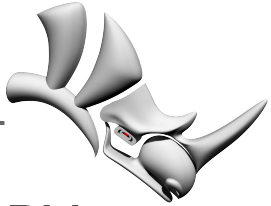
Rosetta



Rosetta



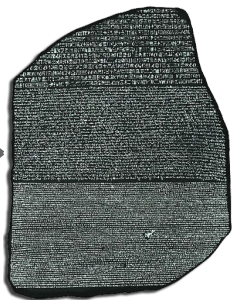
AUTODESK®
AUTOCAD®



Rhino**c**eros



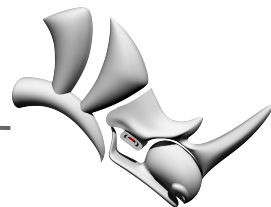
REVIT



Rosetta



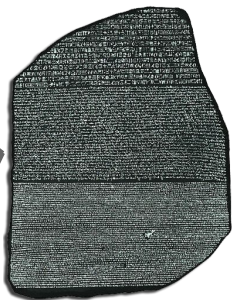
AUTODESK®
AUTOCAD®



Rhino**c**eros



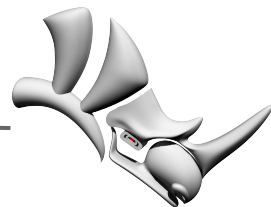
REVIT



Rosetta



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AUTOCAD®



Rhino**c**eros



REVIT

Other Implementations

Other Implementations

	Target Lang	IDE	Runtime
Processing.js	JavaScript	PDE SketchPad	JavaScript

Other Implementations

	Target Lang	IDE	Runtime
Processing.js	JavaScript	PDE SketchPad	JavaScript
Ruby-Processing	JRuby	-	Java

Other Implementations

	Target Lang	IDE	Runtime
Processing.js	JavaScript	PDE SketchPad	JavaScript
Ruby-Processing	JRuby	-	Java
Processing.py	Jython	PDE	Java

Other Implementations

	Target Lang	IDE	Runtime
Processing.js	JavaScript	PDE SketchPad	JavaScript
Ruby-Processing	JRuby	-	Java
Processing.py	Jython	PDE	Java
Professor J	Scheme	DrScheme	Scheme

Important Features

→ Drawing primitives & abstractions

Important Features

- Drawing primitives & abstractions
- Multiple rendering environments

Important Features

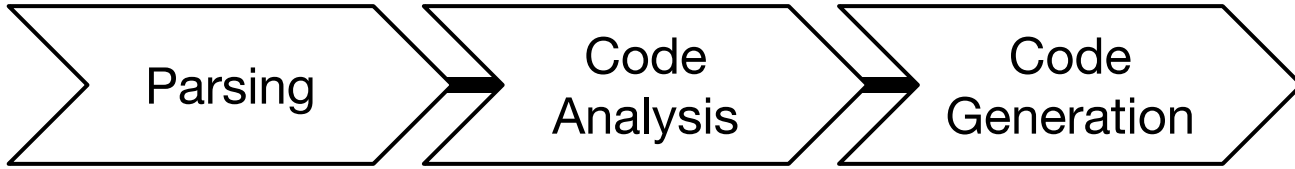
- Drawing primitives & abstractions
- Multiple rendering environments
- IDE

Important Features

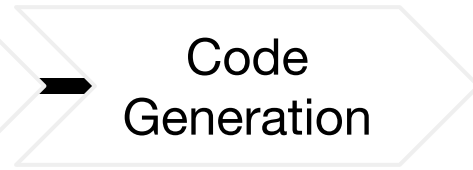
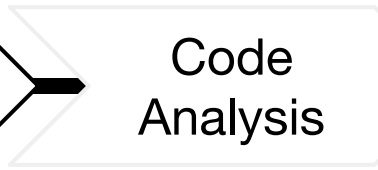
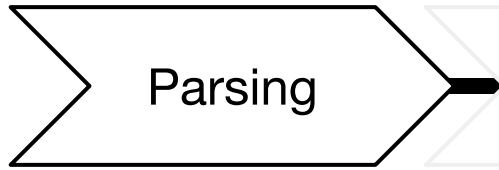
- Drawing primitives & abstractions
- Multiple rendering environments
- IDE
- Access to other languages

Solution

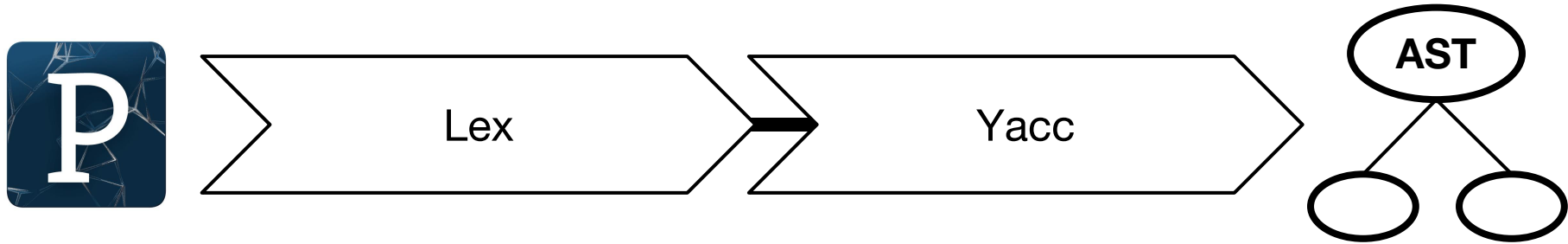
Compilation Process



Compilation Process



Parsing



Parsing

```
float foo = 10;
```

Parsing

float foo = 10;



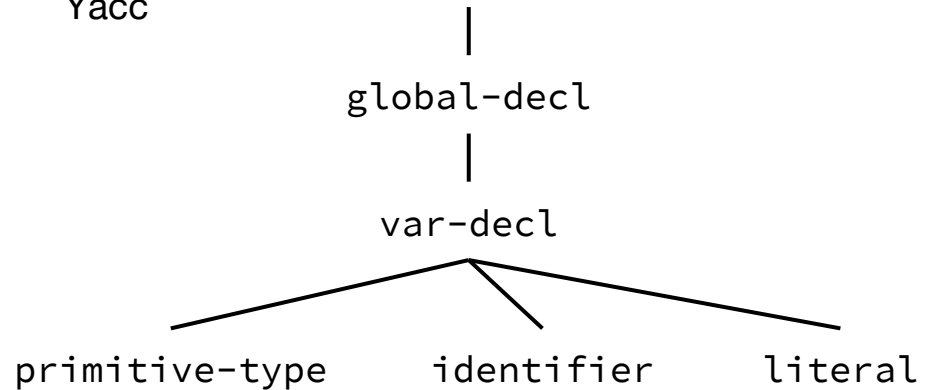
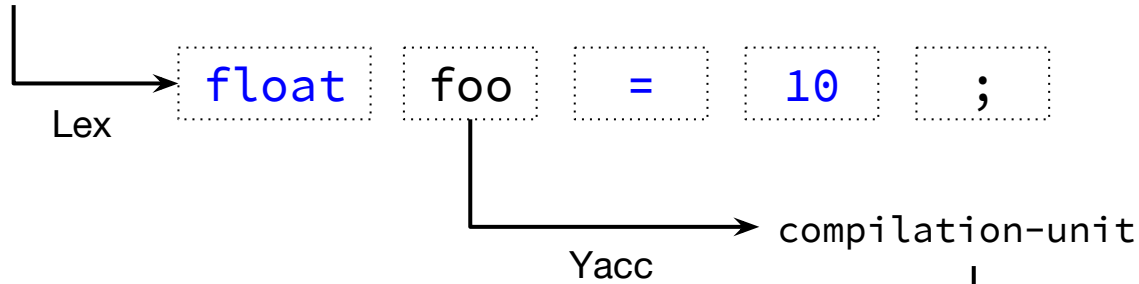
Parsing

float foo = 10;

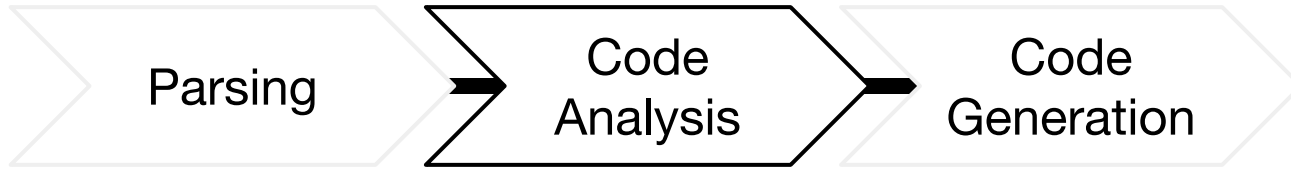


Parsing

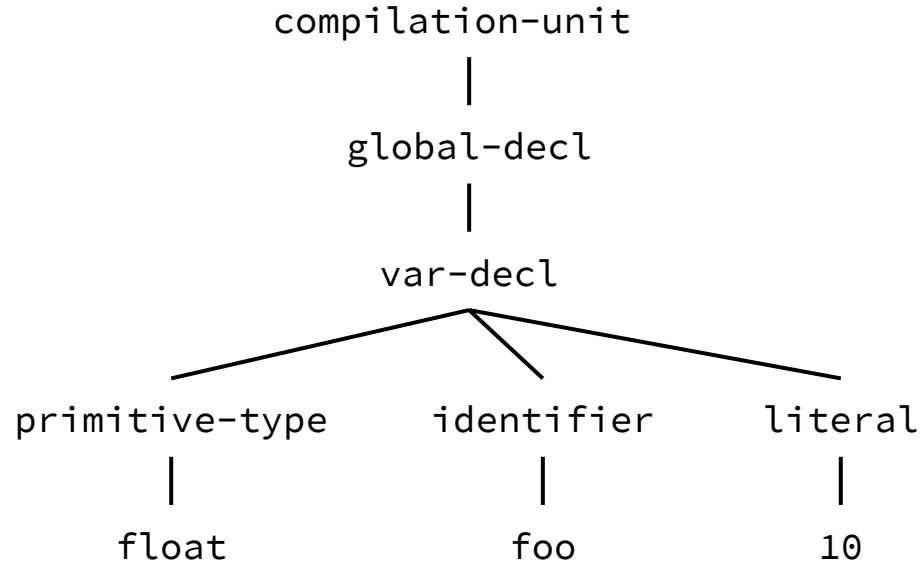
float foo = 10;



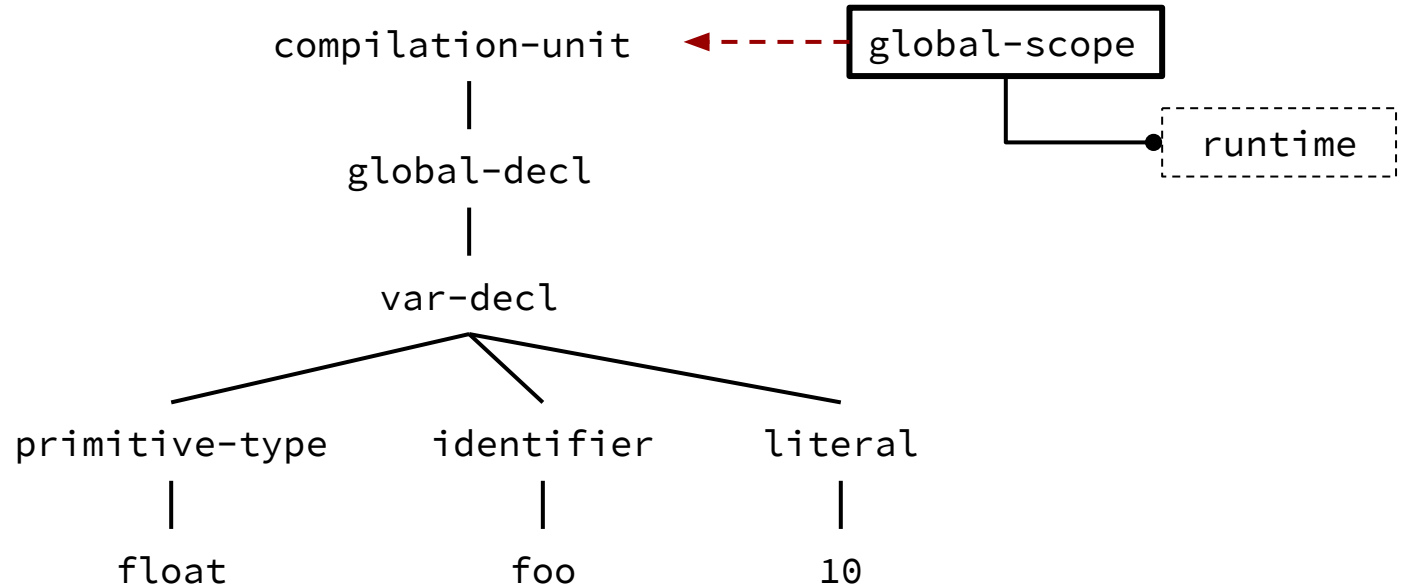
Compilation Process



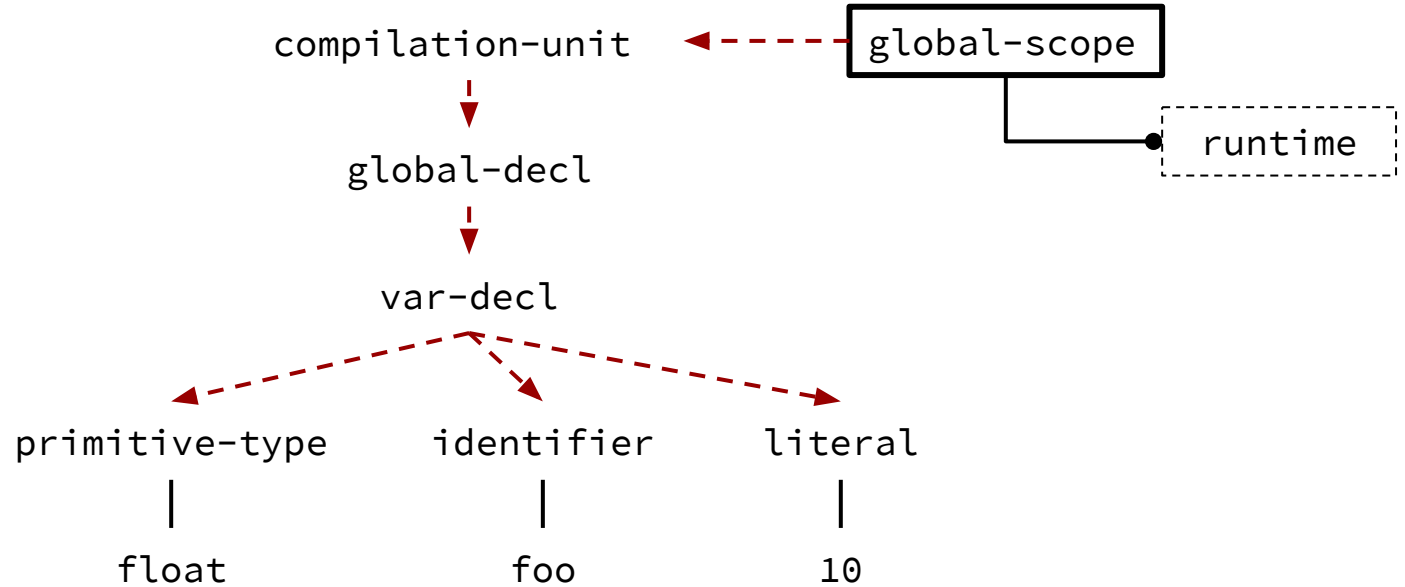
Code Analysis



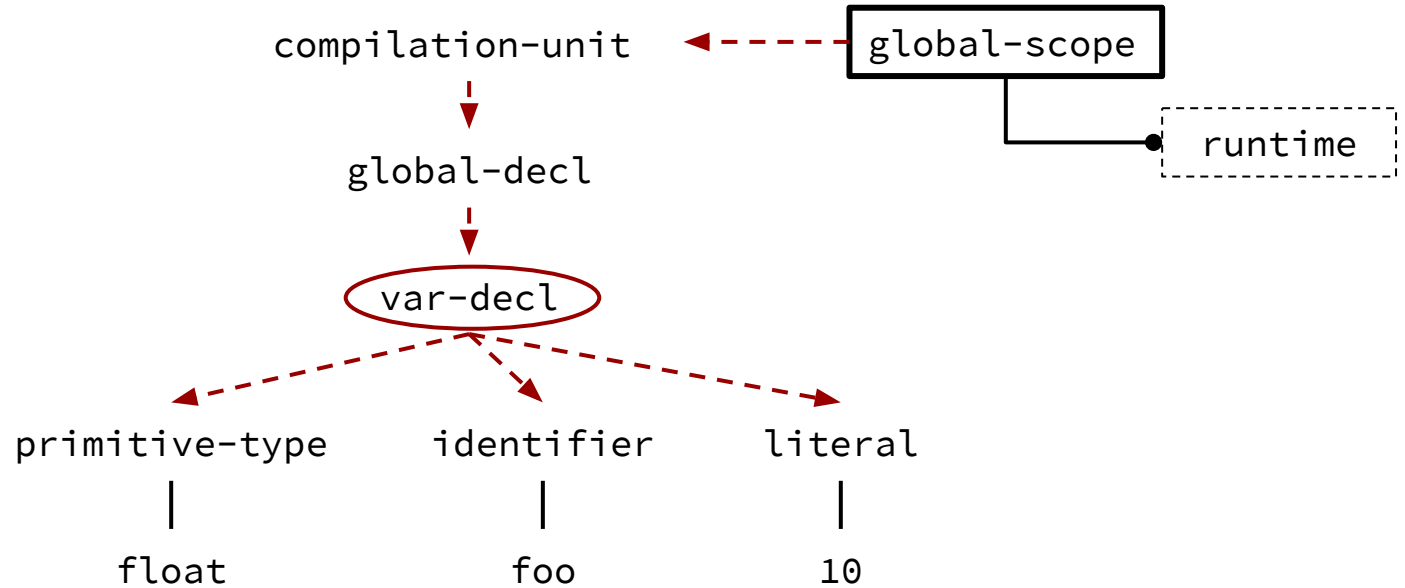
Code Analysis - Bindings



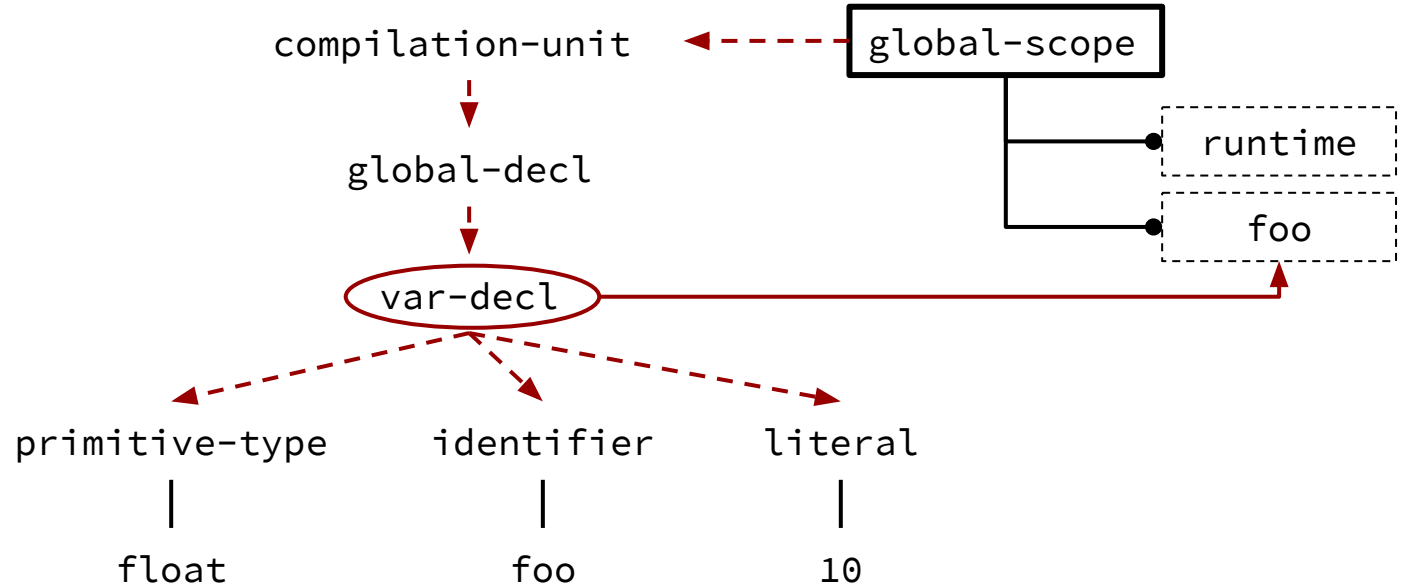
Code Analysis - Bindings



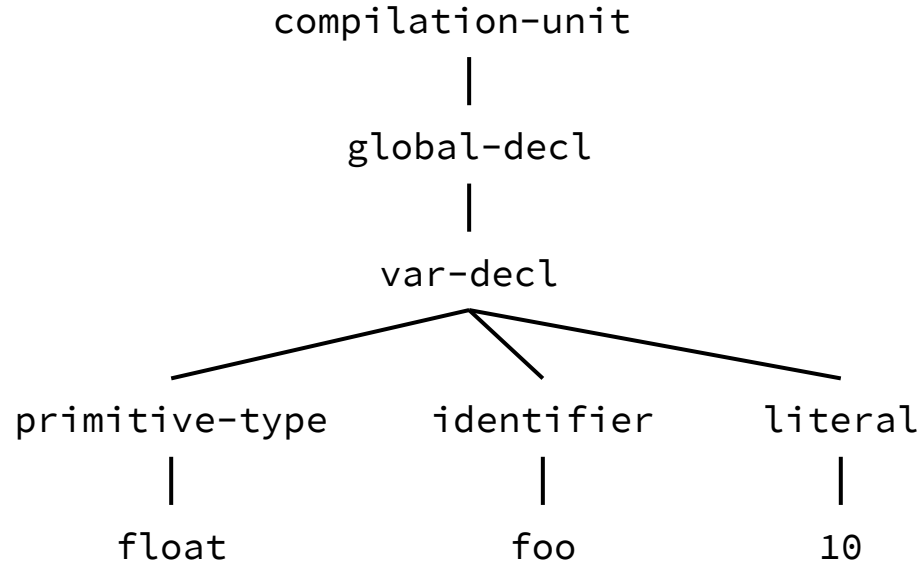
Code Analysis - Bindings



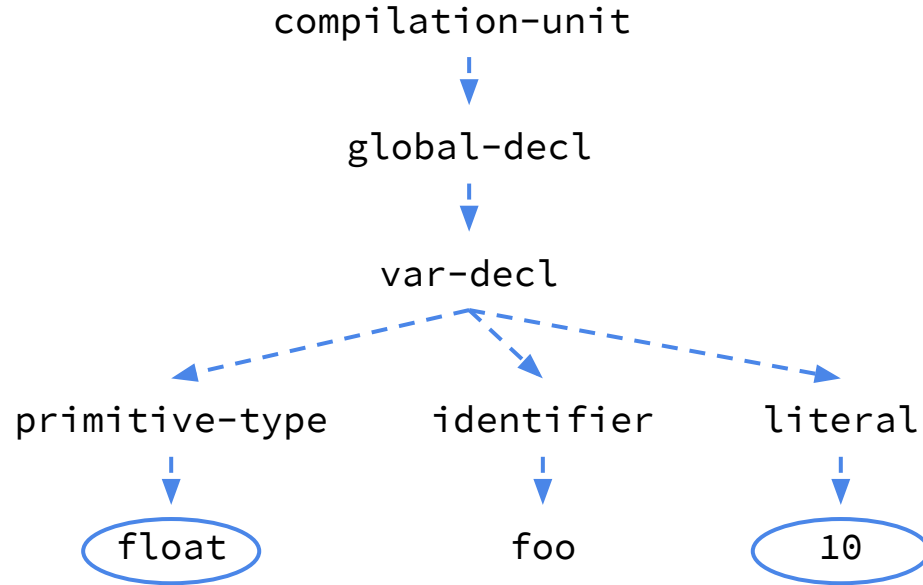
Code Analysis - Bindings



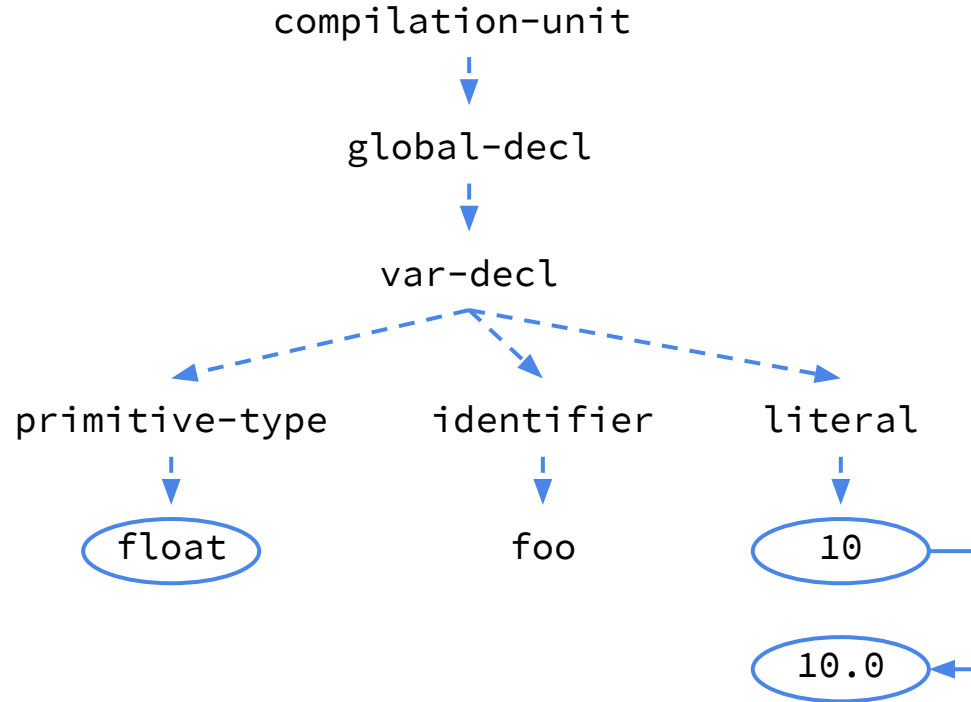
Code Analysis - Types



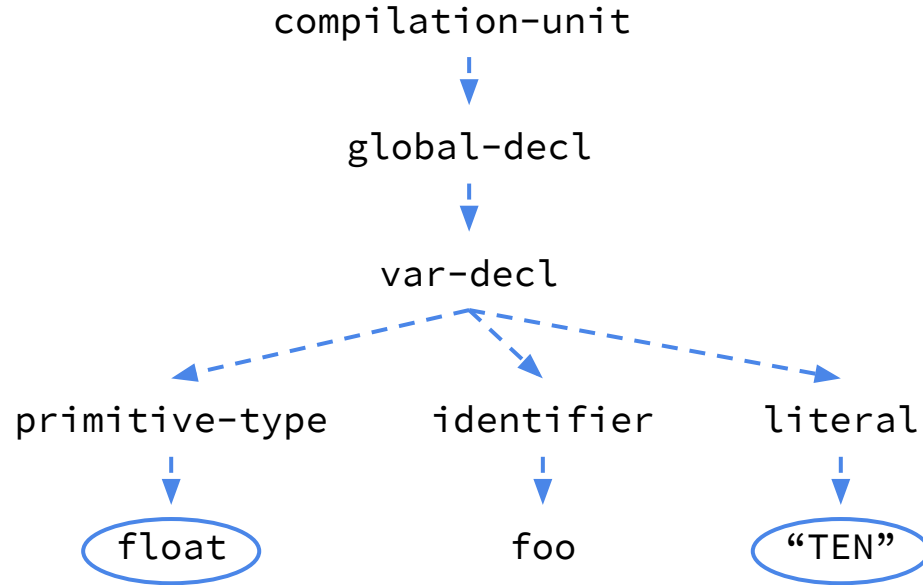
Code Analysis - Types



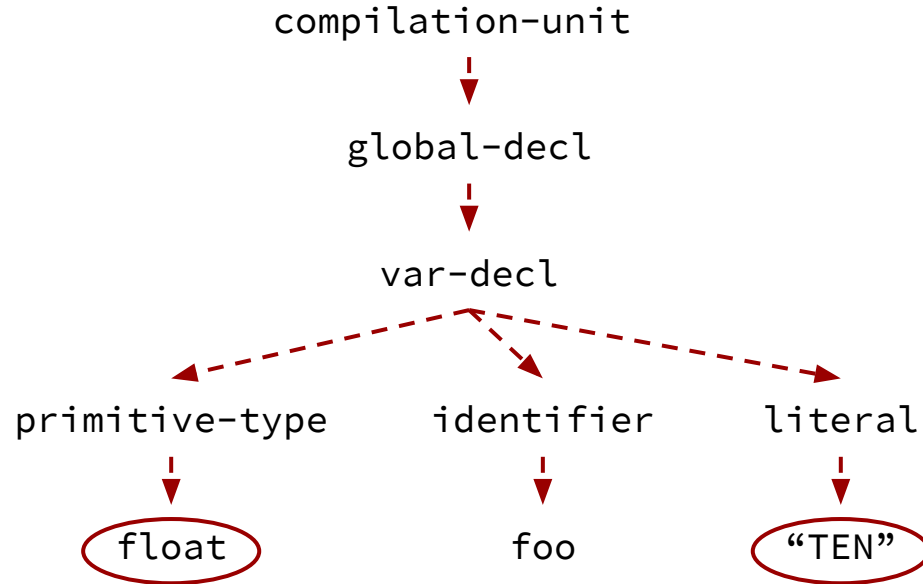
Code Analysis - Types



Code Analysis - Types



Code Analysis - Types

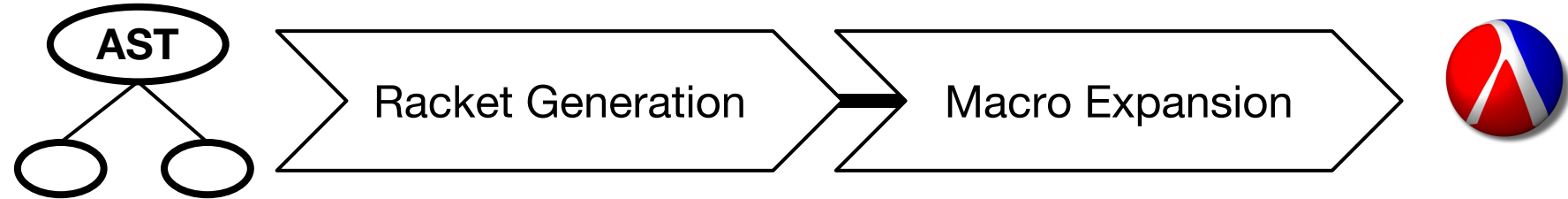


error: Cannot convert String to float

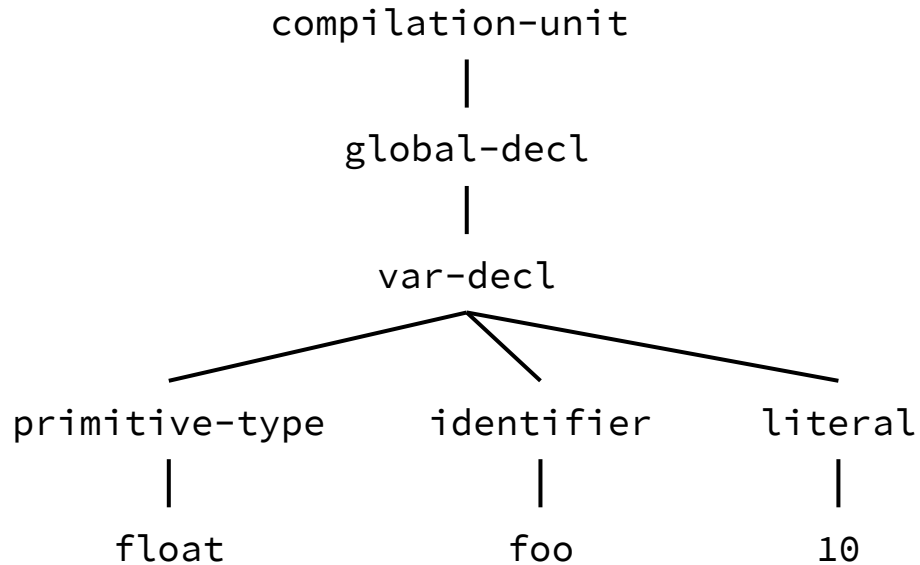
Compilation Process



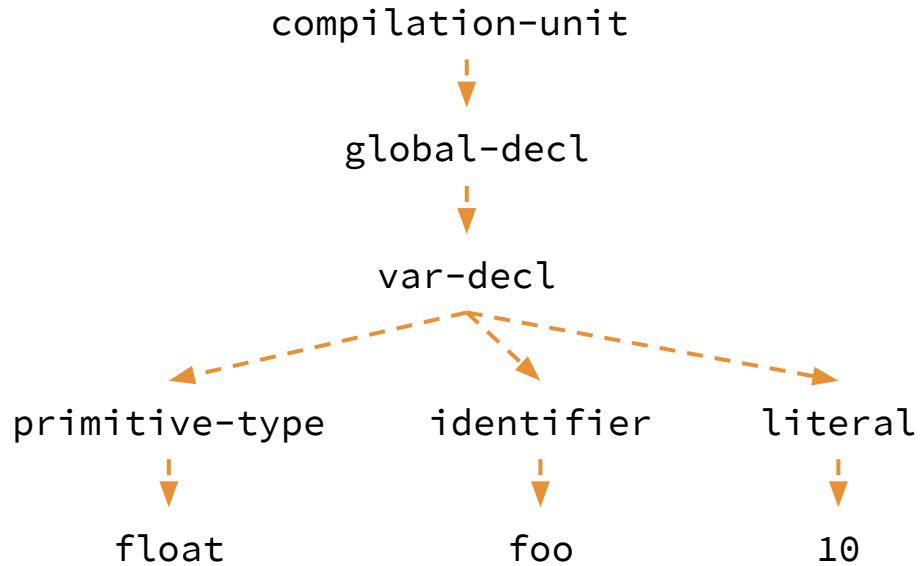
Code Generation



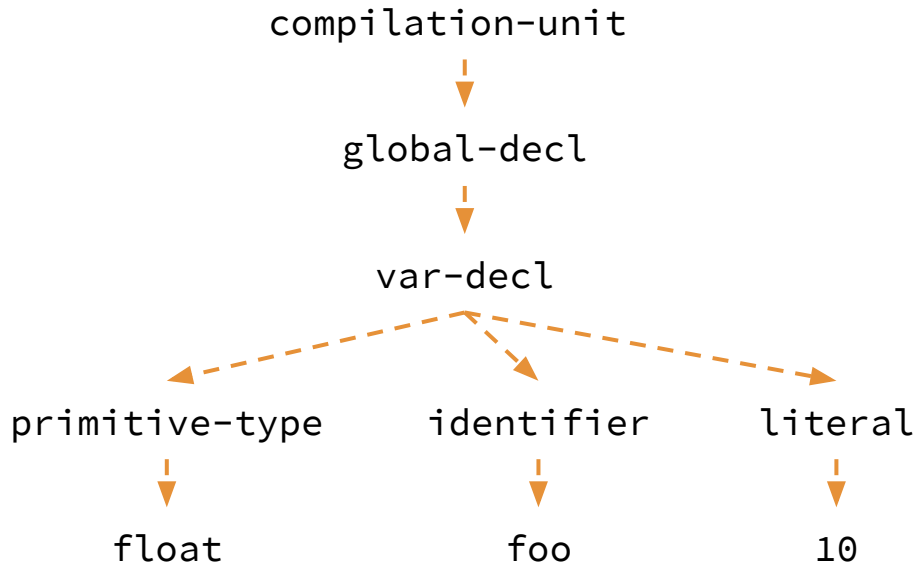
Racket Generation



Racket Generation



Racket Generation



(define foo 10.0)

Namespaces

```
float foo = 10.0
```

Namespaces

```
float foo = 10.0
```

```
=> foo
```

Namespaces

```
float foo = 10.0
```

```
=> foo
```

```
void foo(char bar)
```


Namespaces

```
float foo = 10.0
```

=> foo

```
void foo(char bar)
```

=> foo-fn

Namespaces

```
float foo = 10.0
```

=> foo

```
void foo(char bar)
```

=> foo-fn

```
void foo(char bar, float bazz)
```

Namespaces

`float foo = 10.0`

=> `foo`

`void foo(char bar)`

=> **`foo-C-fn`**

`void foo(char bar, float bazz)`

=> **`foo-CF-fn`**

Runtime

Runtime

```
// Constrains a value to not exceed a maximum and minimum value.  
float constrain(float amt, float low, float high) { ... }
```

Runtime

```
// Constrains a value to not exceed a maximum and minimum value.  
float constrain(float amt, float low, float high) { ... }
```

```
(define (constrain amt low high)  
  (cond [(< amt low) low]  
        [(> amt high) high]  
        [else amt])))
```

Runtime

```
// Constrains a value to not exceed a maximum and minimum value.  
float constrain(float amt, float low, float high) { ... }
```

```
(define (constrain amt low high)  
  (cond [(< amt low) low]  
        [(> amt high) high]  
        [else amt])))
```

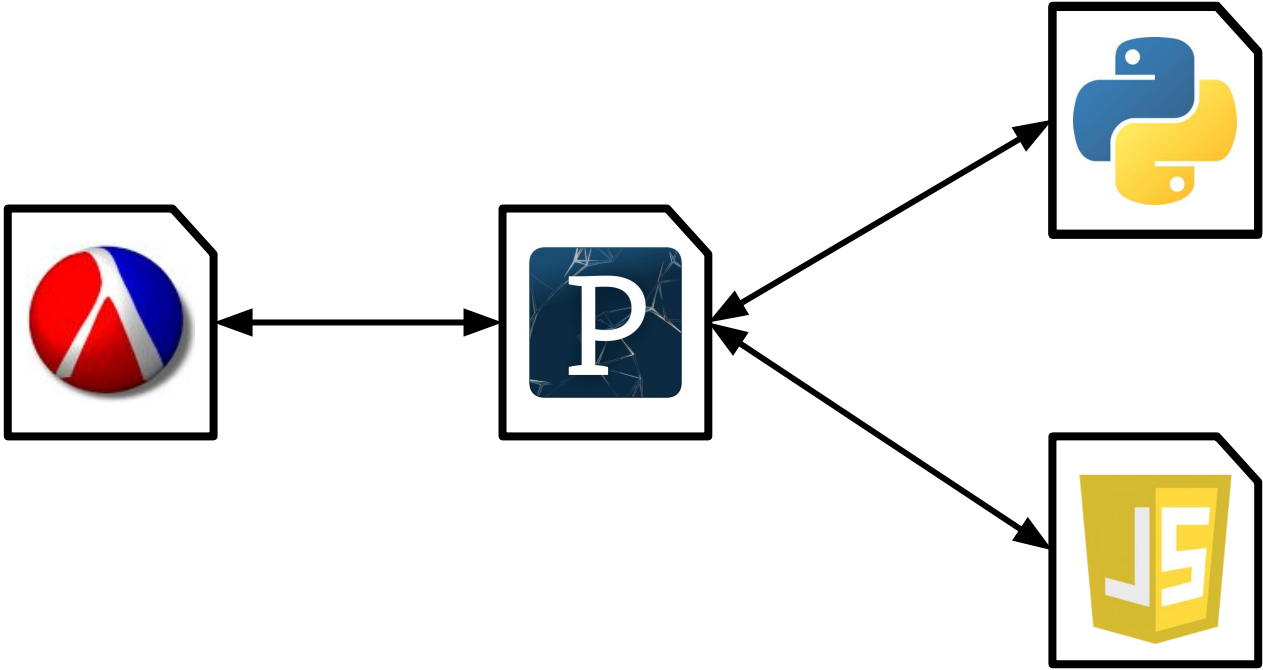
Problem!!

Runtime

```
// Constrains a value to not exceed a maximum and minimum value.  
float constrain(float amt, float low, float high) { ... }
```

```
(define-types (constrain [float amt] [float low] [float high] -> float)  
  (cond [(< amt low) low]  
        [(> amt high) high]  
        [else amt])))
```


Interoperability



```
#lang racket
```

```
(define (foo-bar) "foo")
```

```
#lang racket
```

```
(define (foo-bar) "foo")
```

```
#lang python
```

```
def bazz():  
    return "bazz"
```

```
#lang racket
```

```
(define (foo-bar) "foo")
```

```
#lang python
```

```
def bazz():  
    return "bazz"
```

```
#lang processing
```

```
void quux() {  
    println(fooBar(), bazz());  
}
```

```
#lang racket
```

```
(define (foo-bar) "foo")
```

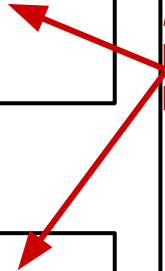
```
#lang python
```

```
def bazz():  
    return "bazz"
```

```
#lang processing
```

```
require "foo.rkt";  
require "bazz.py";
```

```
void quux() {  
    println(fooBar(), bazz());  
}
```



```
#lang racket
```

```
(define (foo-bar) "foo")
```

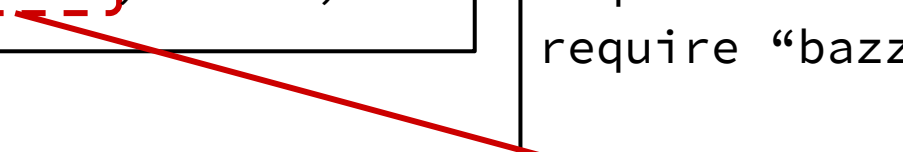
```
#lang python
```

```
def bazz():  
    return "bazz"
```

```
#lang processing
```

```
require "foo.rkt";  
require "bazz.py";
```

```
void quux() {  
    println(fooBar(), bazz());  
}
```



Processing in DrRacket

factorial.pde - DrRacket

Ficheiro Editar Ver Linguagem Racket Insert Tabs Ajuda

factorial.pde (define ...)

```
#lang processing

int factorial(int n) {
  if(n == 1) {
    return 1;
  } else {
    return factorial(n - 1) * n;
  }
}

void draw() {
  println(factorial(5));
}
```

Bem-vindo a [DrRacket](#), versão 6.1.1 [3m].
Linguagem: **processing**; memory limit: 128 MB.
120
>

Determine language from source

11:12 330.75 MB

factorial | Processing 2.2.1

File Edit Sketch Tools Help

factorial

```
int factorial(int n) {
  if(n == 1) {
    return 1;
  } else {
    return factorial(n - 1) * n;
  }
}

void draw(){
  println(factorial(5));
}
```

120

factorial.pde - DrRacket*

Ficheiro Editar Ver Linguagem Racket Insert Tabs Ajuda

factorial.pde (define ...) Macro Stepper Correr Parar

```
#lang processing

int factorial(float n) {
  if(n == 1) {
    return 1;
  } else {
    return factorial(n - 1) * n;
  }
}

void draw(){
  println(factorial(5));
}
```

Cannot convert a float to int

Interactions disabled.

factorial.pde:7:11: Cannot convert a float to int

Determine language from source 7:11 330.75 MB

factorial | Processing 2.2.1

File Edit Sketch Tools Help

factorial Run Java

```
int factorial(float n) {
  if(n == 1) {
    return 1;
  } else {
    return factorial(n - 1) * n;
  }
}

void draw(){
  println(factorial(5));
}
```

cannot convert from float to int

5

Examples

```

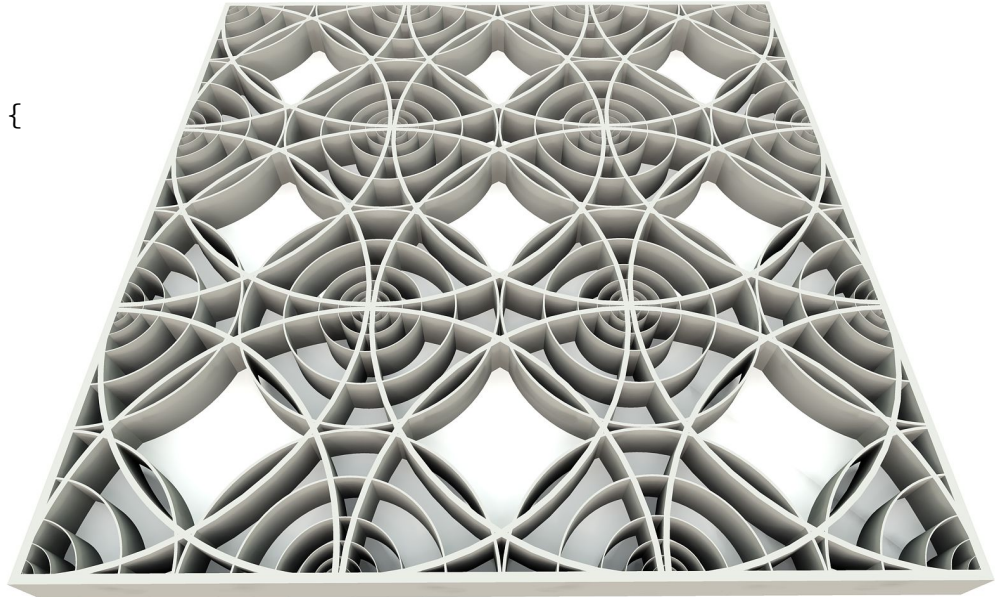
#lang processing

require "fib.rkt"; require "draw.rkt";

void echo(int n, Object pos, float ang, float r) {
  if (n == 1) {
    fullArc(pos, r, ang, HALF_PI, 20);
  }
  else {
    fullArc(pos, r/fib(n), ang, HALF_PI, 20);
    echo(n-1, pos, ang, r);
  }
}

void mosaic(float l, int max) {
  for(int i = 0; i < max; i++) {
    for (int j = 0; j < max; j++) {
      echo(10, xyz(i*l, j*l, 0), 0, l);
      echo(10, xyz(i*l + l, j*l, 0), HALF_PI, l);
      echo(10, xyz(i*l + l, j*l + l, 0), PI, l);
      echo(10, xyz(i*l, j*l + l, 0), 3/2* PI, l);
    }
  }
  frame(xyz(0,0,0), max * l, h);
}

```

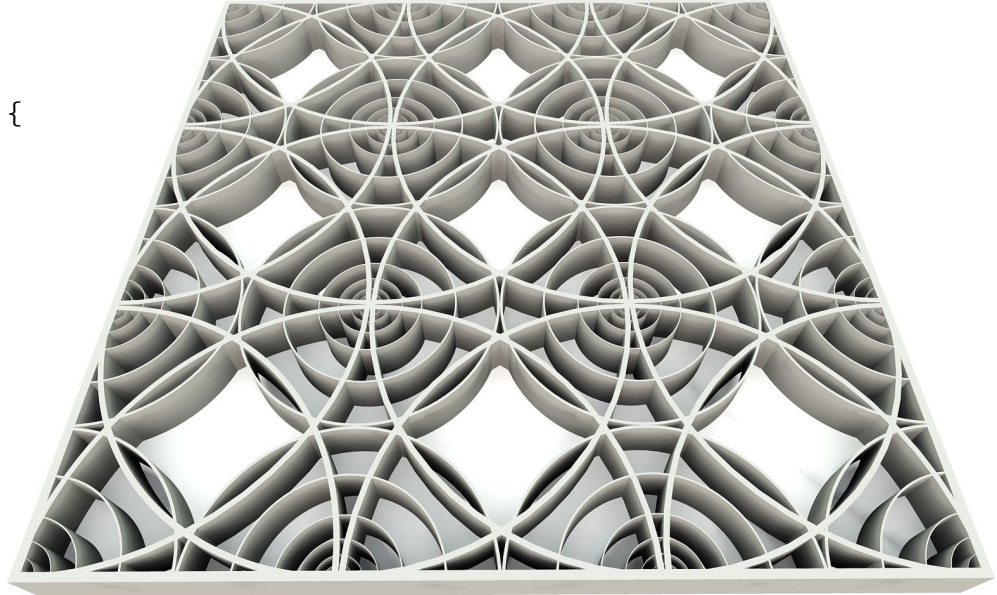


```
#lang processing
```

```
require "fib.rkt"; require "draw.rkt";
```

```
void echo(int n, Object pos, float ang, float r) {  
  if (n == 1) {  
    fullArc(pos, r, ang, HALF_PI, 20);  
  }  
  else {  
    fullArc(pos, r/fib(n), ang, HALF_PI, 20);  
    echo(n-1, pos, ang, r);  
  }  
}
```

```
void mosaic(float l, int max) {  
  for(int i = 0; i < max; i++) {  
    for (int j = 0; j < max; j++) {  
      echo(10, xyz(i*l, j*l, 0), 0, l);  
      echo(10, xyz(i*l + l, j*l, 0), HALF_PI, l);  
      echo(10, xyz(i*l + l, j*l + l, 0), PI, l);  
      echo(10, xyz(i*l, j*l + l, 0), 3/2* PI, l);  
    }  
  }  
  frame(xyz(0,0,0), max * l, h);  
}
```

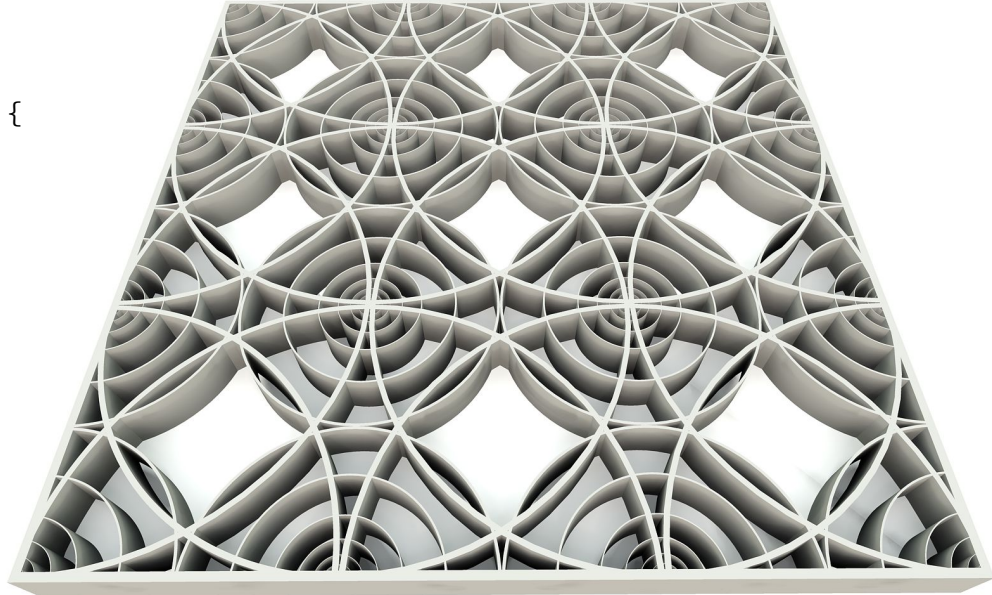


```
#lang processing
```

```
[require "fib.rkt"; require "draw.rkt"; ]
```

```
void echo(int n, Object pos, float ang, float r) {  
  if (n == 1) {  
    [fullArc(pos, r, ang, HALF_PI, 20); ]  
  }  
  else {  
    [fullArc(pos, r/fib(n), ang, HALF_PI, 20); ]  
    echo(n-1, pos, ang, r);  
  }  
}
```

```
void mosaic(float l, int max) {  
  for(int i = 0; i < max; i++) {  
    for (int j = 0; j < max; j++) {  
      echo(10, xyz(i*l, j*l, 0), 0, l);  
      echo(10, xyz(i*l + l, j*l, 0), HALF_PI, l);  
      echo(10, xyz(i*l + l, j*l + l, 0), PI, l);  
      echo(10, xyz(i*l, j*l + l, 0), 3/2* PI, l);  
    }  
  }  
  [frame(xyz(0,0,0), max * l, h); ]  
}
```

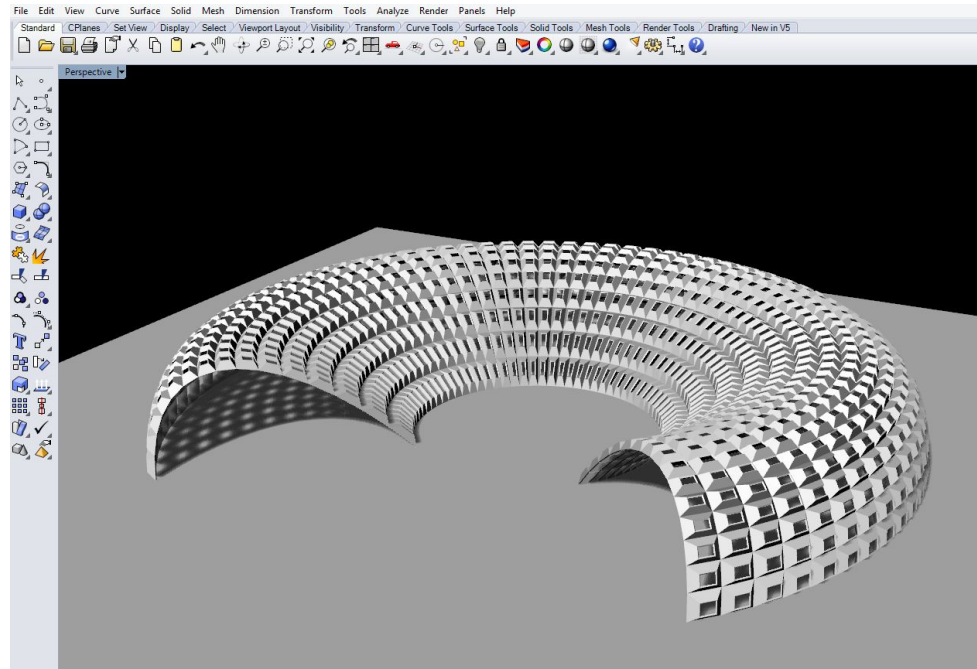


```
#lang processing
```

```
require "torus.rkt";
```

```
void setup() { backend(rhino); }
```

```
void draw() {  
  float da = PI/4, db = 3/4 * PI;  
  float h = 0.003, w = 0.010;  
  Object p = xyz(0,0,0);  
  
  ellipticTorus(p, h, w, 0.6, da, db, 0, 2*PI);  
}
```



#lang processing

```
require "torus.rkt";
```

```
void setup() { backend(rhino); }
```

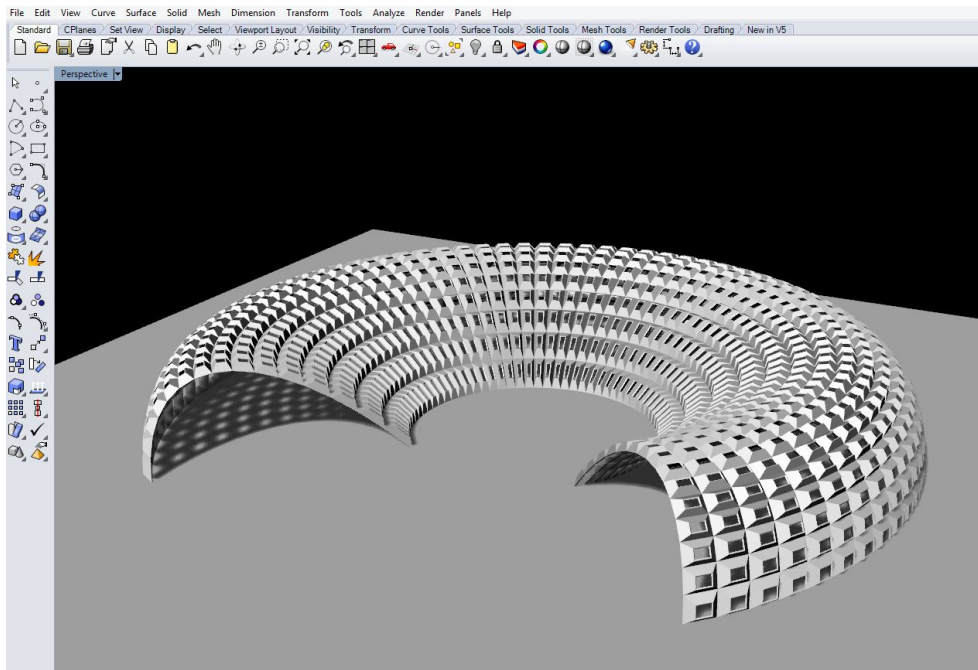
```
void draw() {
```

```
  float da = PI/4, db = 3/4 * PI;
```

```
  float h = 0.003, w = 0.010;
```

```
  Object p = xyz(0,0,0);
```

```
  ellipticTorus(p, h, w, 0.6, da, db, 0, 2*PI);  
}
```



Future Work

→ Classes & Exceptions

Future Work

- Classes & Exceptions
- Editor mode

Future Work

- Classes & Exceptions
- Editor mode
- Graphical REPL interactions



TÉCNICO
LISBOA

Thank you!

Questions?