

USER FRIENDLY by J.D. "Illiad" Frazer



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CS 252:

*Advanced Programming Language Principles*



# Blocks and Message Passing

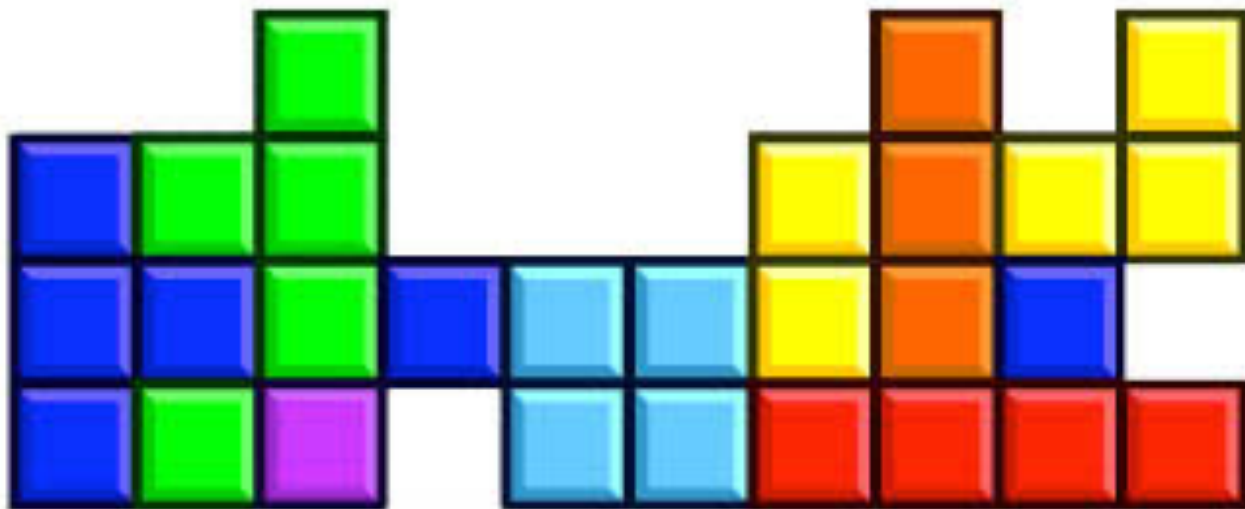
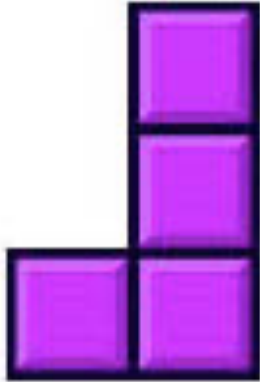
Prof. Tom Austin

San José State University

## Smalltalk influences on Ruby

- Everything is an object
- Blocks
- Message passing

# Blocks



## File I/O

```
file = File.open(  
    'temp.txt', 'r')  
file.each_line do |line|  
    puts line  
end  
file.close
```

## File I/O with blocks

```
File.open('file', 'r') do |f|  
  f.each_line { |ln| puts ln }  
end
```

## Creating custom blocks

Ruby methods can accept blocks to

- create custom **control structures**
- eliminate **boilerplate code**

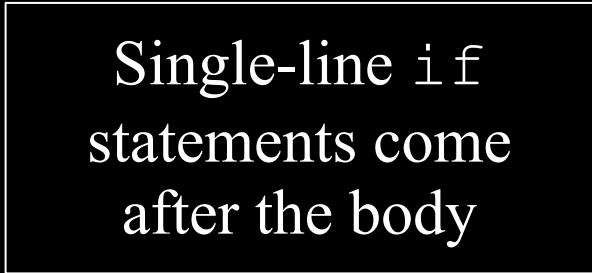


## `with_prob`

- **Accepts:**
  - a probability (between 0 and 1)
  - a block
- **Executes block probabilistically**
  - `with_prob 0 { puts "hi" }`
  - `with_prob 1 { puts "hi" }`
  - `with_prob 0.5 { puts "hi" }`

```
def with_prob (prob)
  yield if (Random.rand < prob)
end

with_prob 0.42 do
  puts "There is a 42% chance "
    + "that this code will print"
end
```



Single-line `if`  
statements come  
after the body

```
def with_prob (prob, &blk)  
  blk.call if (Random.rand < prob)  
end
```

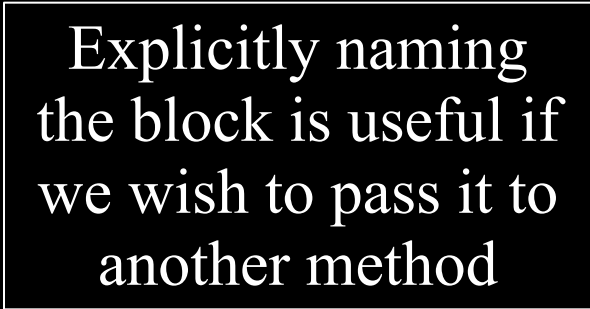
Note that there  
is no '&' here.

We can explicitly  
name the block of  
code

```
with_prob 0.42 do  
  puts "There is a 42% chance "  
    + "that this code will print"  
end
```

```
def with_prob (prob, &blk)  
  blk.call if (Random.rand < prob)  
end
```

```
def half_the_time (&block)  
  with_prob(0.5, &block)  
end
```



Explicitly naming  
the block is useful if  
we wish to pass it to  
another method

# Conversion table example

(in class)

Blocks are *closures*, though there are some differences between JavaScript functions and Ruby blocks.

Let's see how the two compare...

# Writing `withProb` in JavaScript

```
function withProb(prob, f) {  
  if (Math.random() < prob) {  
    return f();  
  }  
}
```



JavaScript uses  
callbacks rather  
than blocks

# What is the difference?

```
def coin_flip          function coinFlip() {
  with_prob 0.5        withProb(0.5,
  do                   function() {
    return "H"         return "H";
  end                 });
  return "T"          return "T";
end                   }
```

# Singleton classes

# JavaScript & prototypes

```
function Employee(name, salary) {  
  this.name = name;  
  this.salary = salary;  
}  
var a = new Employee("Alice", 75000);  
var b = new Employee("Bob", 50000);  
  
b.signingBonus = 2000;  
console.log(a.signingBonus);  
console.log(b.signingBonus);
```

Can we do the  
same thing in  
Ruby?

In Ruby, every object has a special *singleton class*.

This class holds methods unique to that object.

# Singleton Class Example

(in-class)



# Message Passing

## Message passing (object interaction)

- Sender sends
  - message: method name
  - data: method parameters
- Receiver
  - processes the message
  - (optionally) returns **data**

If receiver doesn't understand message?

```
irb> "hello".foo
```

```
NoMethodError: undefined  
method `foo' for  
"hello":String  
  from (irb):2  
  from /usr/bin/irb:12:in  
`<main>'
```

```
irb>
```

# method\_missing

- You can override this behavior
  - Smalltalk: doesNotUnderstand
  - Ruby: method\_missing
- This method is called when an unknown method is invoked

```
class Person
  attr_accessor :name
  def initialize(name)
    @name = name
  end
  def method_missing(m)
    puts "Didn't understand #{m}"
  end
end
```

```
gracie = Person.new "Gracie"
```

```
class << gracie  
  def method_missing m  
    phrase = m.to_s.sub(  
      /say_(.*)/, '\1')  
    puts phrase  
  end  
end
```

```
gracie.say_goodnight_gracie
```

# Rails ActiveRecord example

```
Person.find_by(first_name: 'David')
```

```
Person.find_by_first_name "John"
```

```
Person.find_by_first_name_and_last_name \  
  "John", "Doe"
```

# Record example (in class)

## Lab: Ruby Metaprogramming

Today's lab explores blocks and `method_missing`.

Download `tree.rb` from the course website. The lab description is available in both Canvas and the course website.