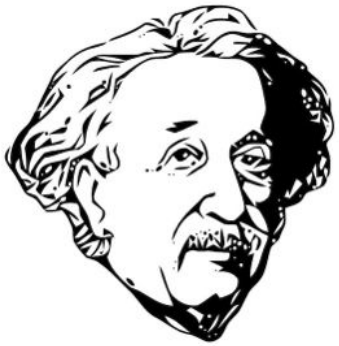


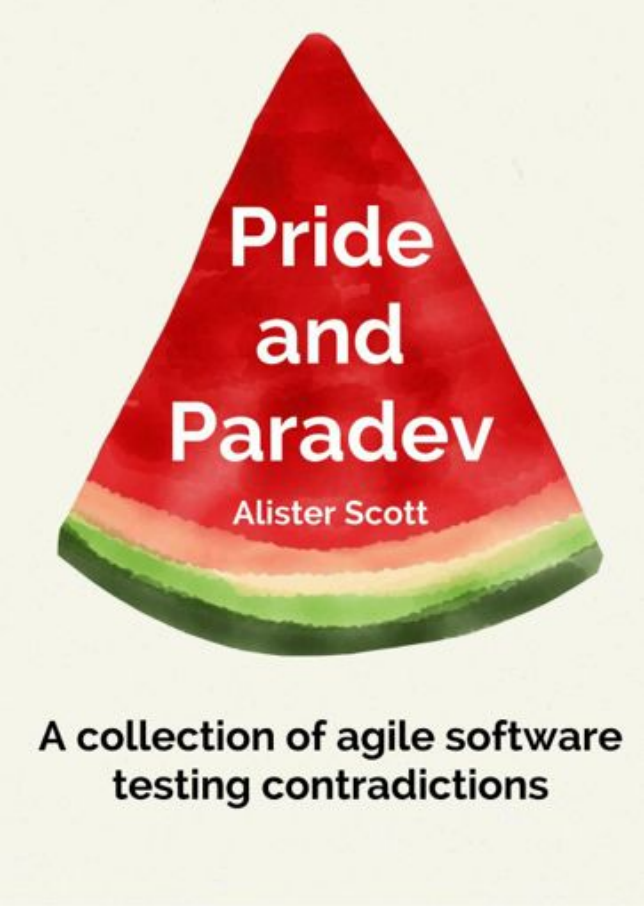
Einstein

building a minesweeper robot using tests

Alister Scott

ThoughtWorks®

About Me



- QA consultant @ ThoughtWorks Brisbane
- Tester/Coder
- Father of 2 (almost 3) boys
- Blogger of **watirmelon.com**
- Writer of '**Pride & Paradev**'
- Collector of arid plants

what can writing a minesweeper robot teach us about testing?

who here has never played minesweeper?

who here has never heard of minesweeper?

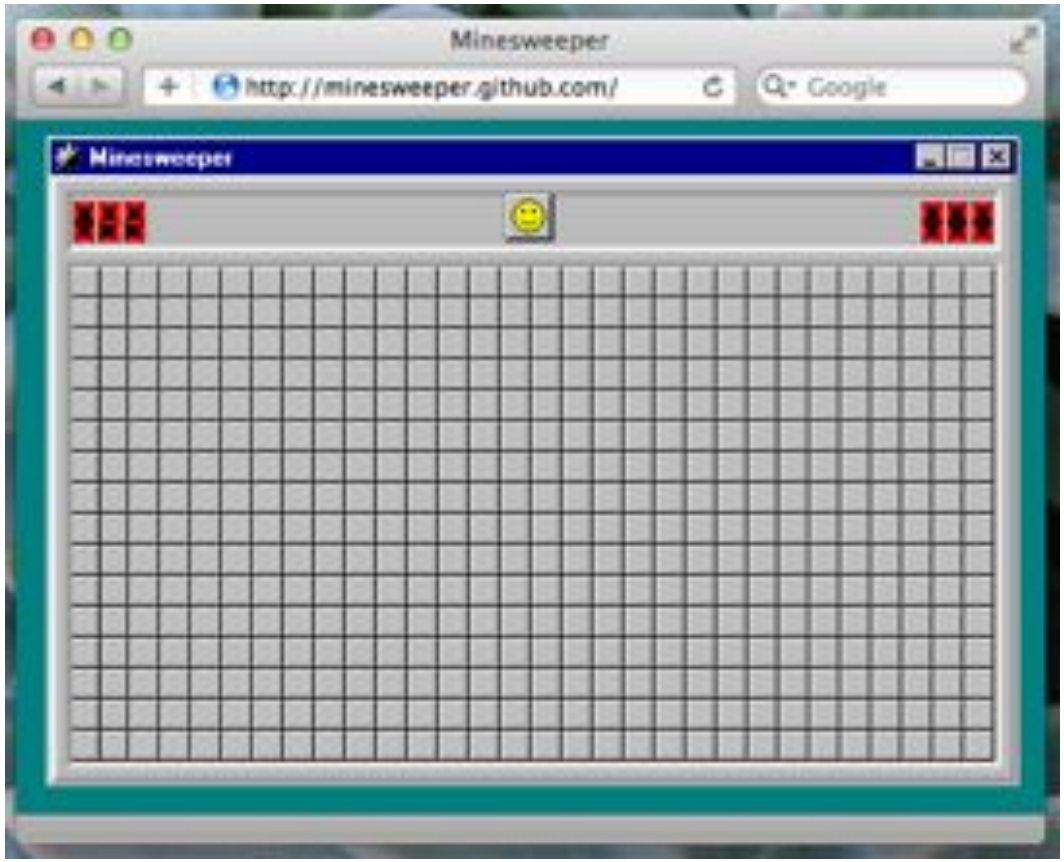
a little refresher <video>

windows minesweeper has some issues:

* non testable
* hard to automate
* need windows

we wrote our own

minesweeper.github.io



open source
CoffeeScript

347 lines of
CoffeeScript =>
478 lines of
JavaScript

minesweeper.github.io

Jasmine specs

74 specs in 0.3 seconds

687 lines of CoffeeScript (nearly double prod code)

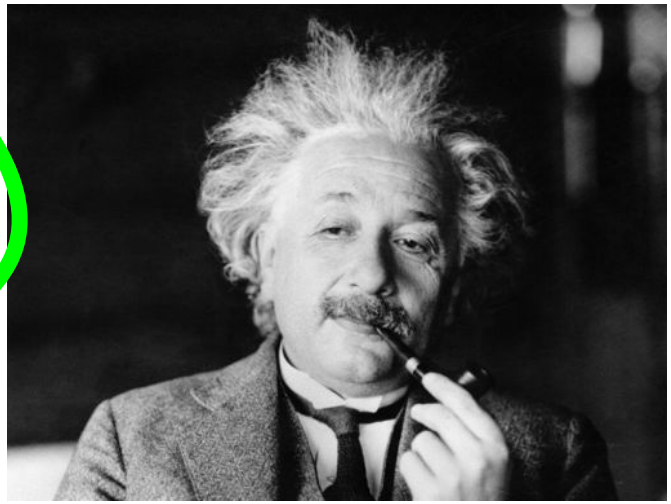
biggest benefit of writing something yourself is building testability in

but writing the game minesweeper is so much easier than writing a robot to play it => I'll talk about that

solving a complex problem (automating minesweeper) is a lot like testing; I'll share my lessons on the way

how?

tests!



how do we create an Einstein robot?

outside

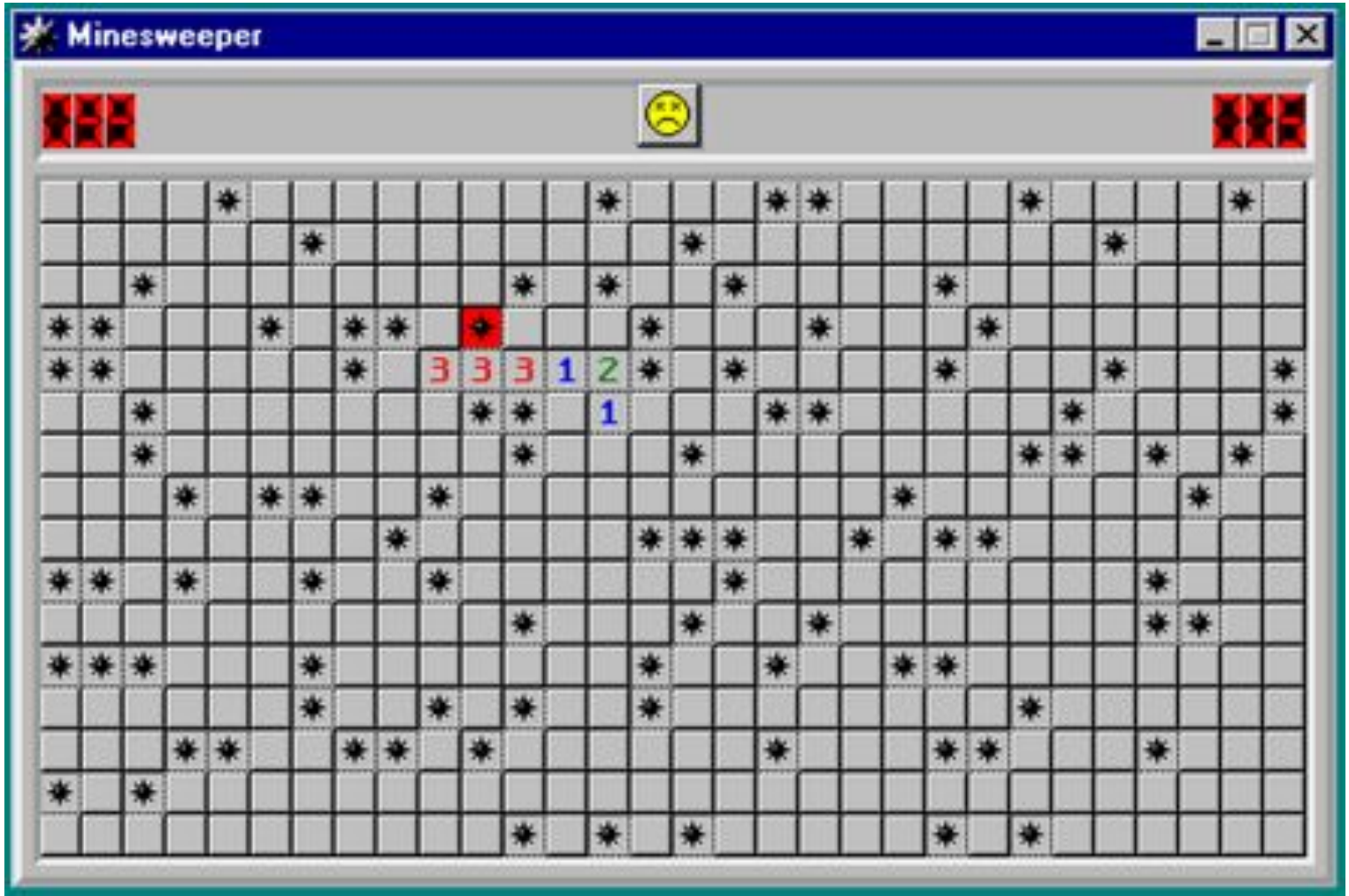
in

Break it down

"The secret of getting ahead is getting started. The secret of getting started is breaking your complex overwhelming tasks into small manageable tasks, and then starting on the first one."

~ Mark Twain

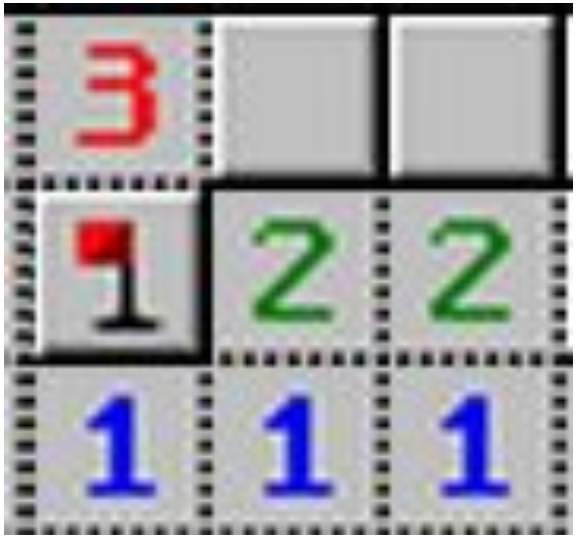
iteration one: guess

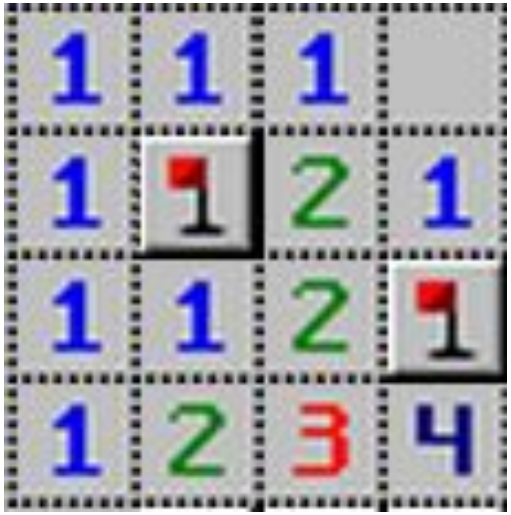


success rate: < 0.1%

how can you break your big testing problems down into smaller ones and get started?

iteration two: identify obvious mines



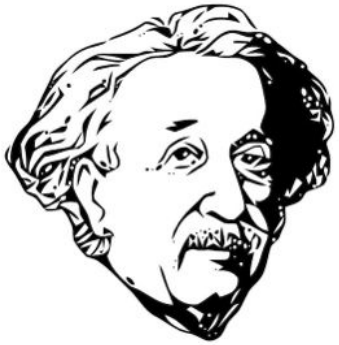


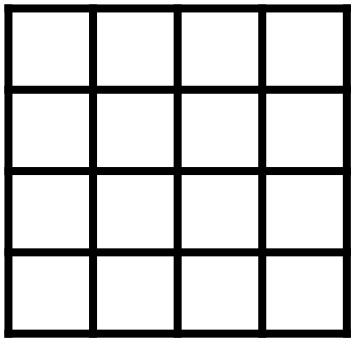
iteration two: identify obvious mines

```
describe 'safe cells to click' do
  it 'should determine safe cells to left click' do
    analyse <<-EOF
    * 1
    . .
    EOF
    analyser.safe_cells_to_click.should == [[1,0],[1,1]]
  end
```


success rate:< 2%

a minesweeper robot: separation of concerns



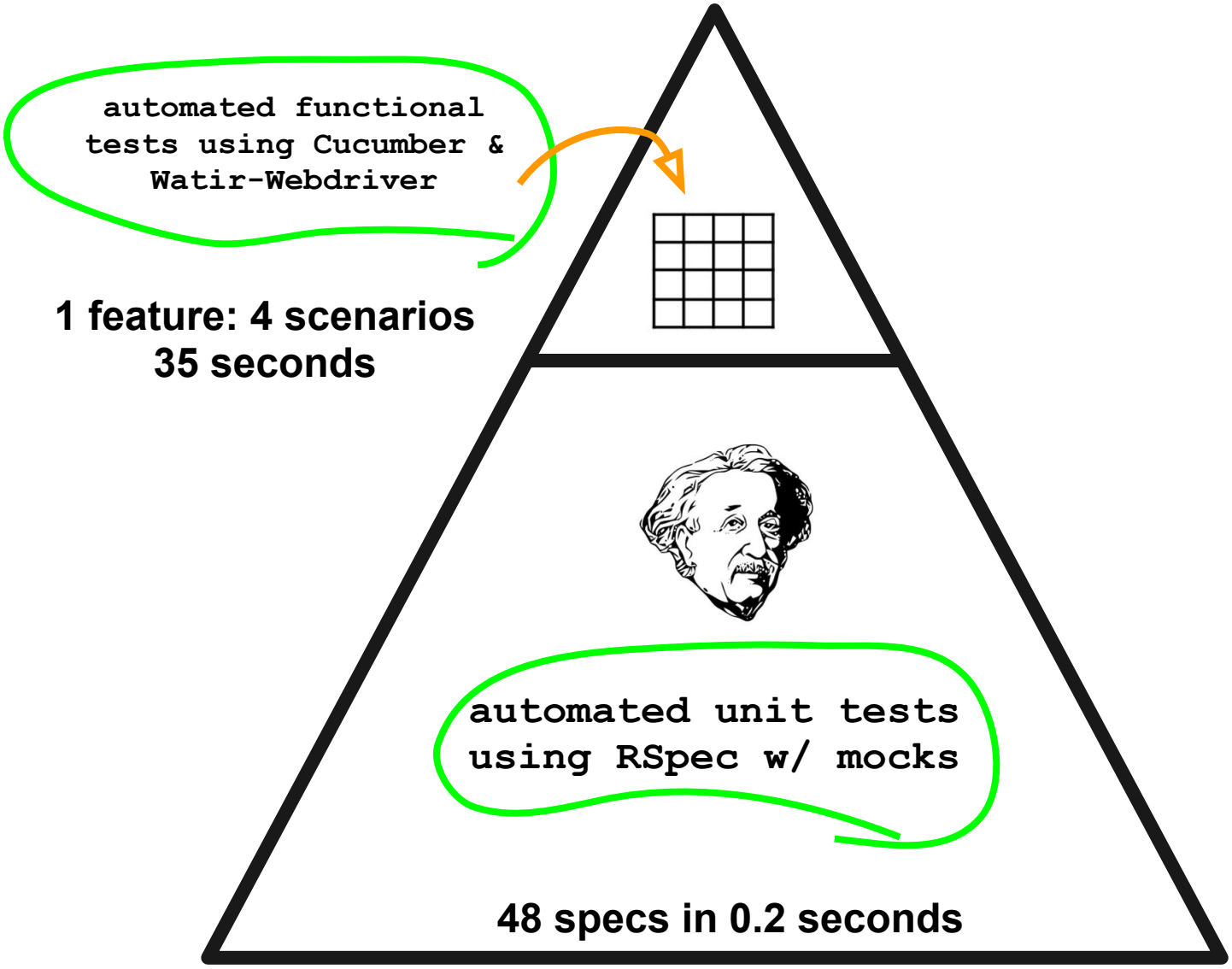


can play any minesweeper implementation game using in built intelligence

a web implementation of minesweeper that can be automatically controlled

`automated unit tests using RSpec w/ mocks`

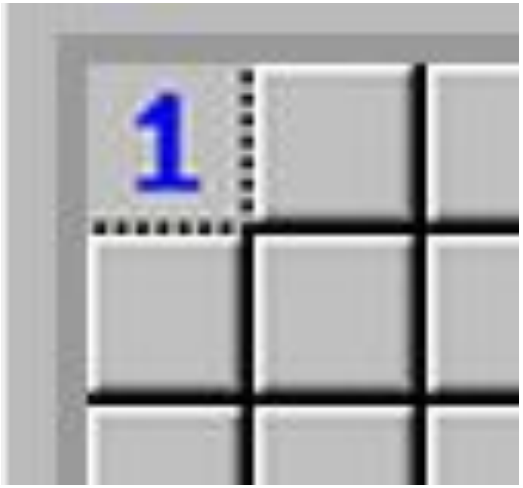
`automated functional tests using Cucumber & Watir-Webdriver`



minesweeper robot testing pyramid

are there other ways that you can test? perhaps accessing an API or via the database?

iteration three: guess better




```
it 'should calculate mine placement probability considering adjacent revealed cells'
  analyse <<-EOF, 1
  1 . .
  . . .
  EOF
  analyser.probability_of_mine_at(0,1).should be_within(0.001).of(0.333)
end
```


success rate: 5%

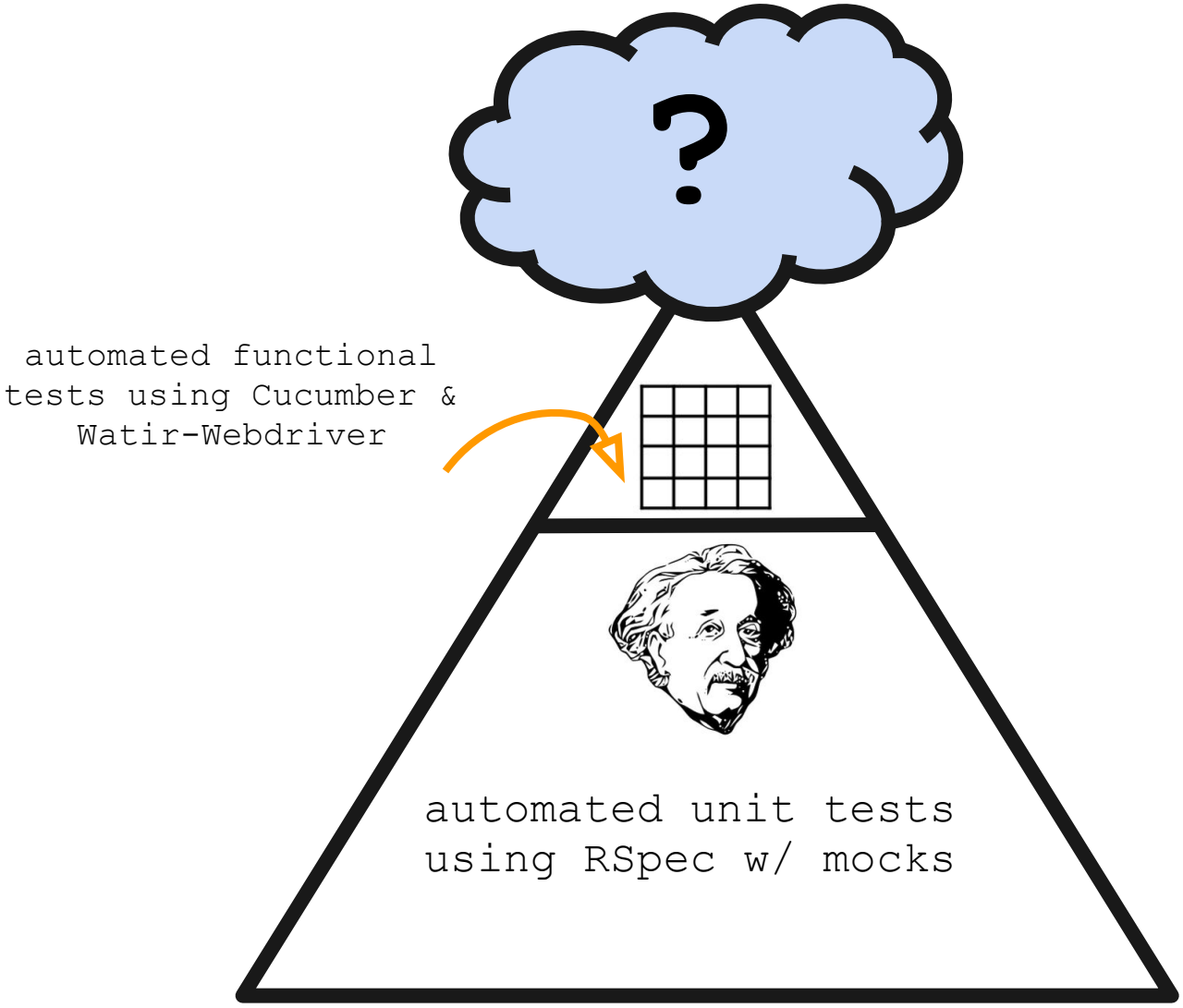
iteration four: 'clusters'

```
it 'should detect a safe cell to click taking an adjacent
  cell cluster into consideration' do
  analyse <<-EOF
  0 0 0 .
  1 1 2 .
  . . . .
  EOF
  analyser.safe_cells_to_click.should == [[2,2]]
end
```


success rate: 13%

iteration five: 'derived clusters' via exploratory testing

success rate: 20%



exploratory testing

every guess that shouldn't be a guess is a bug (which can kill us)

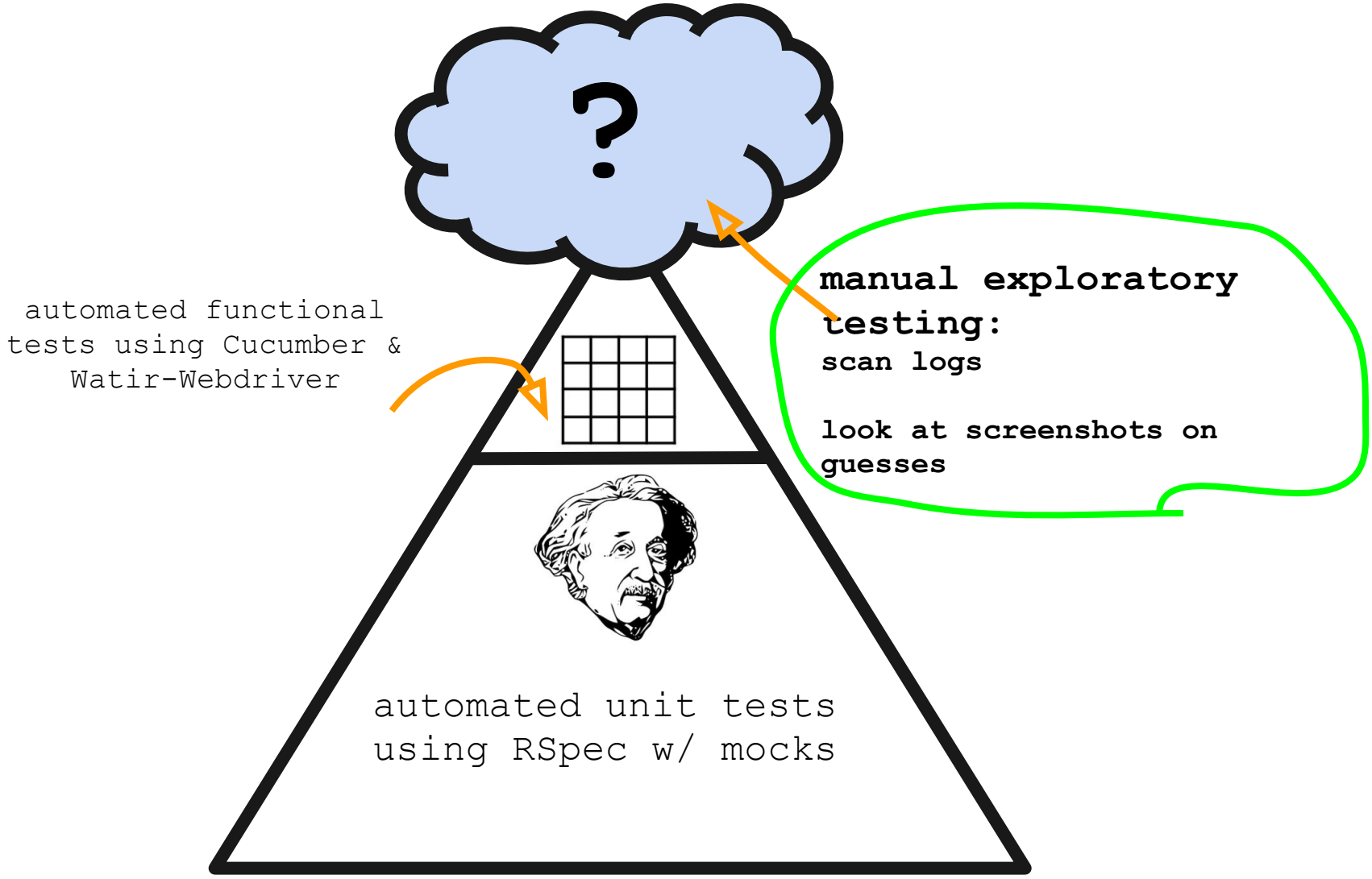
Exploratory Testing

1. **Let robot play heaps of games**
2. **Study each guess (logs/screenshots)**
3. **Was it absolutely necessary to guess? If not, it's a bug!**
4. **Write failing spec from screenshot**
5. **Make it pass!**

eliminate unnecessary guesses!

```
describe 'safe cells to click' do
    it 'should detect safe cells taking multiple  non-
    adjacent cell clusters into consideration' do
        analyse <<-EOF
        3 * 3 1 2 1
        * * 4 * 3 *
        3 4 . . . 2
        * 2 . 2 . 1
        EOF
        analyser.safe_cells_to_click.should == [[3, 2],
            [3, 4], [2, 3]]
    end
end
```

example: gets hard



exploratory testing

how can you use exploratory testing to ensure your automated testing is valid?

how can you use logs?

detect some obvious mines

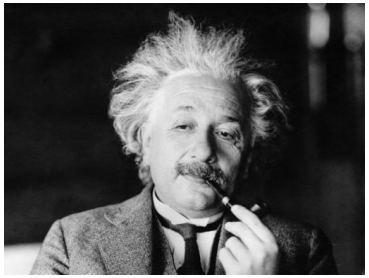
detect some safe cells

guessing by field probability

clusters

related clusters

derived clusters



progressive intelligence: law of diminishing returns?

have you noticed as you do more and more testing, it gets harder to find bugs?

Performance Testing

How do you test performance of an algorithm that tries to solve a **non-deterministic** problem?

Can always win this without guessing (start at 0,0)

Ensure we never degrade performance

can you find a known constant pattern that you can baseline & measure performance against over time?

Einstein's Performance Metrics

Beginner

Games won: 85%

Best time: 2 seconds

Intermediate:

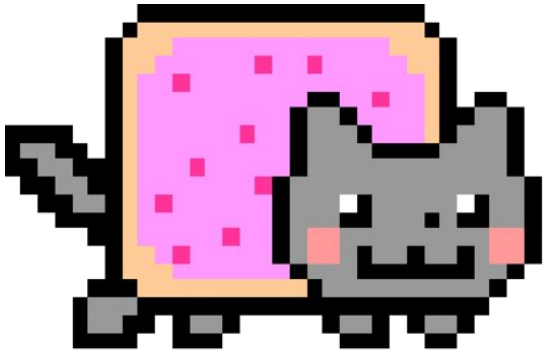
Games won: 65%

Best time: 8 seconds

Expert:

Games won: 20%

Best time: 21 seconds



Enough talk already

Let's see Einstein in action!

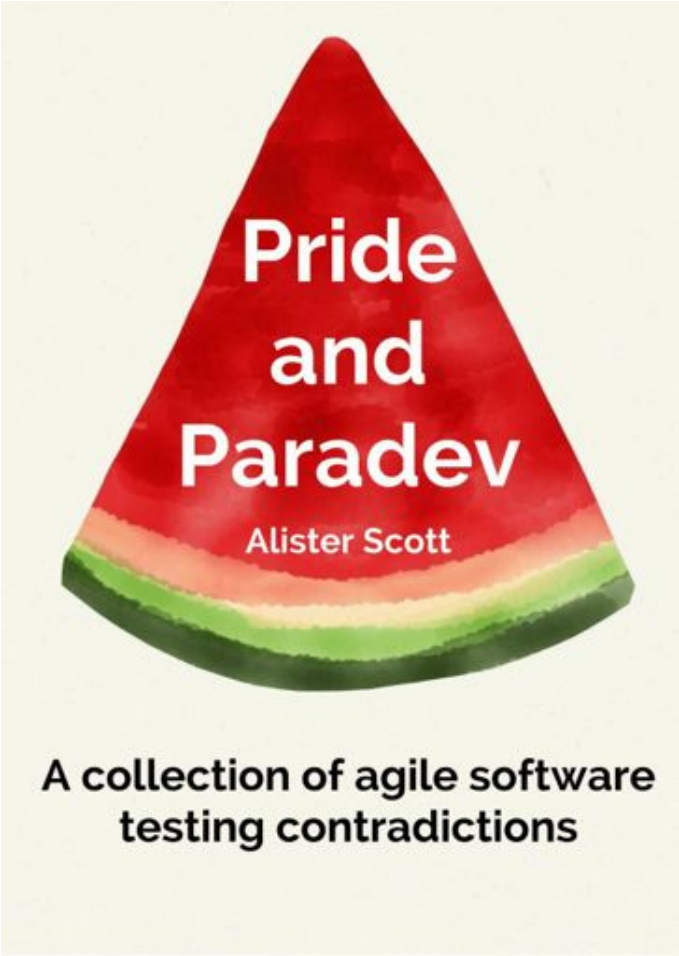
[http://soundcloud.com/blaketothefuture/nyan-cat-the-movie]

Lessons Learned

- Break big things down into little things
- Design for testability - test only features
- Test in the right places
- Supplement your automated testing with exploratory testing
- Build in performance measures
- Change your mind
- Be young, be foolish, be happy

what's one thing you'll try today?

More



Source code: github.com/minesweeper/minesweeper-robot

Game: minesweeper.github.io

My blog: watirmelon.com

My book: leanpub.com/pride-and-paradev