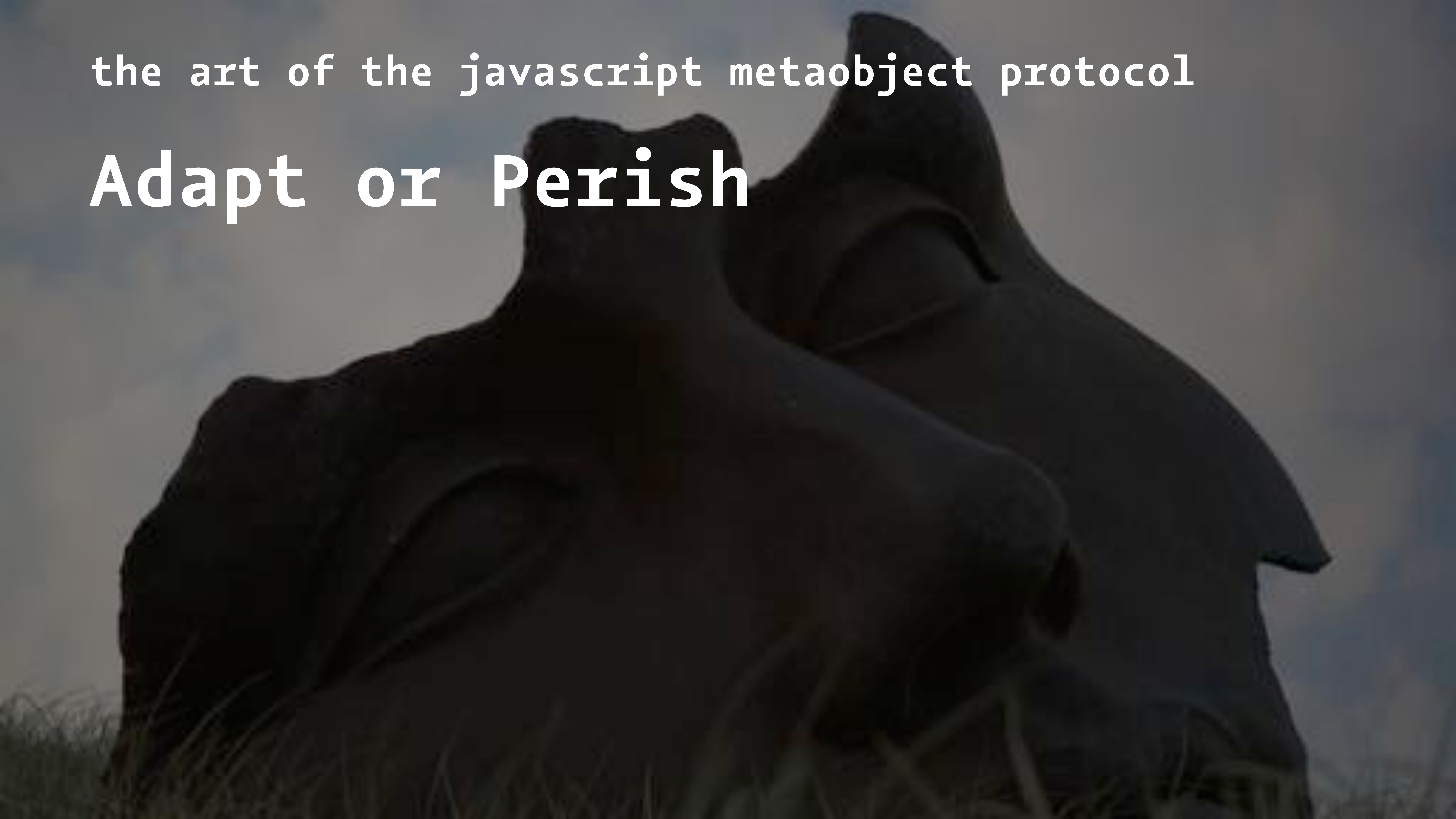
the art of the javascript metaobject protocol

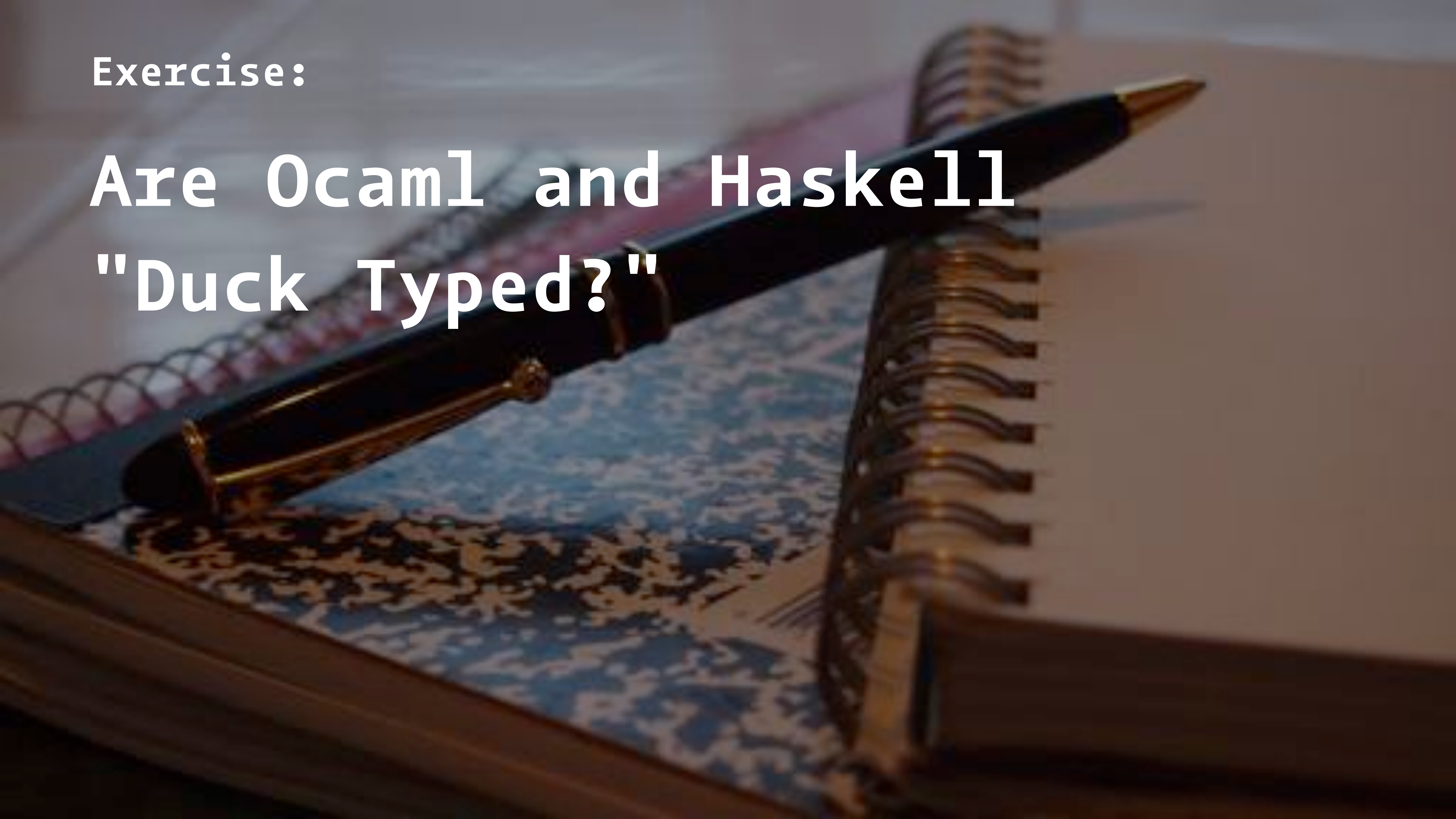
Adapt or Perish



20
15
16
17

Duck typing is a style of typing in which an object's methods and properties determine the valid semantics,

...rather than its inheritance from a particular class or implementation of an explicit interface.



Exercise:

Are Ocaml and Haskell "Duck Typed?"

Fruit

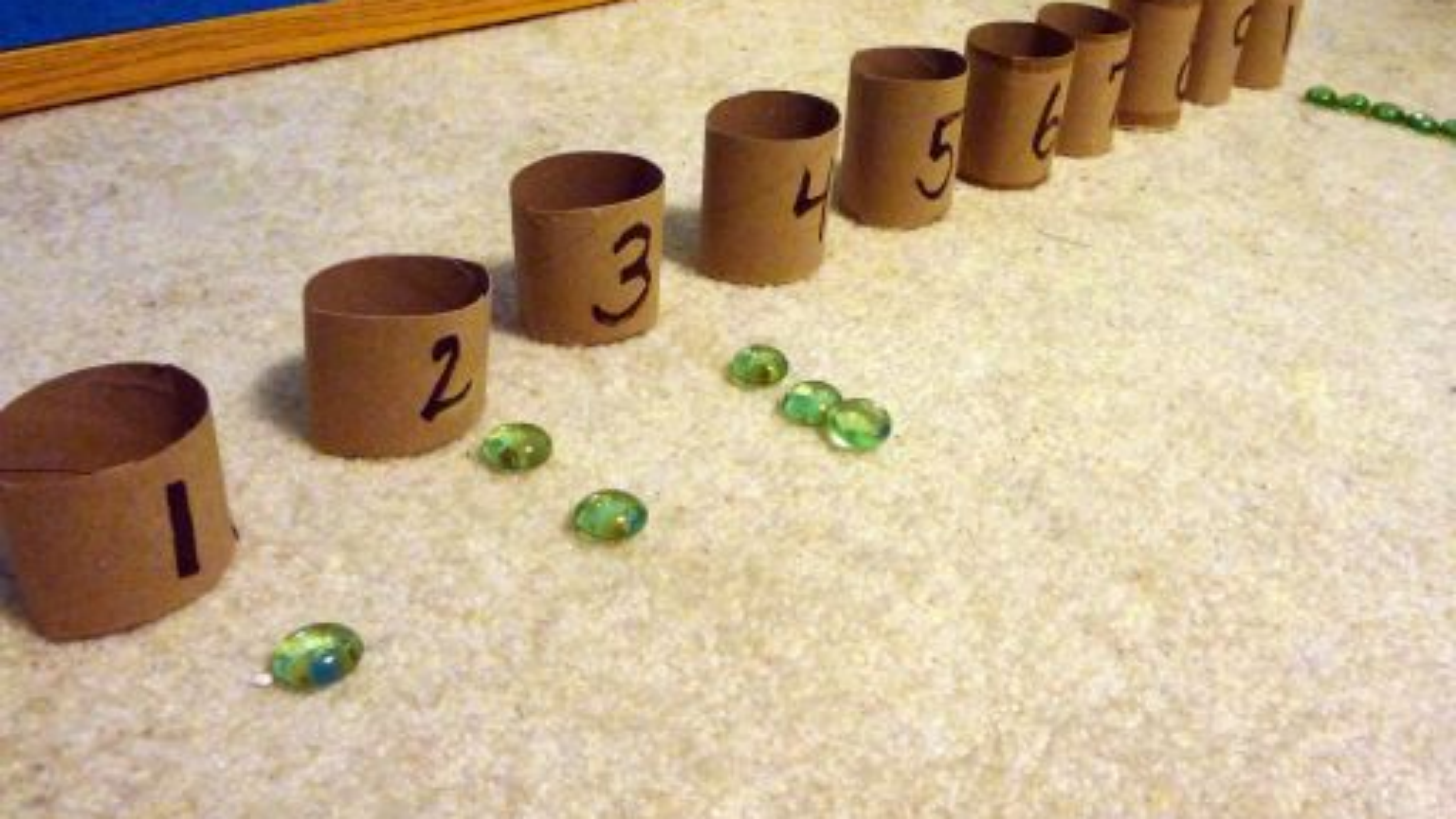
Not Fruit

"fruit" is not defined by its

Properties

0 0 2 9 0 7 2 0 1

Addition


1
2
3
4
5
6
7
8
9
1

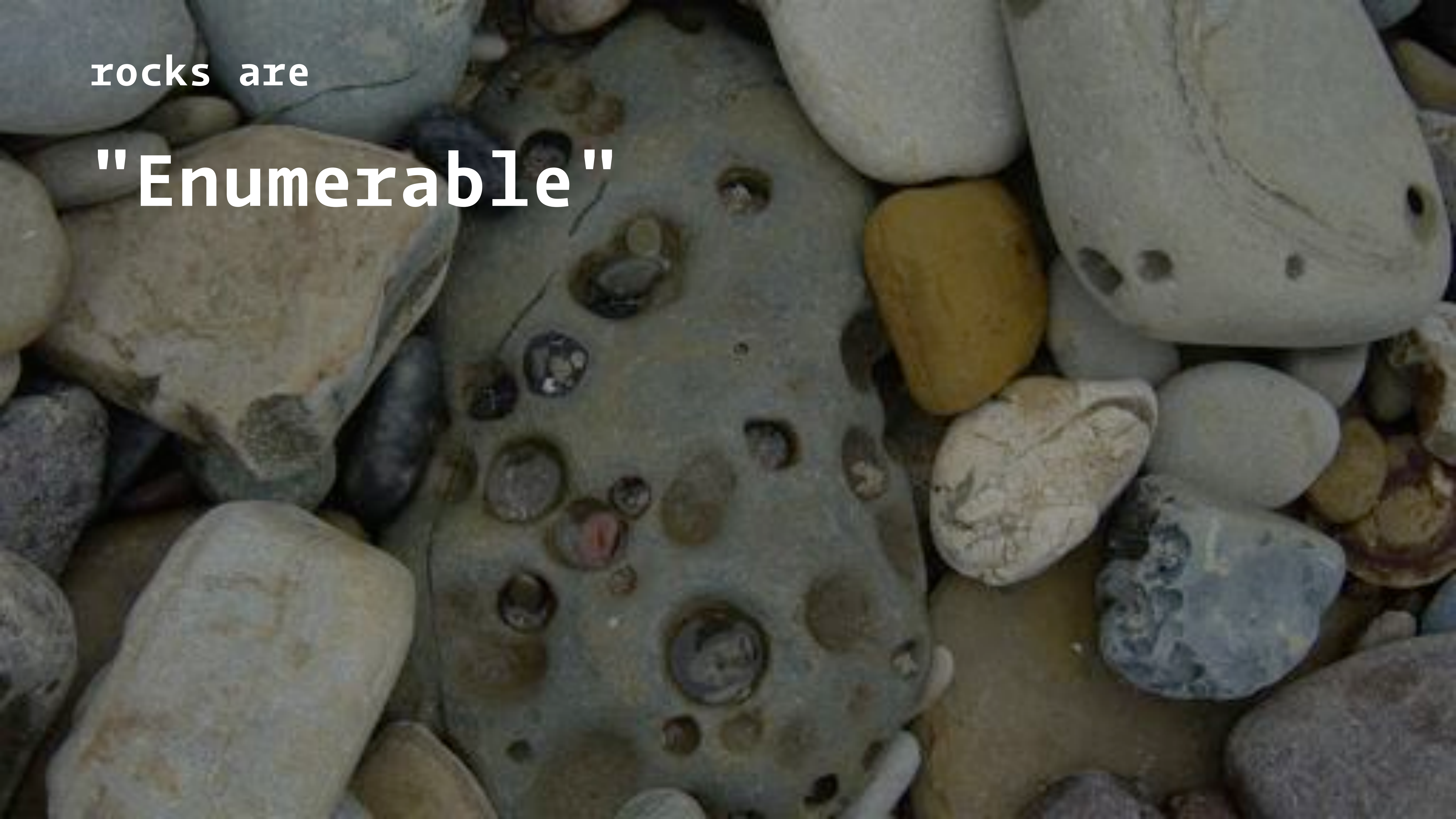
addition is based on being

"Enumerable"

VEGAS
INSIDE
Dexter S. Guida

people are

"Enumerable"

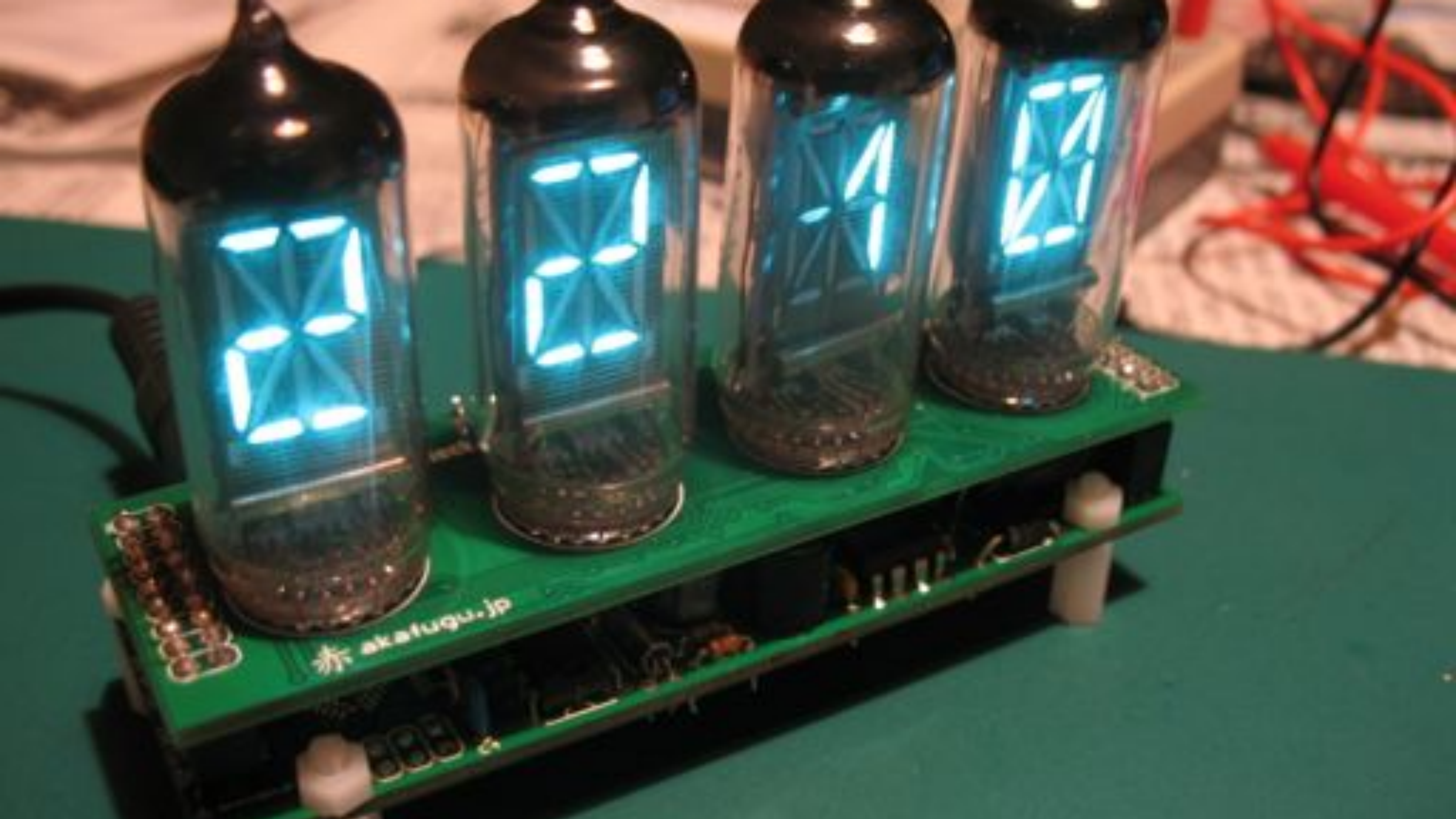


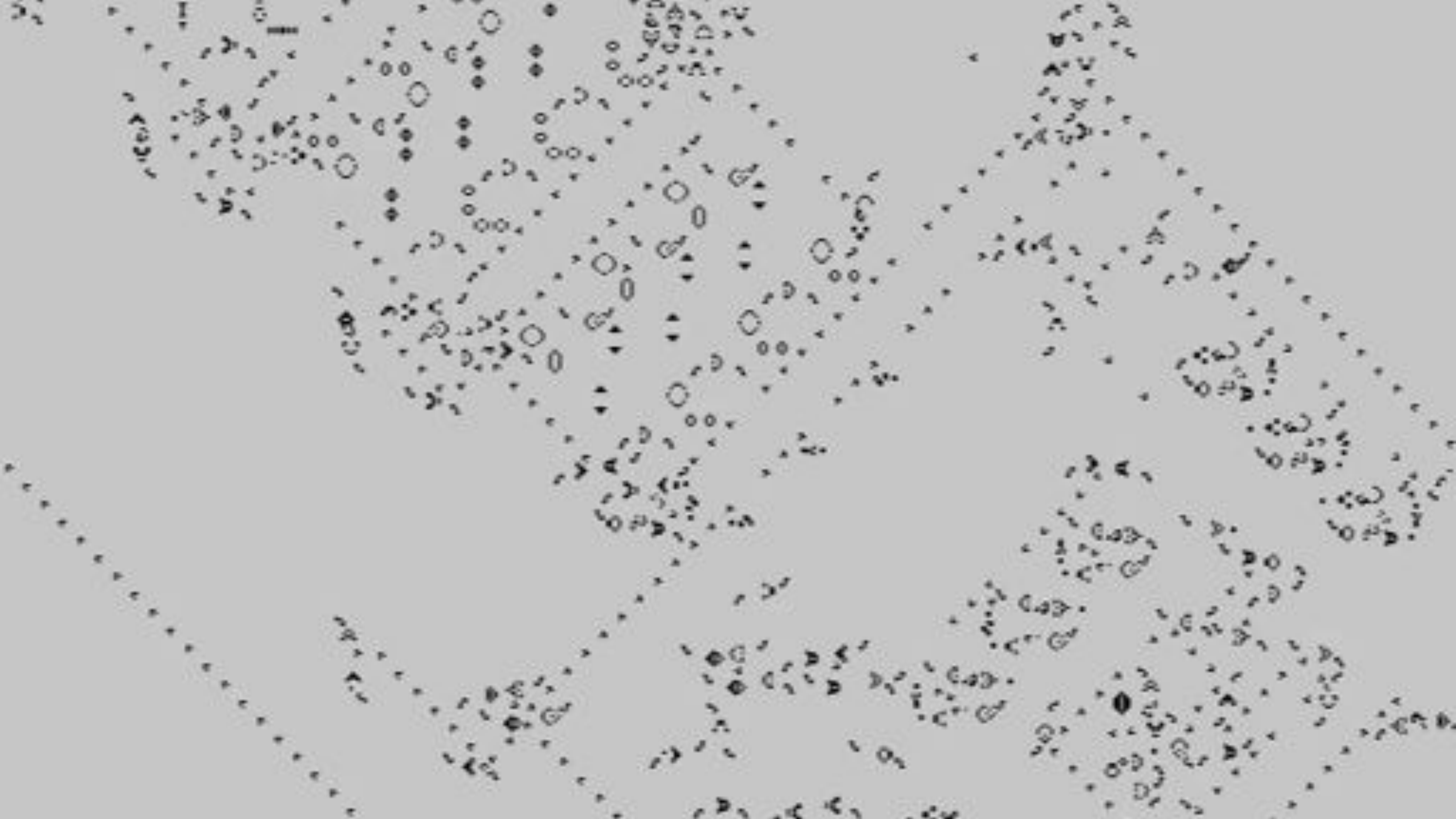
rocks are

"Enumerable"

duck typing is like

"Enumerable," not like "Fruit"


赤 akafugu.jp



Conway's Game of Life

```
function StandardCell () {
  this._neighbours = [];
  this._alive      = false;
}
```

```
StandardCell.prototype.neighbours =
  function neighbours (neighbours) {
    return this._neighbours;
  };

StandardCell.prototype.setNeighbours =
  function setNeighbours (neighbours) {
    this._neighbours = neighbours.slice(0);
    return this;
  };
```

```
StandardCell.prototype.alive =
  function alive () {
    return this._alive;
  };

StandardCell.prototype.setAlive =
  function setAlive (alive) {
    this._alive = alive;
    return this;
  };
```

Today
4 billion years
11 billion ye

moving through

Time

Today
4 billion years
11 billion ye

```
StandardCell.prototype.nextAlive =
  function nextAlive () {
    var alives =
      this._neighbours.filter(function (n) {
        return n.alive();
      }).length;
    if (this.alive()) {
      return alives === 2 ||
             alives == 3;
    }
    else {
      return alives == 3;
    }
  };
```

```
Universe.prototype.iterate =
  function iterate () {
    var aliveInNextGeneration = this.cells().map(
      function (c) {
        return [c, c.nextAlive()];
      }
    );

    aliveInNextGeneration.forEach(function (a) {
      var cell = a[0],
          next = a[1];

      cell.setAlive(next);
    });
  };
```

drawing

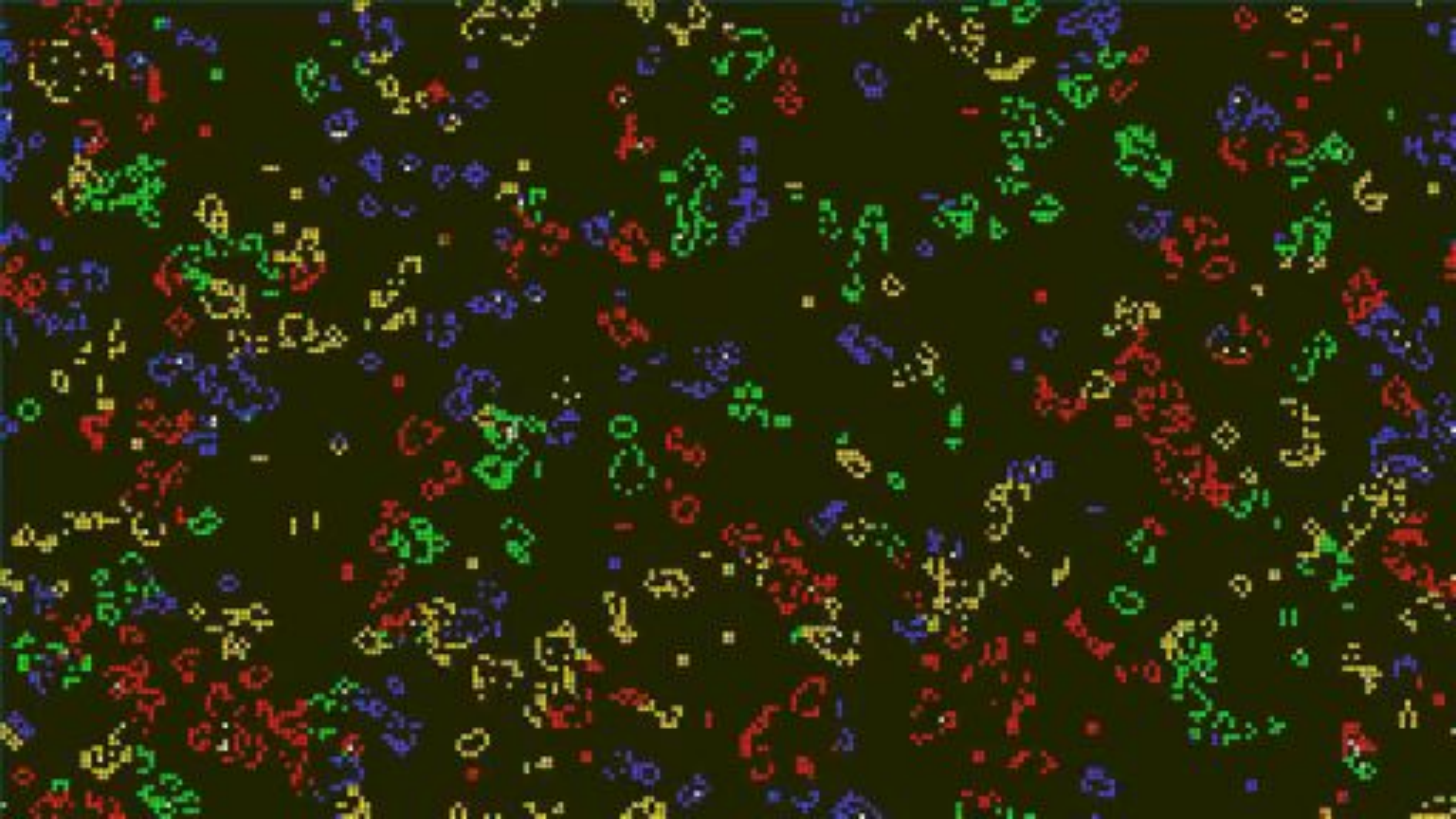
Life

```
View.prototype.drawCell =
  function drawCell (cell, x, y) {
    var xPlus = x + this.cellSize(),
        yPlus = y + this.cellSize()
    this._canvasContext.clearRect(x, y, xPlus, yPlus);
    this._canvasContext.fillStyle = this.cellColour(cell);
    this._canvasContext.fillRect(x, y, xPlus, yPlus);
    return self;
  };
```

```
View.prototype.cellColour =
  function cellColour (cell) {
    return cell.alive()
           ? WHITE
           : BLACK;
  };
```

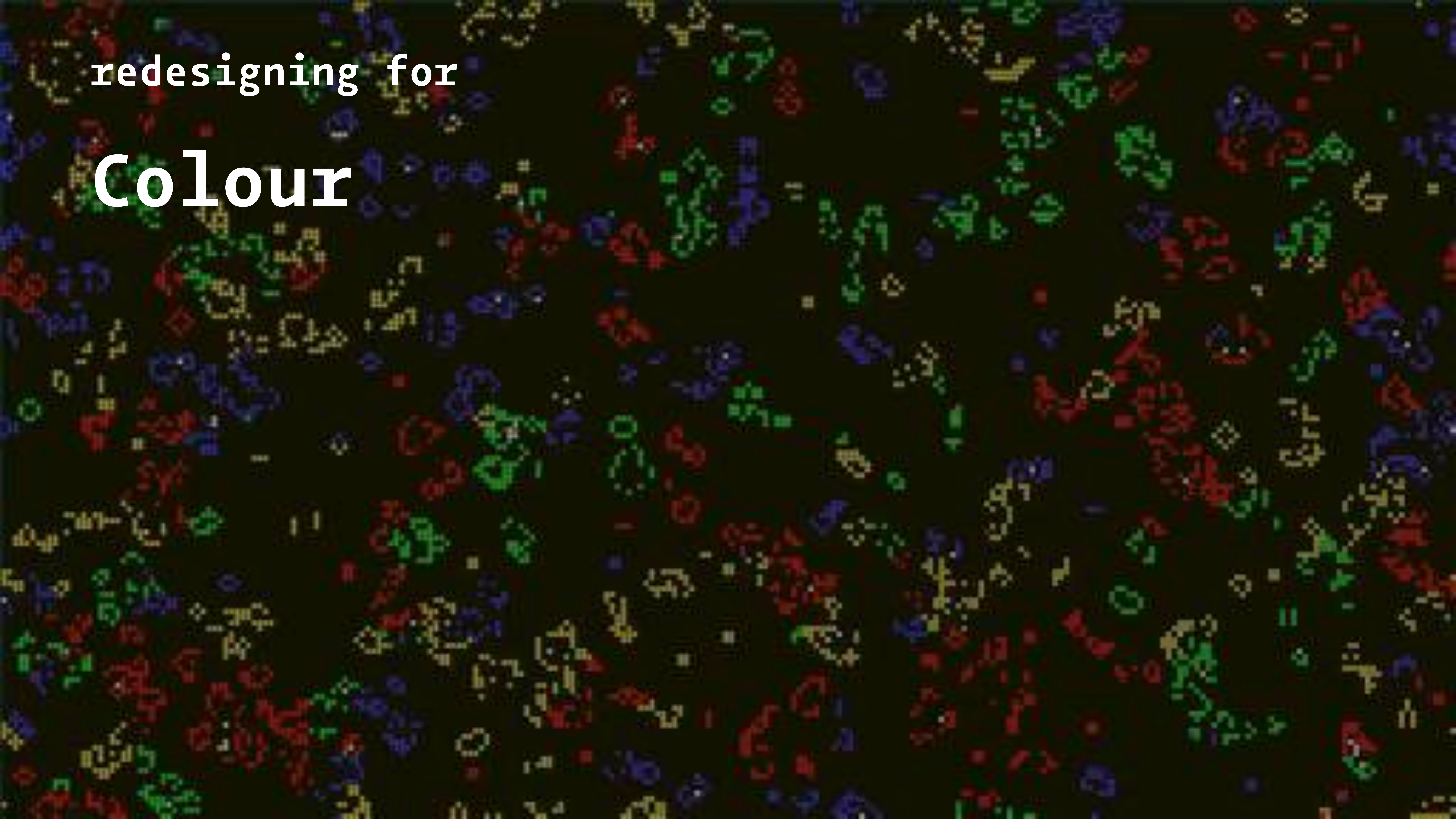
CHANGE

Ch-ch-ch-changes!



redesigning for

Colour



```
function ColourCell () {
  this._neighbours = [];
  this._age        = 0;
}

ColourCell.prototype.neighbours =
  StandardCell.prototype.neighbours;


ColourCell.prototype.setNeighbours =
  StandardCell.prototype.setNeighbours;
```

```
ColourCell.prototype.age =
  function age () {
    return this._age;
  };

ColourCell.prototype.setAge =
  function setAge (age) {
    this._age = age;
    return this;
  };
```

moving through time

in Colour

```
ColourCell.prototype.nextAge =
  function next () {
    var alives =
      this._neighbours.filter(function (n) {
        return n.age() > 0;
      }).length;
    if (this.age() > 0) {
      return (alives === 2 || alives == 3)
             ? (this.age() + 1)
             : 0;
    }
    else {
      return (alives == 3)
             ? (this.age() + 1)
             : 0;
    }
  };
```

```
Universe.prototype.iterate =
  function iterate () {
    var ageInNextGeneration = this.cells().map(
      function (c) {
        return [c, c.nextAge()];
      }
    );

    ageInNextGeneration.forEach(function (a) {
      var cell = a[0],
          next = a[1];

      cell.setAge(next);
    });
  };
```

drawing life

in Colour

```
var COLOURS =
  [ BLACK, GREEN, BLUE, YELLOW, WHITE, RED ];

View.prototype.cellColour =
  function cellColour (cell) {
    return COLORS[
                   (cell.age() >= COLOURS.length)
                   ? (COLOURS.length - 1)
                   : cell.age()
                 ];
  };

// ...
```

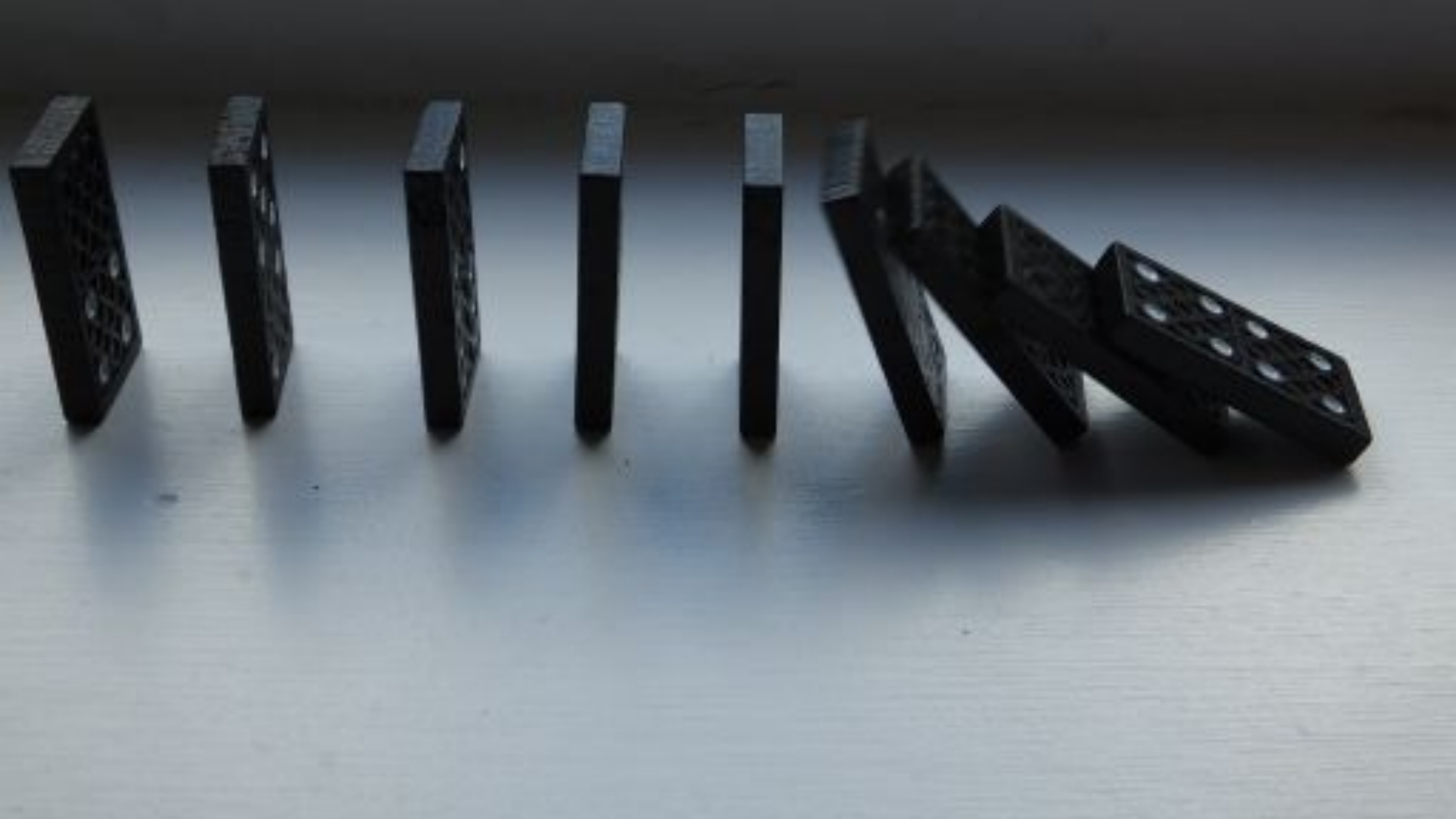
OBS.

something

Doesn't Fit

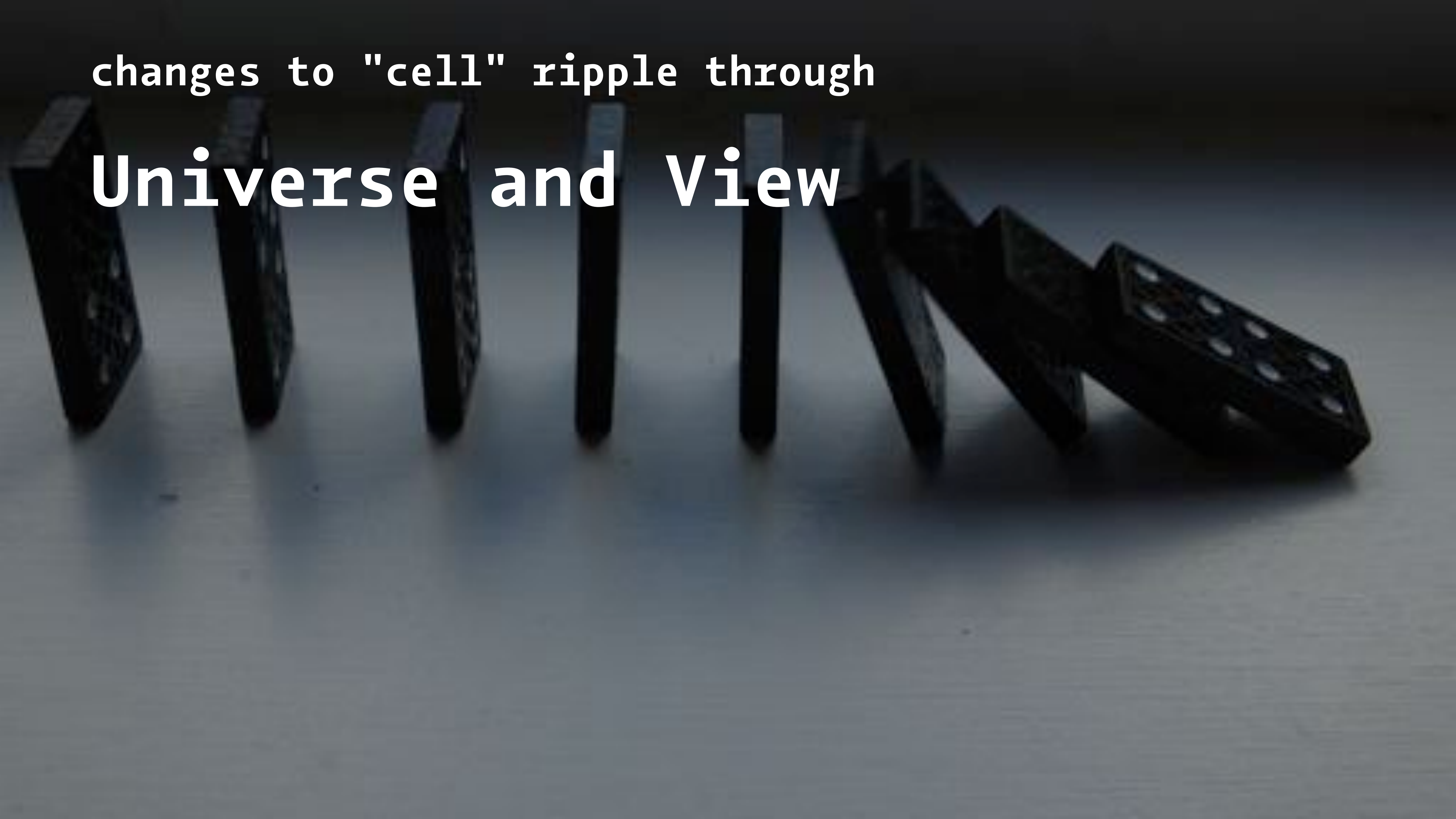
```
Object.keys(StandardCell.prototype)
// =>
  [ 'neighbours',
    'setNeighbours',
    'alive',
    'setAlive',
    'nextAlive' ]
```

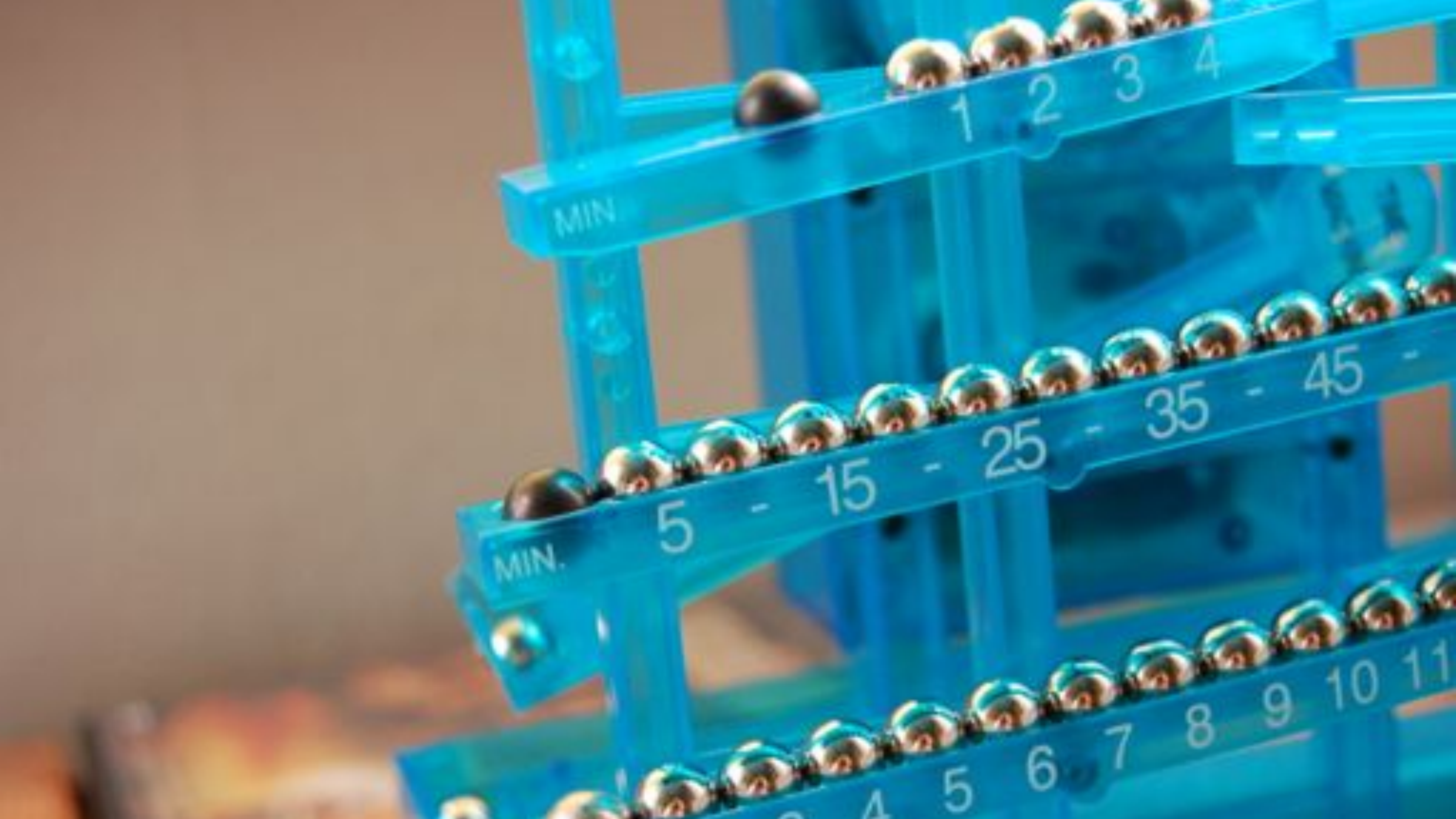
```
Object.keys(ColourCell.prototype)
// =>
  [ 'neighbours',
    'setNeighbours',
    'age',
    'setAge',
    'nextAge' ]
```



changes to "cell" ripple through

Universe and View




MIN
1 2 3 4
MIN.
5 - 15 - 25 - 35 - 45 -
4 5 6 7 8 9 10 11

direct

Duck Typing

```
ColourCell.prototype.alive =
  function alive () {
    return this._age > 0;
  };
```

```
ColourCell.prototype.setAlive =
 function setAlive (alive) {
  if (alive) {
   this.setAge(this.age() + 1);
  }
  else this.setAge(0);
  return this;
 };
```

```
ColourCell.prototype.nextAlive =
  StandardCell.prototype.nextAlive;
```

```
Object.keys(ColourCell.prototype)
// =>
  [ 'neighbours',
    'setNeighbours',
    'age',
    'setAge',
    'nextAge',
    'alive',
    'setAlive',
    'nextAlive' ]
```

there is

Another Way

```
function AsStandard (colour) {
  this.it = colour;
}

var quacksLikeAStandardDuck =
  new AsStandard(aColourCell);
```

```
AsStandard.prototype.neighbours =
  function neighbours () {
    return this.it.neighbours();
  };

AsStandard.prototype.setNeighbours =
  function setNeighbours (neighbours) {
    this.it.setNeighbours(neighbours);
    return this;
  };
```

```
AsStandard.prototype.alive =
  function alive () {
    return this.it.age() > 0;
  };
```

```
AsStandard.prototype.setAlive =
  function setAlive (alive) {
    if (alive) {
      this.it.setAge(this.it.age() + 1);
    }
    else this.it.setAge(0);
    return this;
  };
```

```
AsStandard.prototype.nextAlive =
  function nextAlive () {
    return this.it.nextAge() > 0;
  }
```

```
Object.keys(AsStandard.prototype)
// =>
  [ 'setNeighbours',
    'alive',
    'setAlive',
    'nextAlive' ]
```

we can go in the

Other Direction

```
function AsColour (standard) {
  this.it = standard;
}

var quacksLikeAColouredDuck =
  new AsColour(aStandardCell);
```

```
AsColour.prototype.neighbours =
  function neighbours () {
    return this.it.neighbours();
  };

AsColour.prototype.setNeighbours =
  function setNeighbours (neighbours) {
    this.it.setNeighbours(neighbours);
    return this;
  };
```

```
AsColour.prototype.age =
  function age () {
    return this.it.alive()
           ? 1
           : 0;
  };
```

```
AsColour.prototype.setAge =
  function setAge (age) {
    this.it.setAlive(age > 0);
    return this;
  };
```

```
AsColour.prototype.nextAge =
  function nextAge () {
    return this.it.nextAlive()
           ? 1
           : 0;
  }
```

```
Object.keys(AsColour.prototype)
// =>
  [ 'neighbours',
    'setNeighbours',
    'age',
    'setAge',
    'nextAge' ]
```

AsStandard and AsColour are

Adapters

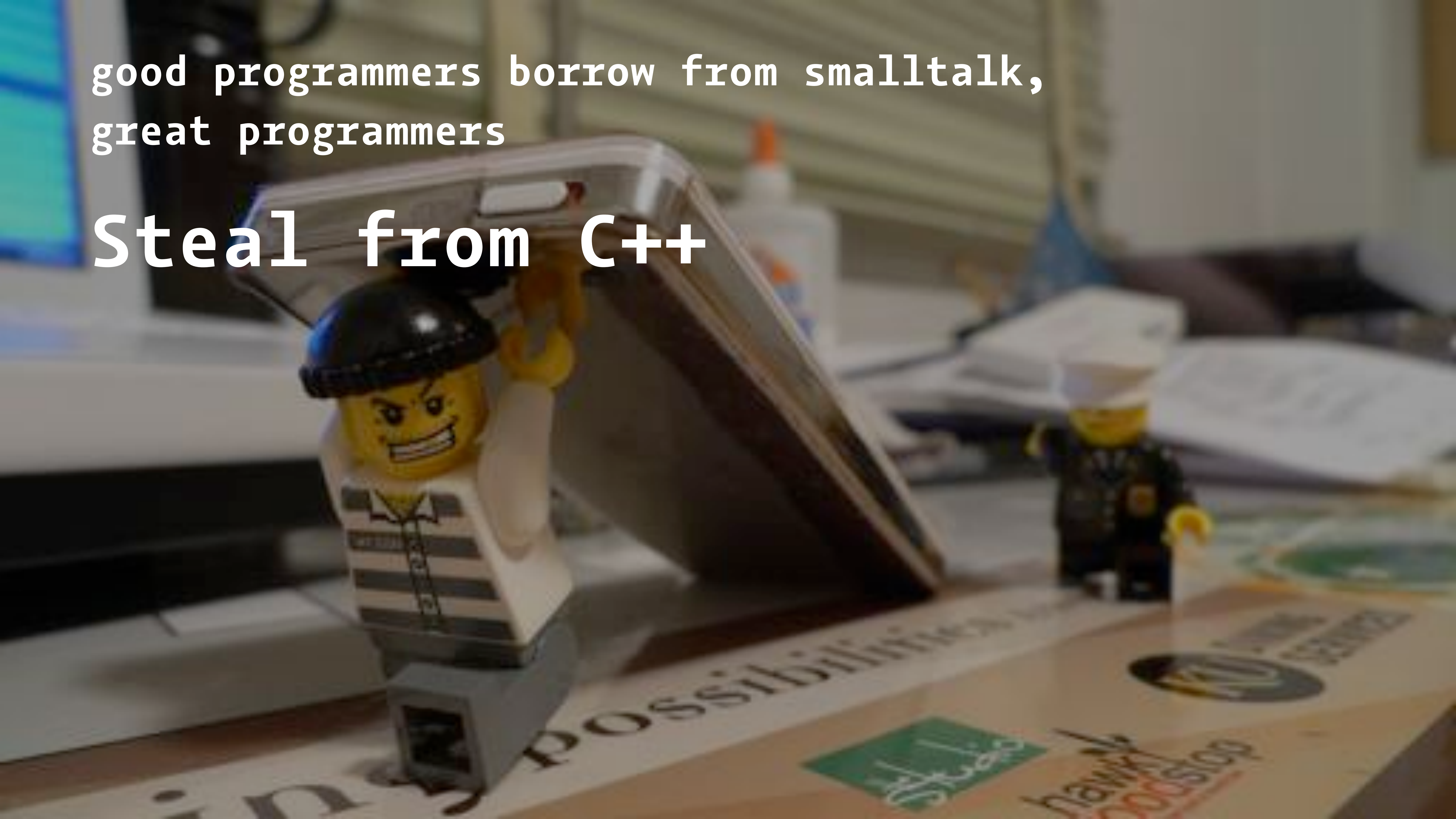
The adapter pattern is a software design pattern that allows the interface of an existing class to be used from another interface...

... It is often used to make existing classes work with others without modifying their source code.

possibilities
studio
hawk

good programmers borrow from smalltalk,
great programmers

Steal from C++



copy constructors are

Value Adapters

```
function colourFromStandard (standard) {
  return new ColourCell()
         .setNeighbours(standard.neighbours())
         .setAge(standard.alive() ? 1 : 0);
}
```

```
function standardFromColour (colour) {
  return new StandardCell()
         .setNeighbours(colour.neighbours())
         .setAlive(colour.age() > 0);
}
```

if you use rails, you'd call these

"Object Migrations"

Hmmm, that's interesting!

What if we could decouple modules by migrating between versions of classes?

30

adapters

separate concerns

57309

adapters

Decouple Modules

sometimes, you only want to

Pretend to be a Duck

carbon fiber

instead of

Conflating Interfaces

Hogan Transport
HAULAGE & STORAGE
FT
UBC
BULK

consider writing

Adapters

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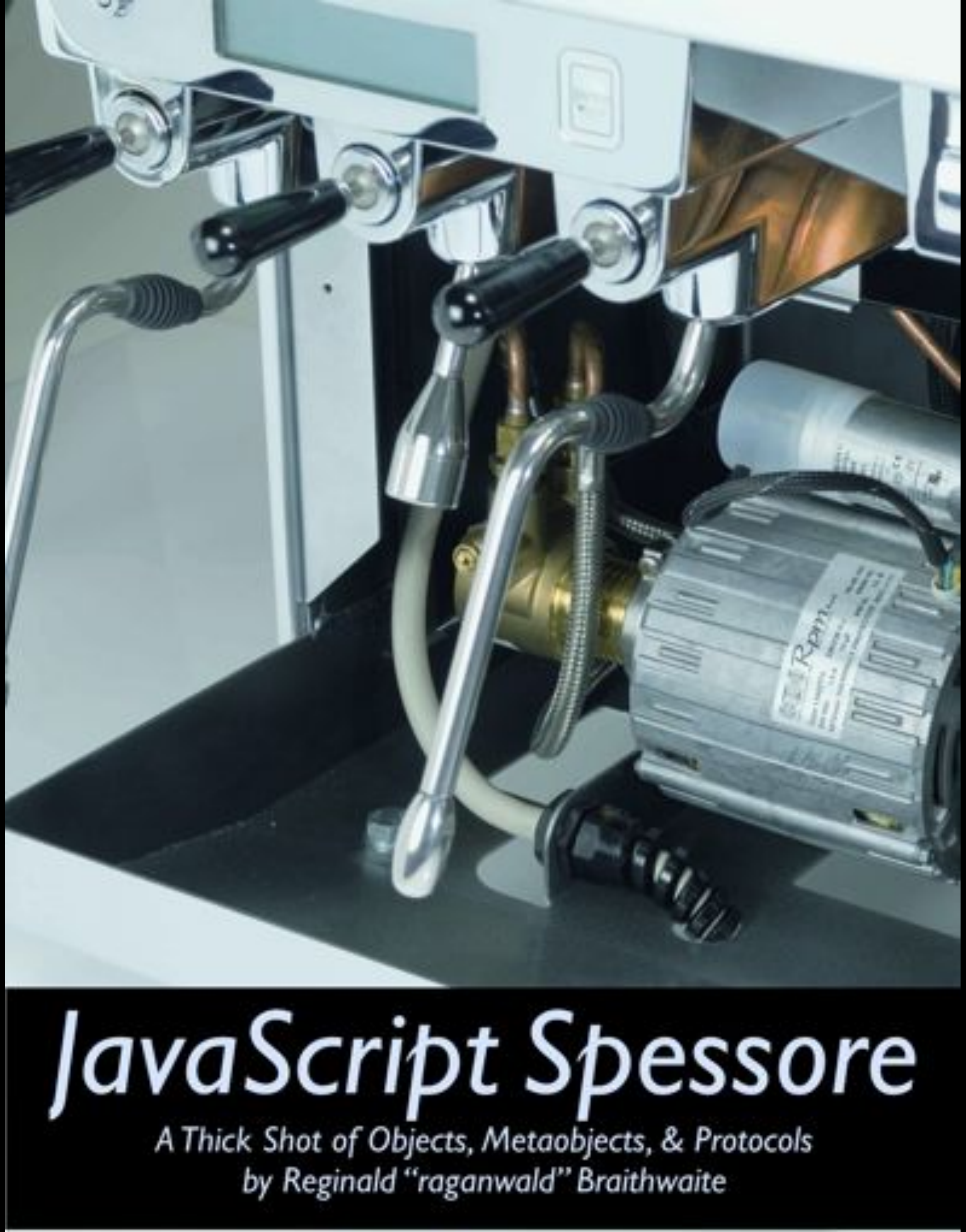

JavaScript Spessore

A Thick Shot of Objects, Metaobjects, & Protocols
by Reginald "raganwald" Braithwaite