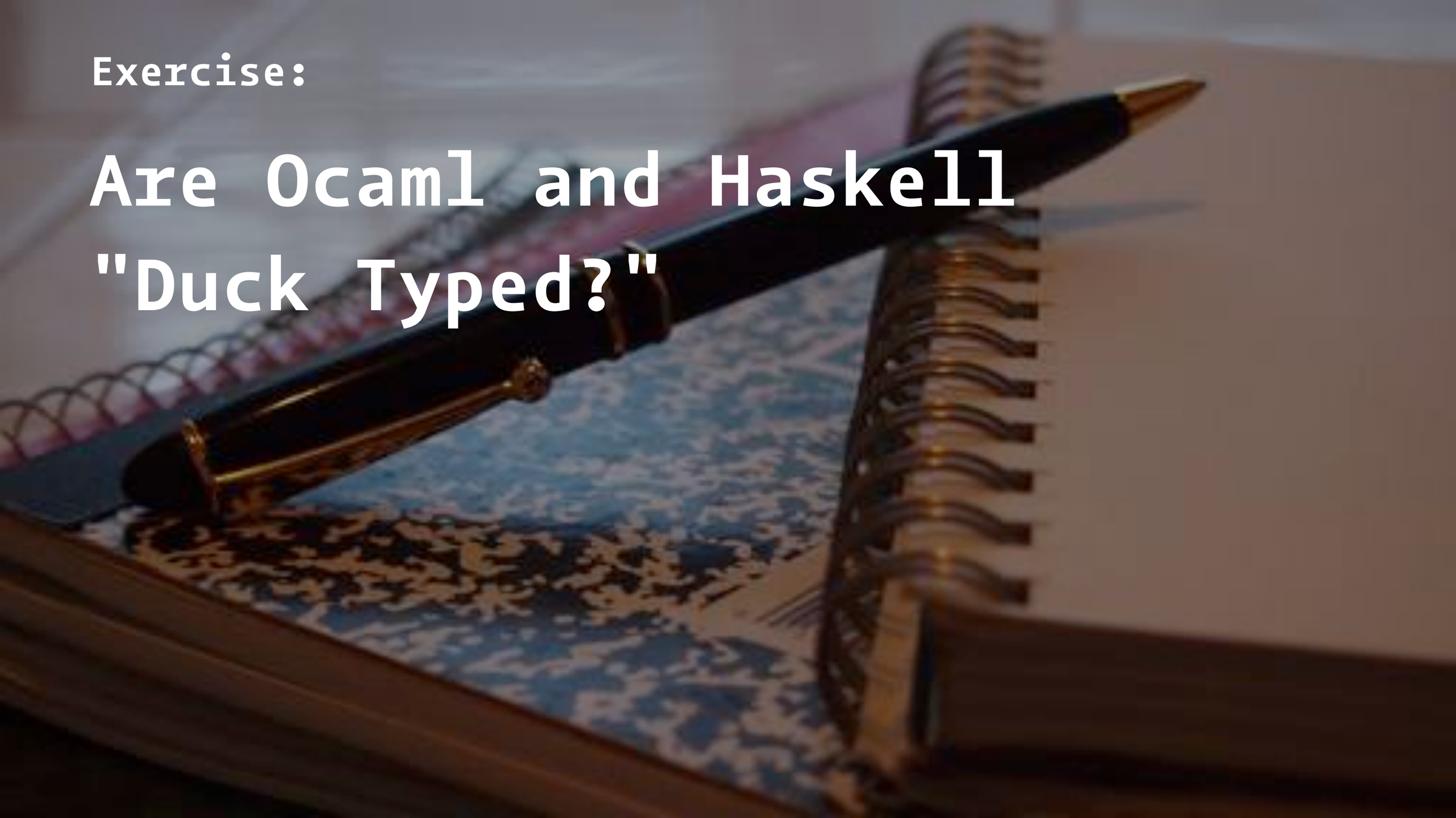
the art of the javascript metaobject protocol

Adapt or Perish


20

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

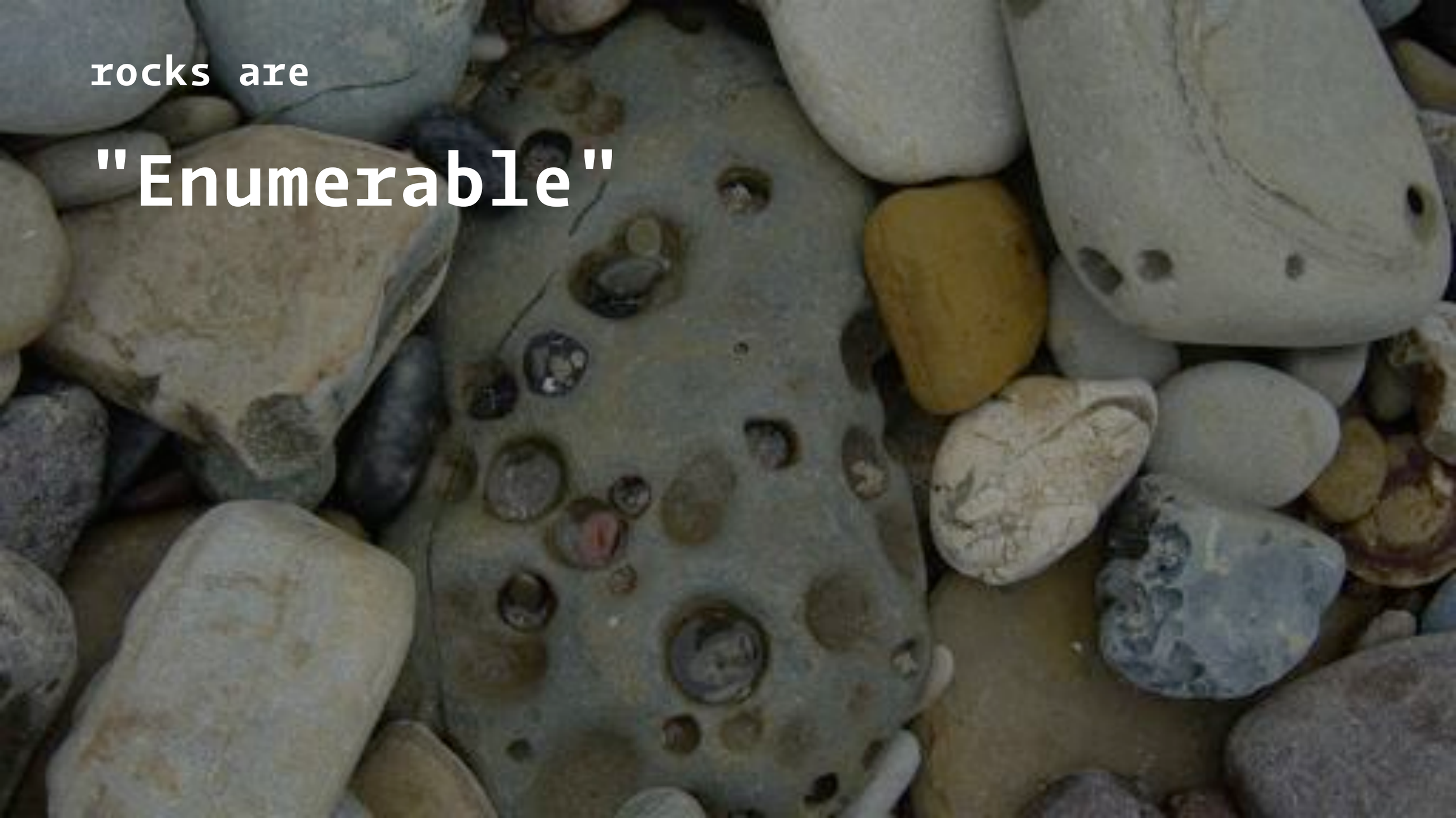

1
2
3
4
5

addition is based on being

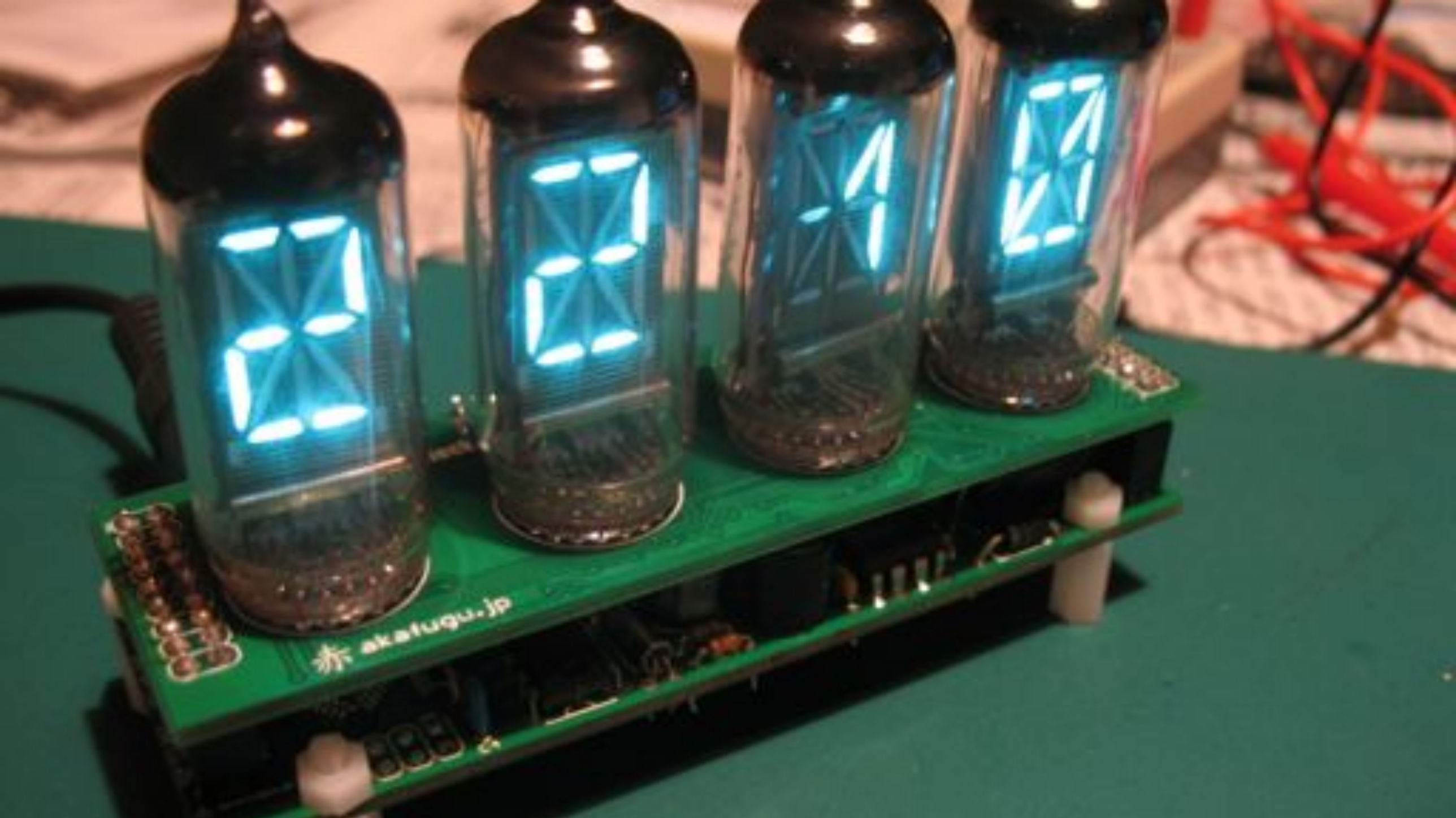
"Enumerable"


VFGAS
INSIDE
Dieter S. Gunda


people are
"Enumerable"
GAS
INSIDE


rocks are
"Enumerable"


duck typing is like
"Enumerable," not like "Fruit"


akafuqu.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

```
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);
    });
  };
```

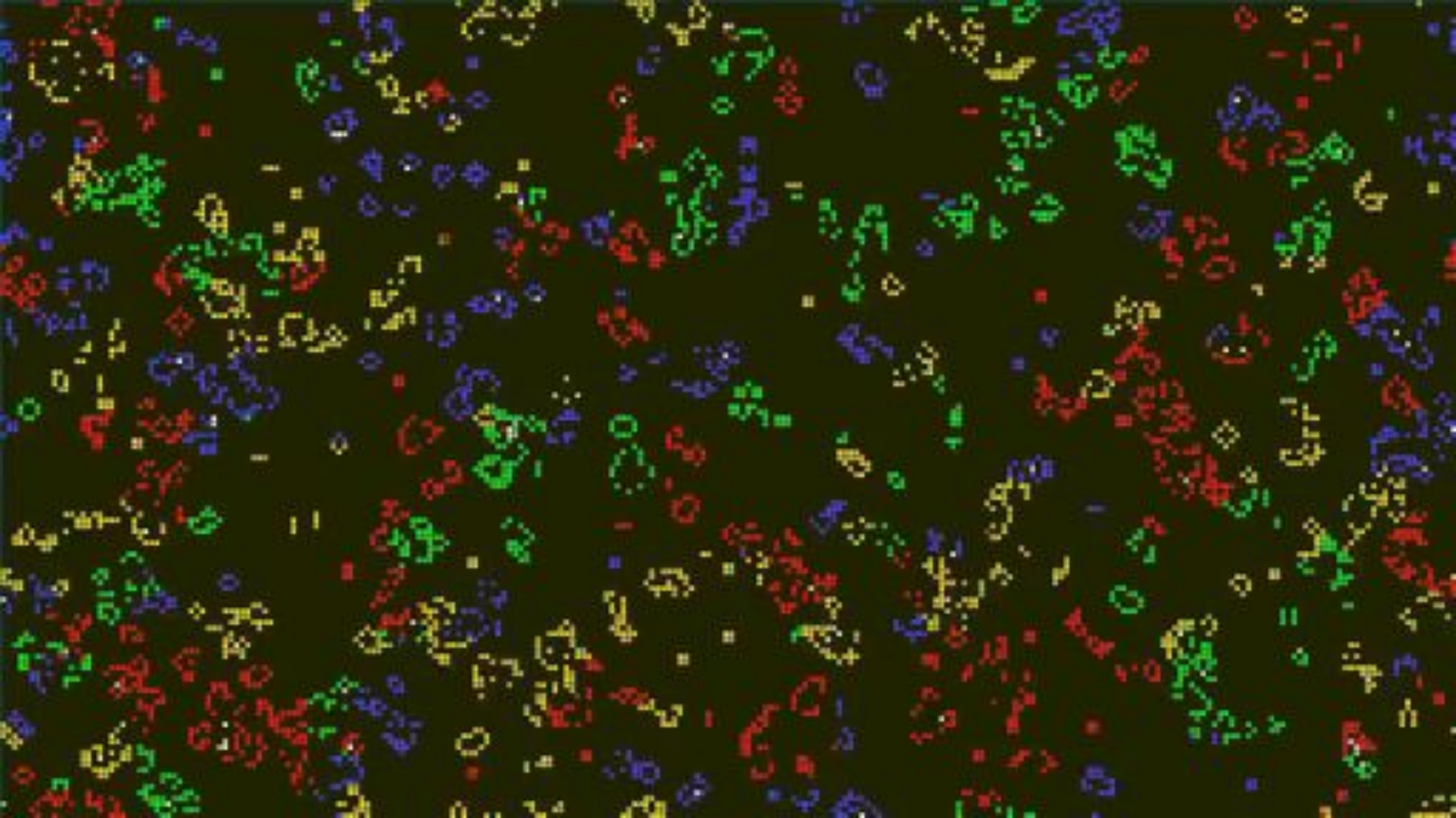

drawing
Life

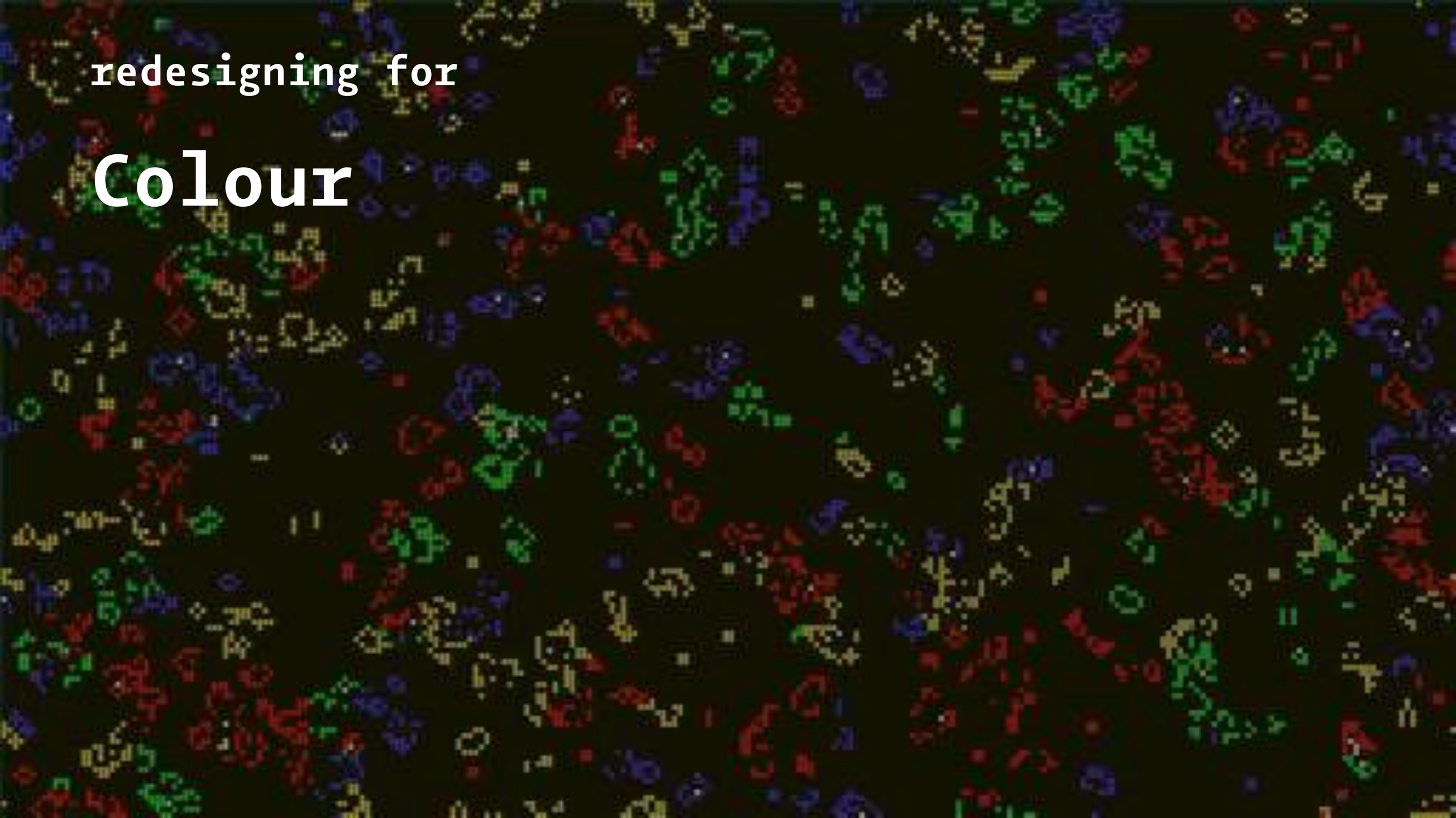
```
View.prototype.drawCell =
  function drawCell (cell, x, y) {
    var xPlus = x + this.cellSize(),
        yPlus = y + this.cellSize()
    this._canvasContext.clearRect(x, y, xPlus, yPlus);
    this._canvasContext.fillStyle = this.cellColour(cell);
    this._canvasContext.fillRect(x, y, xPlus, yPlus);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

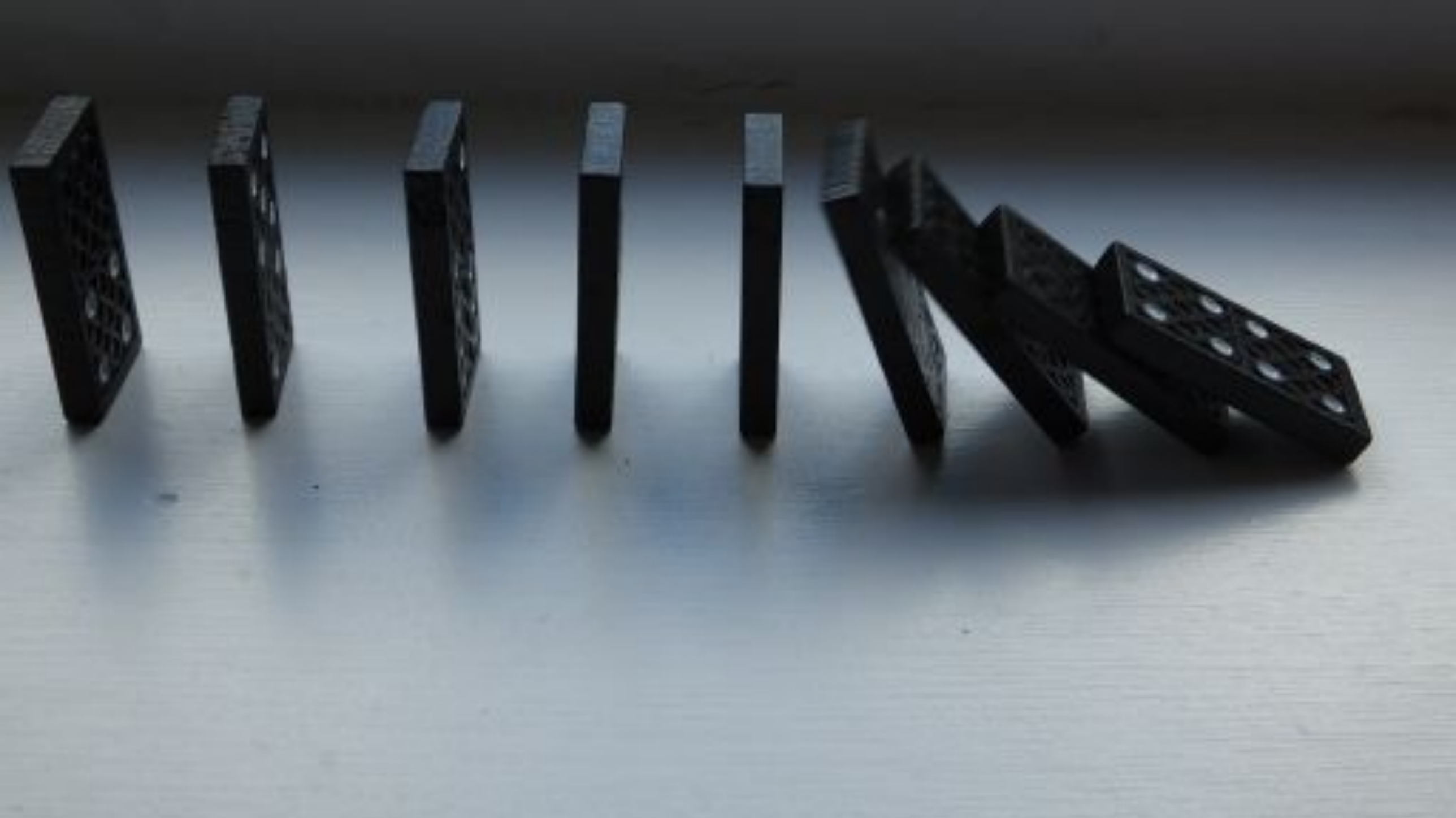
```
var COLOURS =
  [ BLACK, GREEN, BLUE, YELLOW, WHITE, RED ];

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

// ...
```

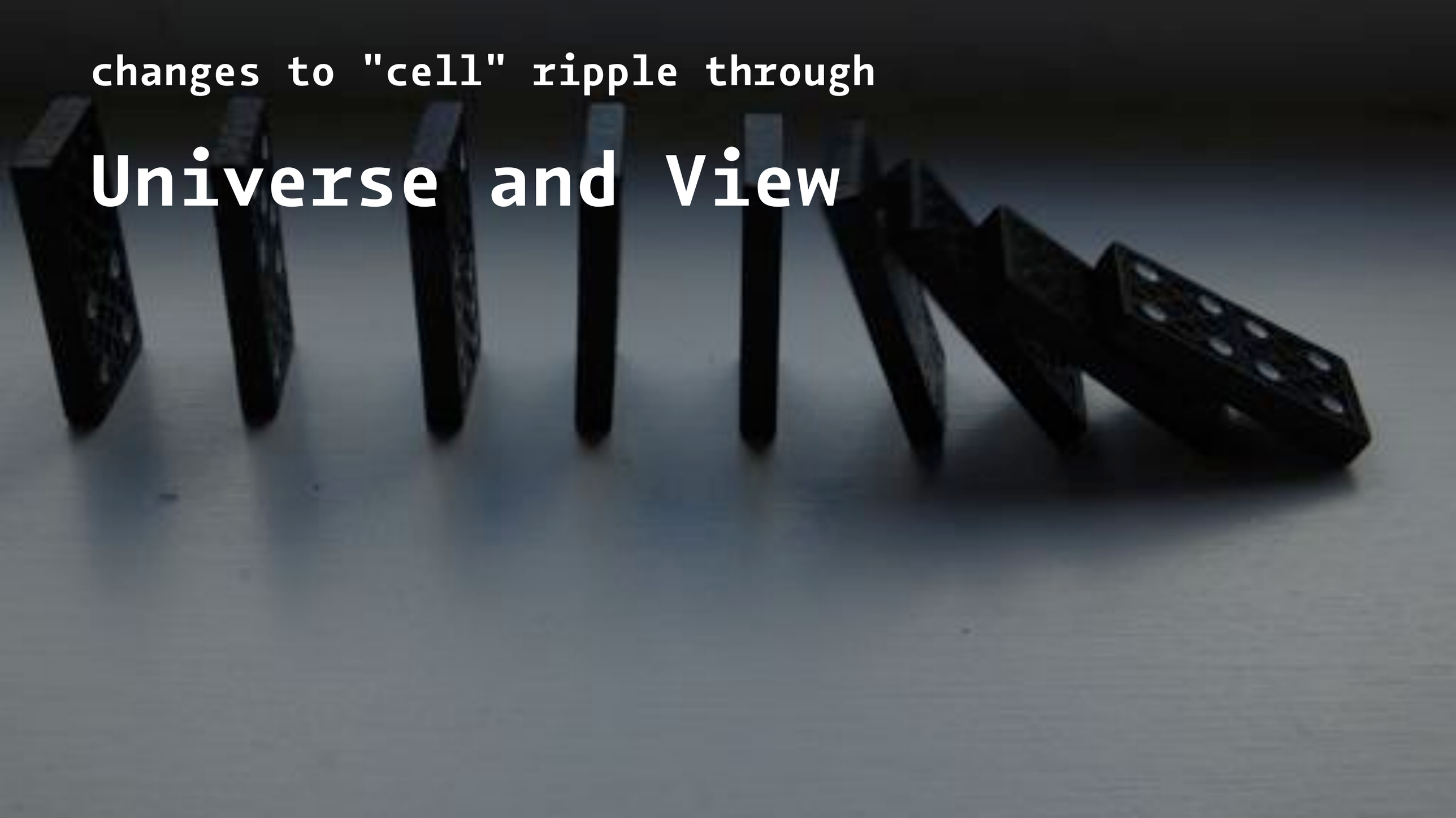

85


something
Doesn't Fit

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

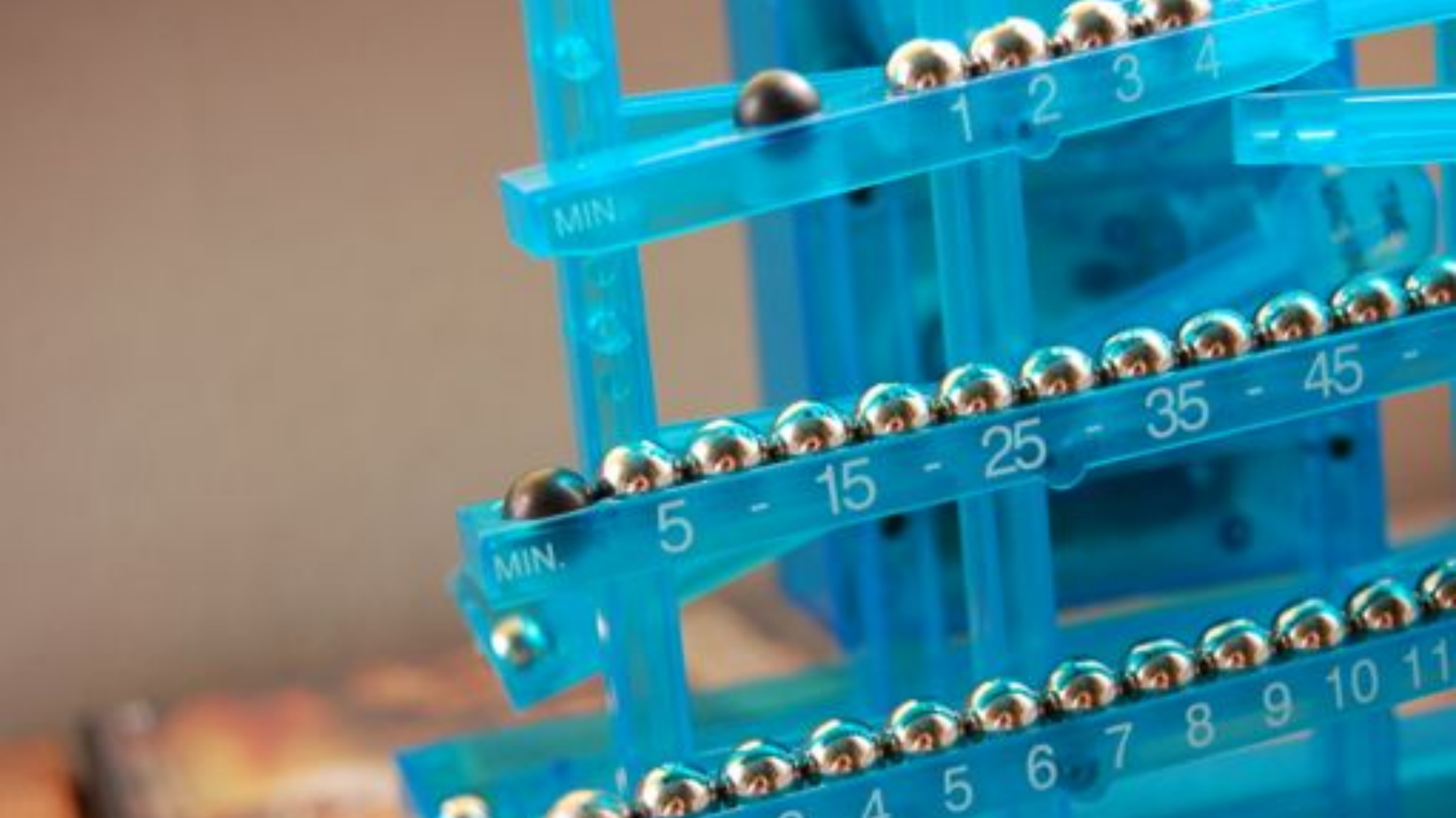
```
Object.keys(ColourCell.prototype)
// =>
  [ 'neighbours',
    'setNeighbours',
    'age',
    'setAge',
    'nextAge' ]
```





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...

```
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' ]
```

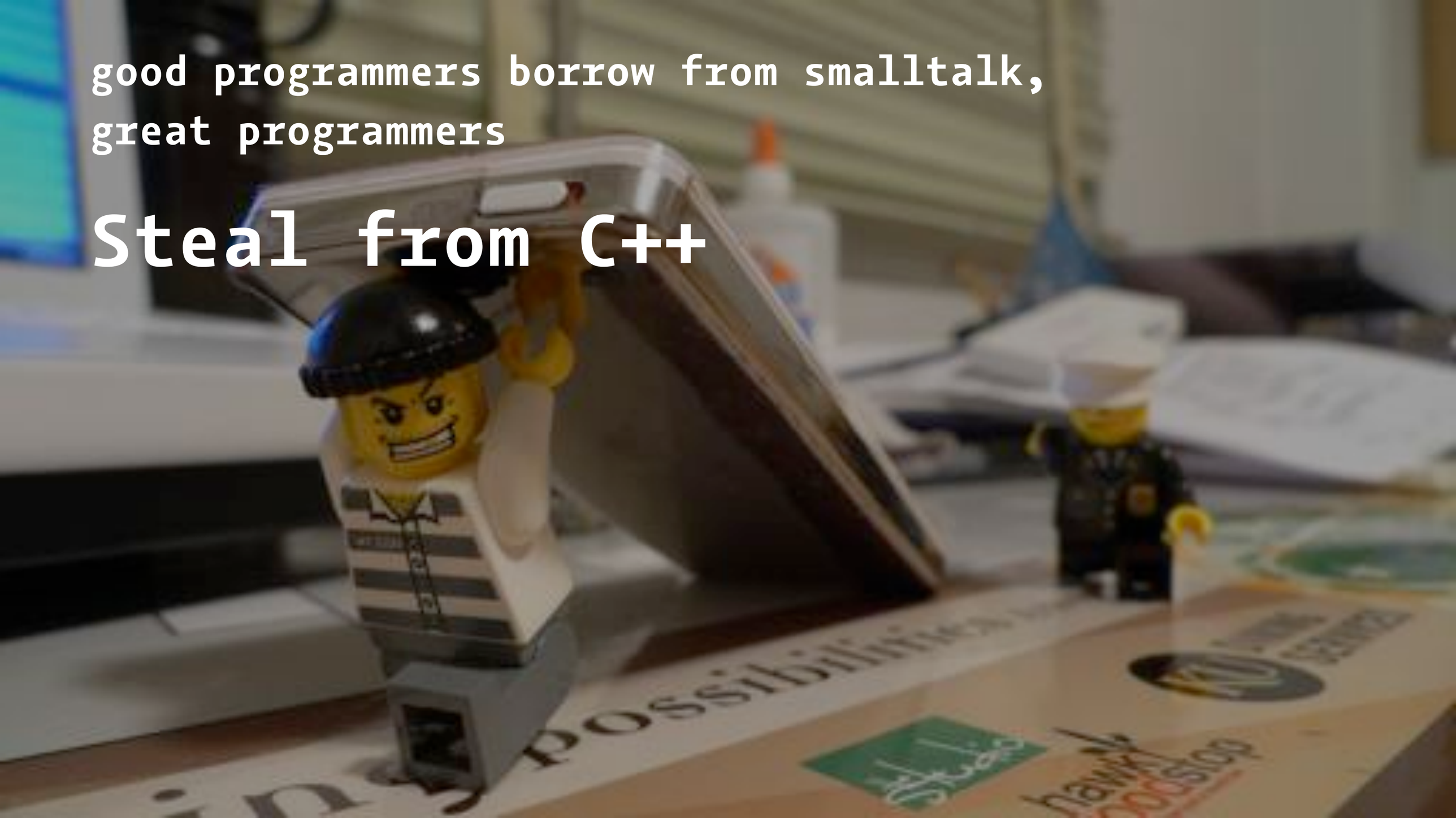
AsStandard and AsColour are

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


good programmers borrow from smalltalk,
great programmers
Steal from C++

copy constructors are

Value Adapters

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

```
function standardFromColour (colour) {
  var colour = 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


UBC

consider writing

Adapters

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September 19, 2014