

# Magenta

The Art of Abstraction



# Magento™

Open Source eCommerce

"The World's Fastest  
Growing eCommerce Platform"

**\$25 Billion**  
in transactions

**60,000+**  
merchants

The latest brands using magento









META





“Anything that is in the world when you’re born is normal and ordinary and is just a natural part of the way the world works.

Anything that's invented between when you're fifteen and thirty-five is new and exciting and revolutionary and you can probably get a career in it.

Anything invented after you're thirty-five is against the natural order of things”

*-Douglas Adams*

# Computer Science

# Colour Perception

**I HAVE SEEN  
THE TRUTH  
AND IT DOESN'T  
MAKE SENSE**

# Conclusion

spoiler alert

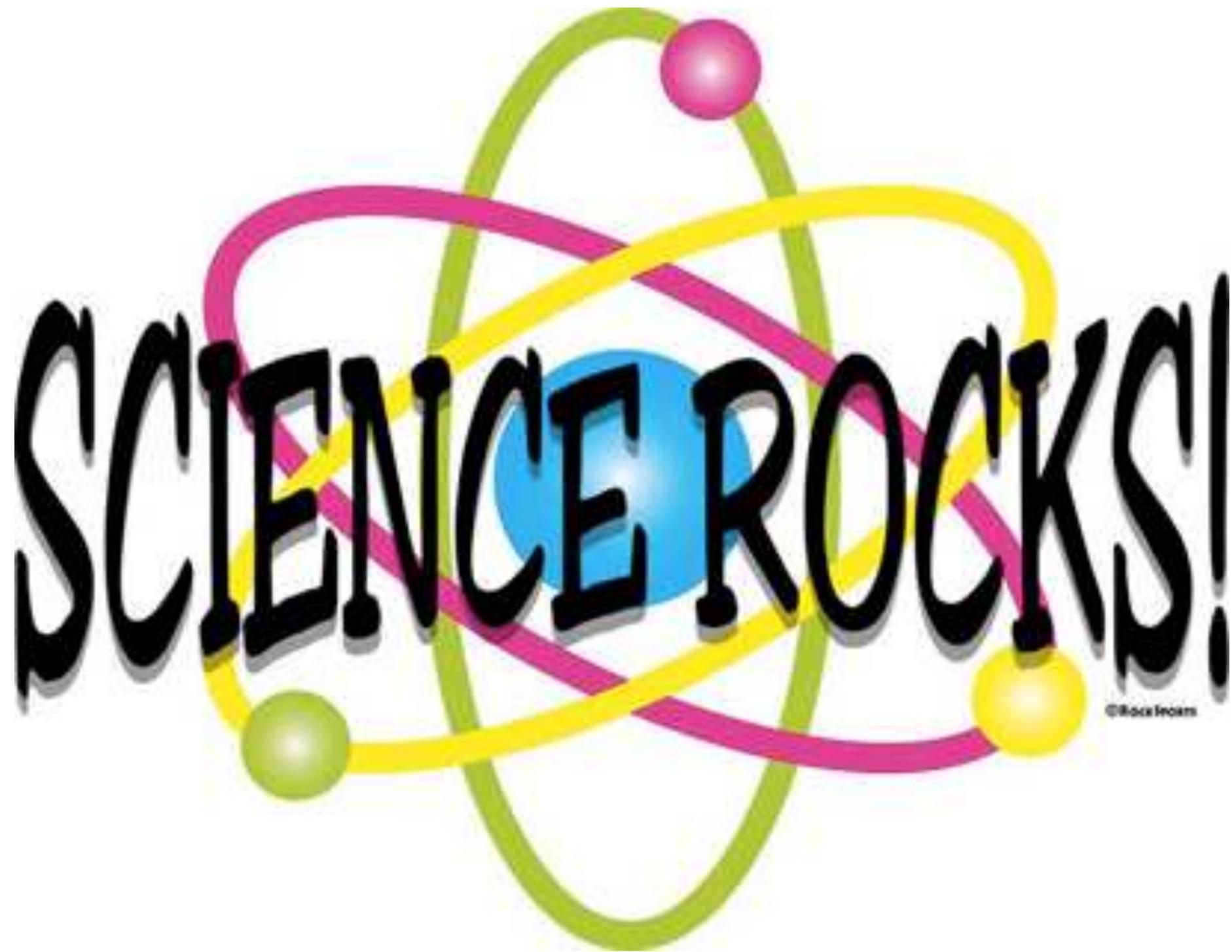
Abstraction happens  
in our minds

Abstractions shape  
how we perceive things

Changing abstractions is  
a basic principle of  
innovation and progress

Abstraction is the basis  
of Computer Science

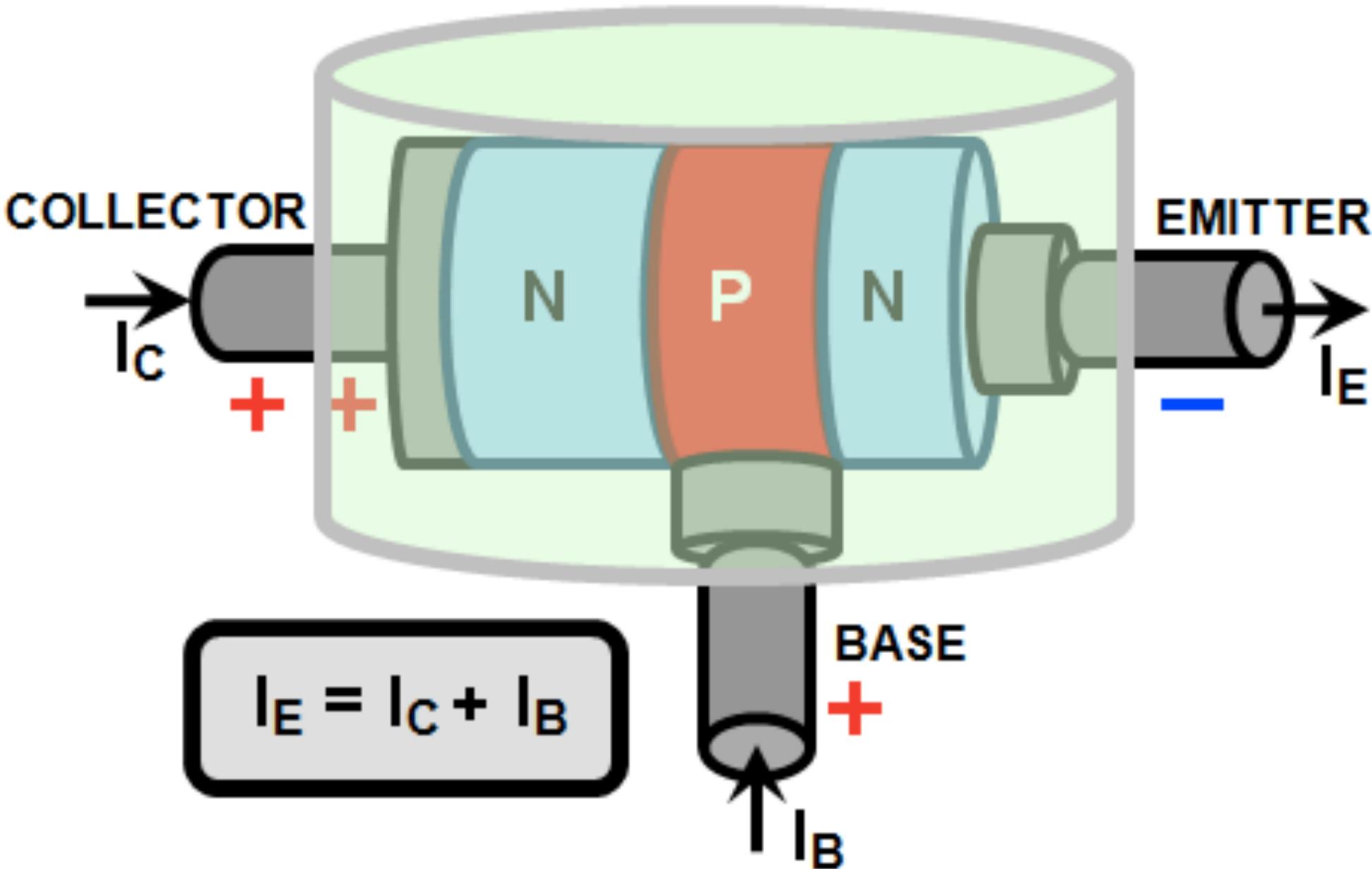
Abstraction is the basis  
of ~~Computer~~ Science



**SCIENCE ROCKS!**

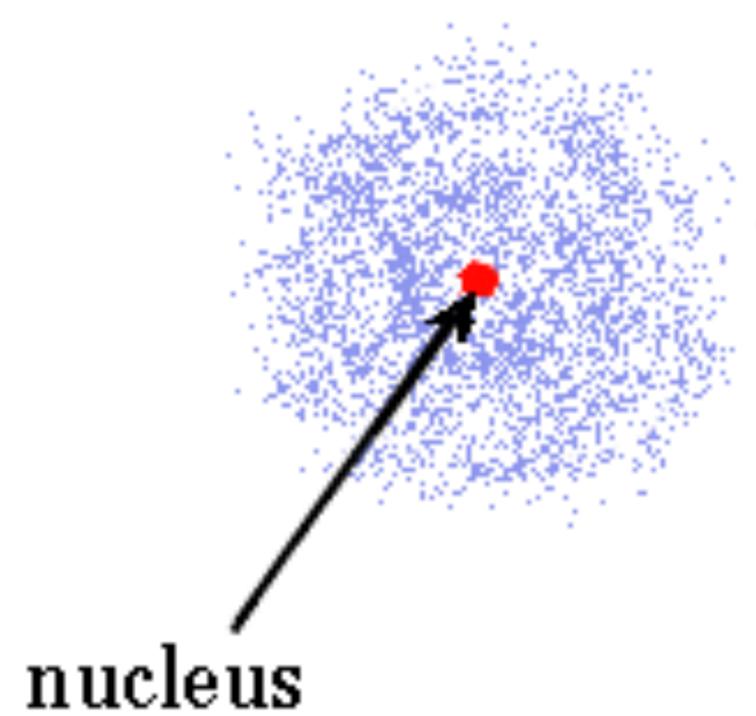
©Rock Icons

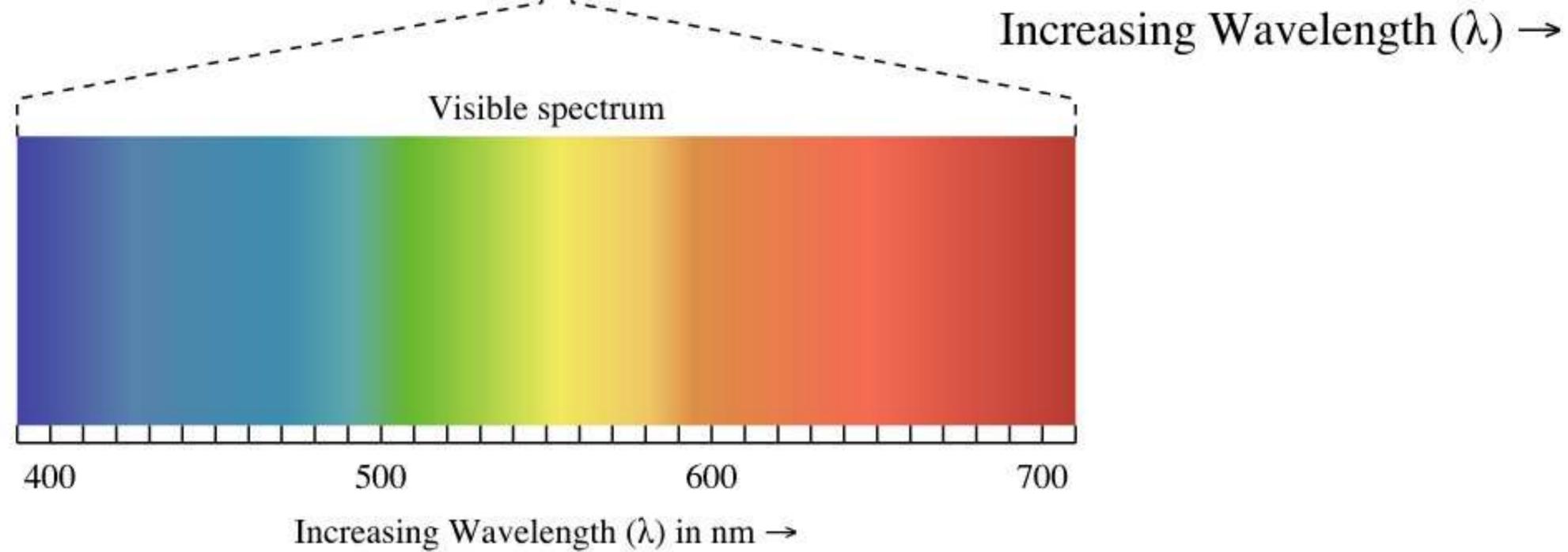
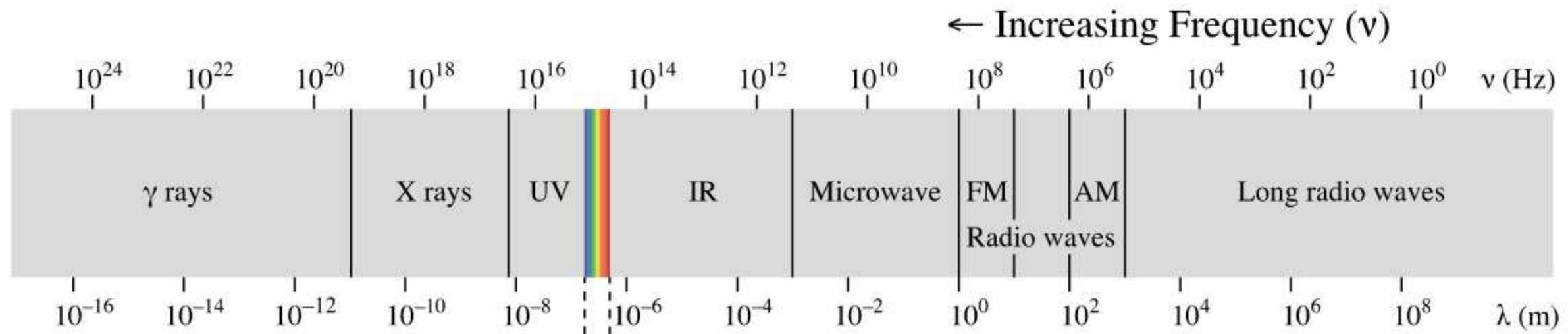
# NPN BJT TRANSISTOR



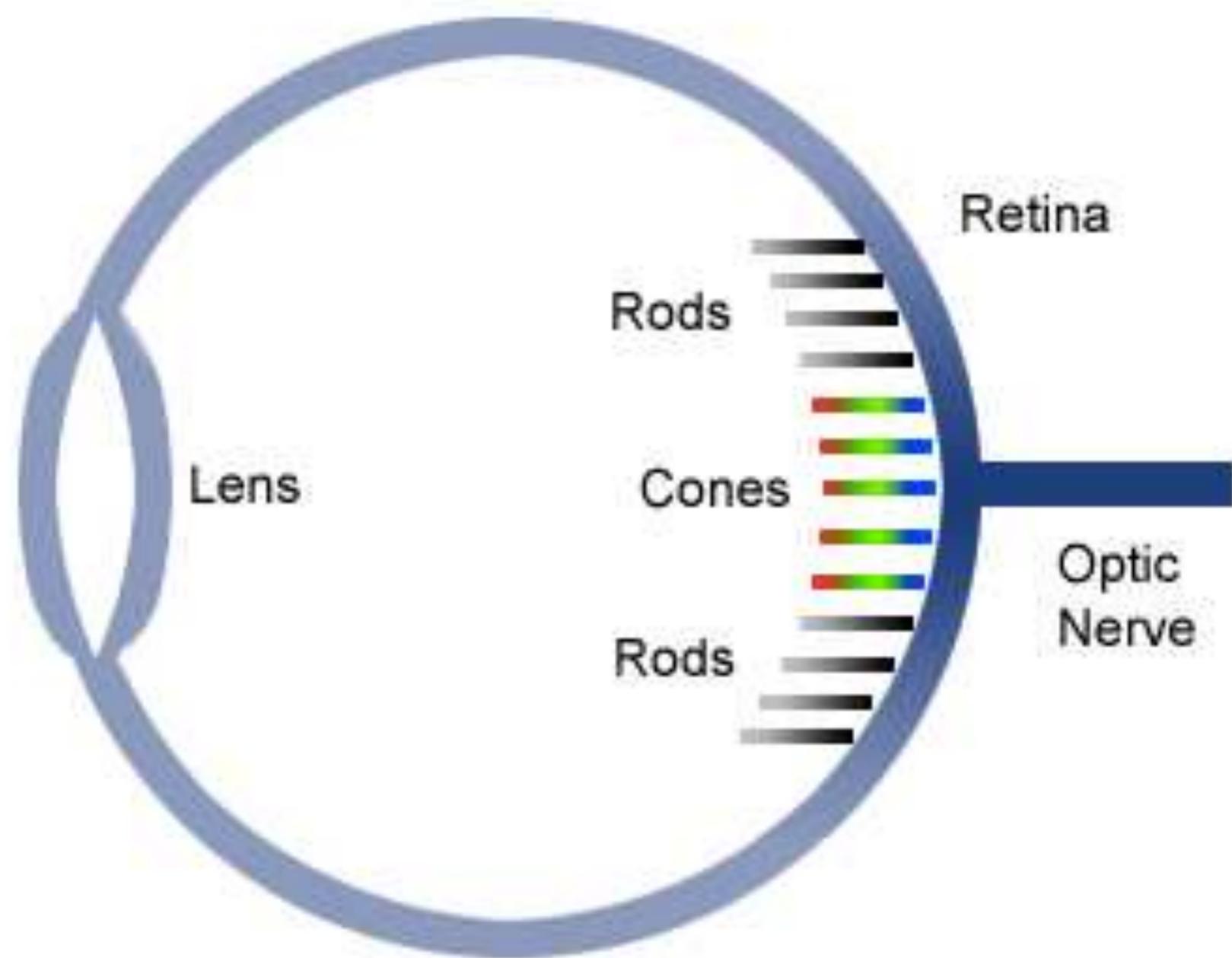
```
require "sinatra"  
  
get "/:name" do  
  "Hello World!"  
  
end
```

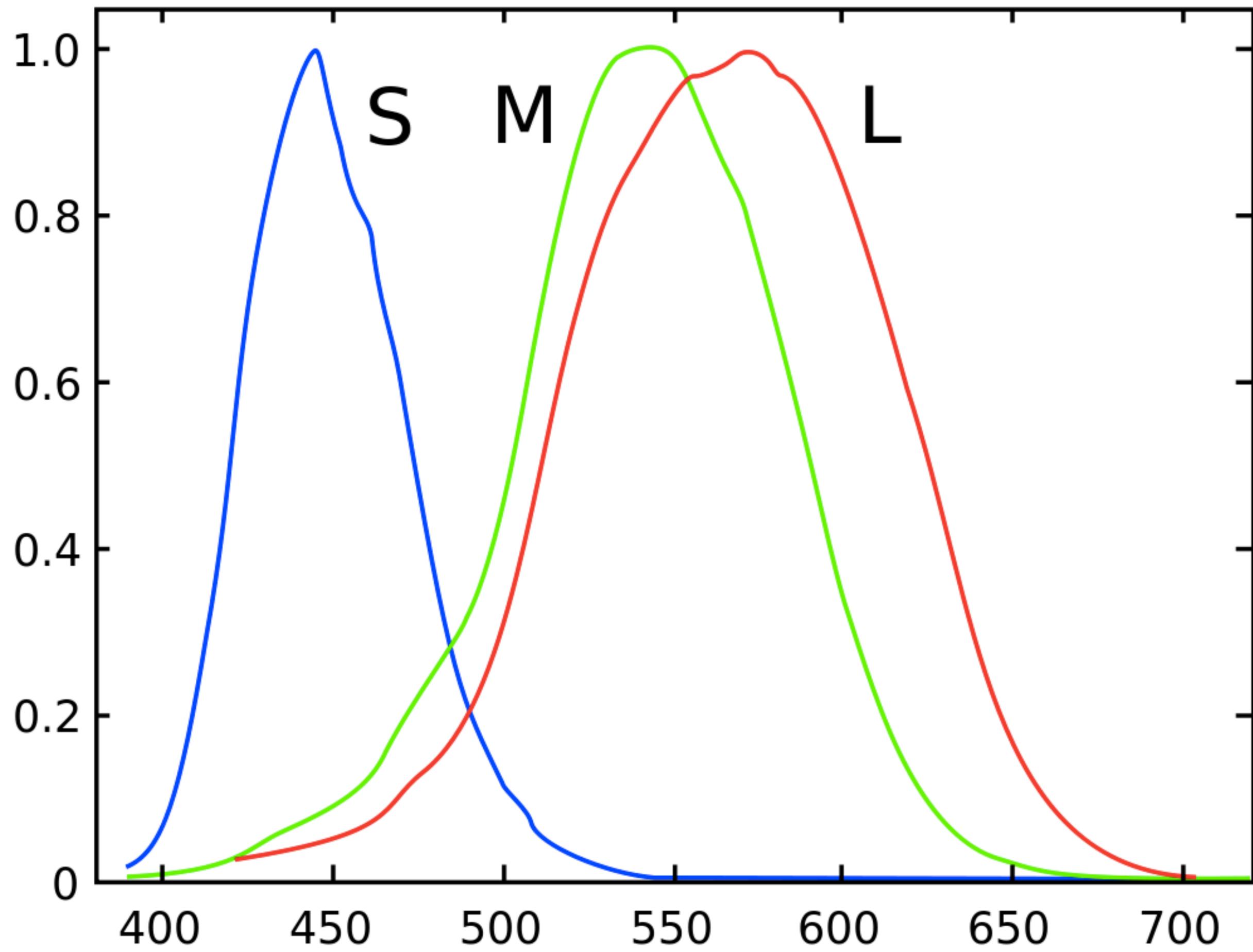
Hydrogen atom with  
excited electron in  
the  $n = 3$  shell

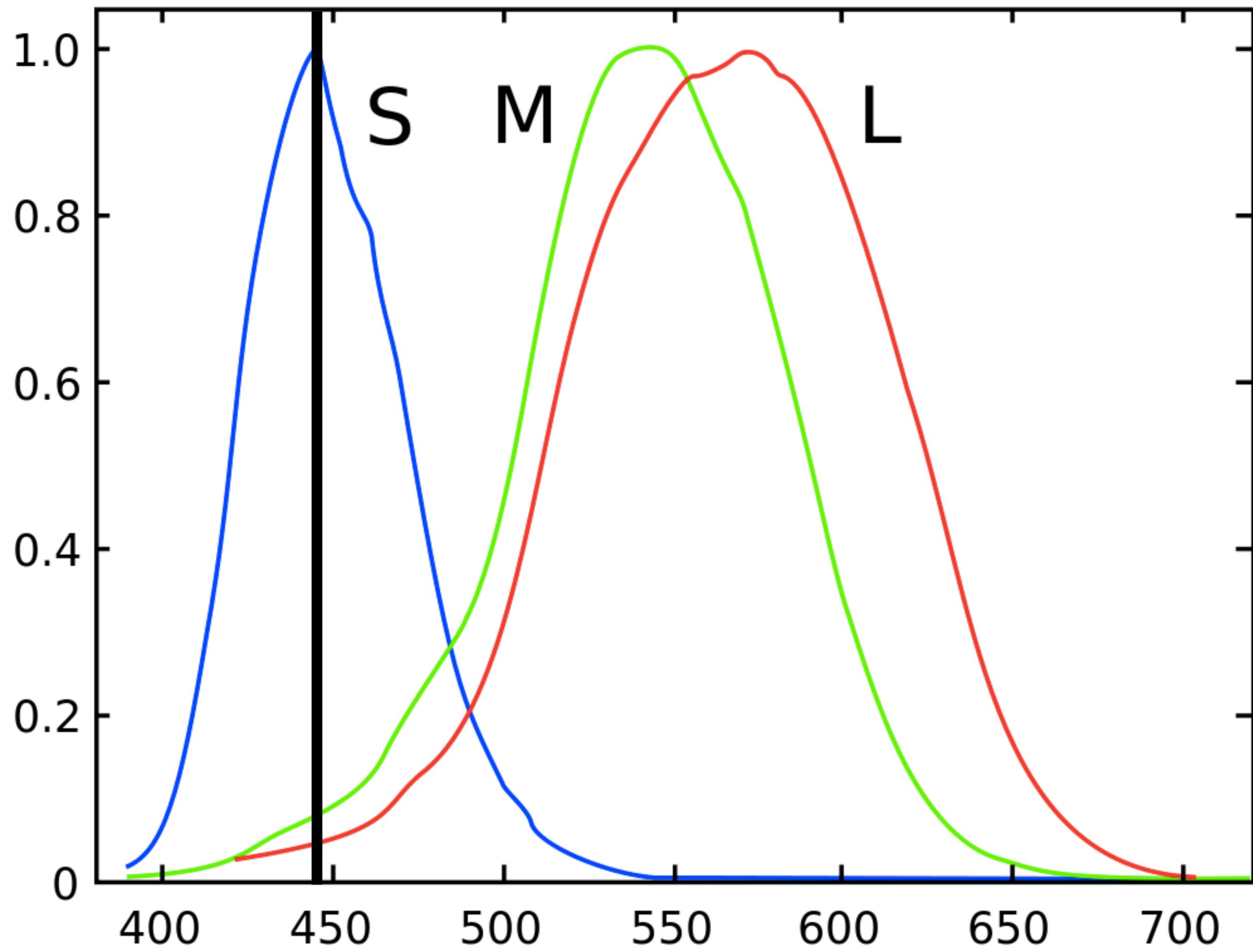


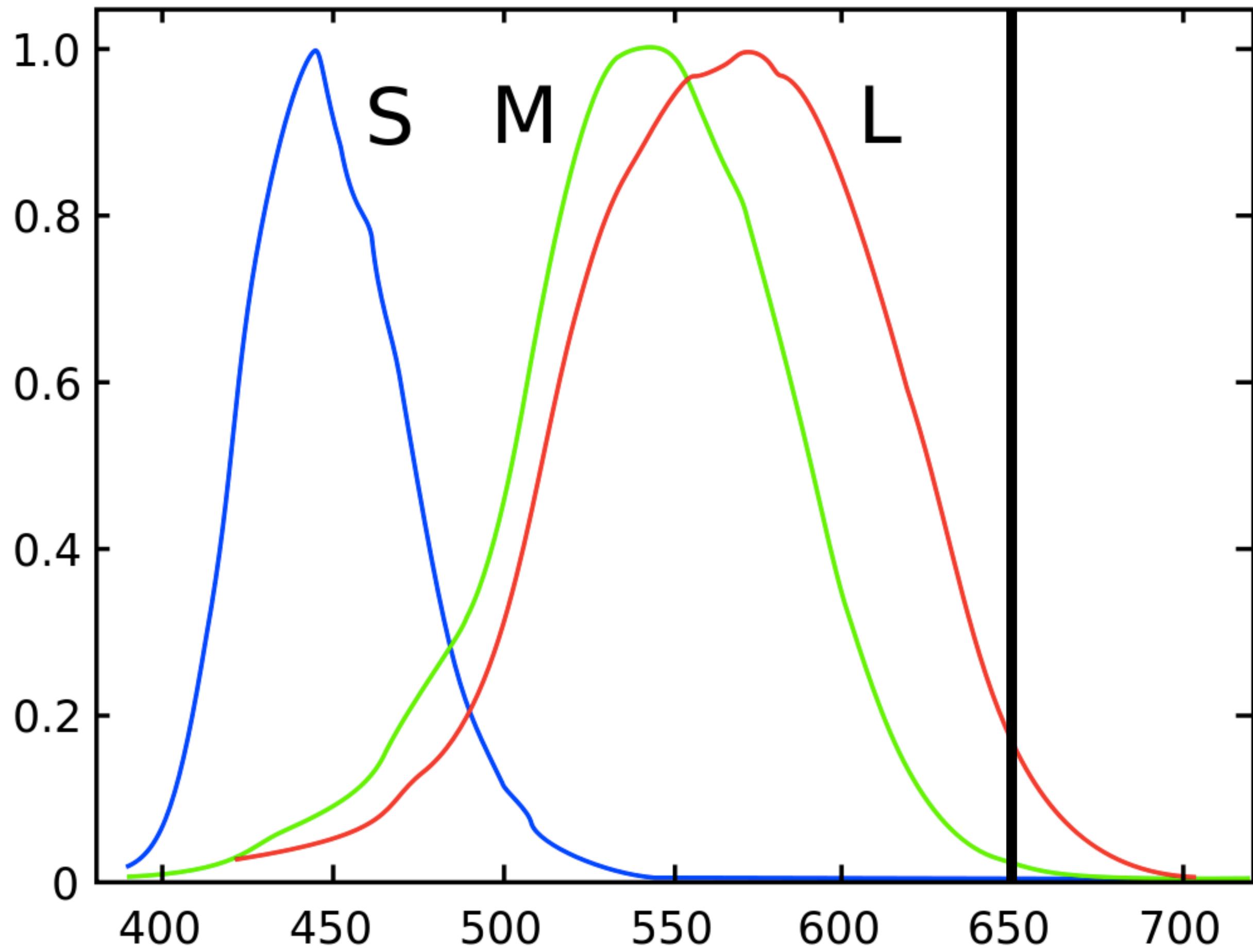


Trichromacy









# Patterns and Algorithms

# A Pattern Language

Towns · Buildings · Construction



Christopher Alexander

Sara Ishikawa · Murray Silverstein

WITH

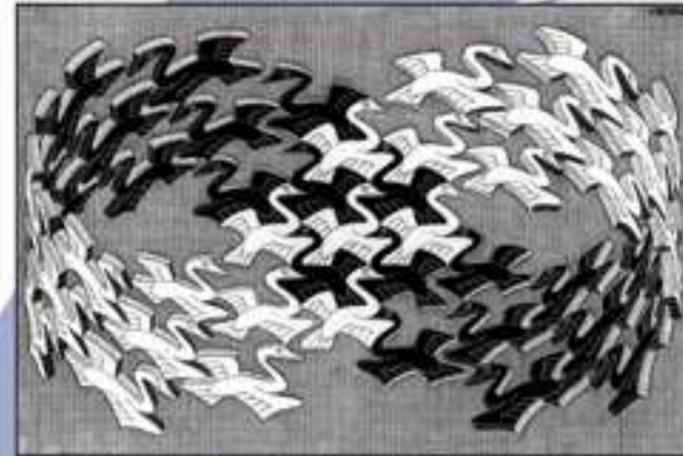
Max Jacobson · Ingrid Fiksdahl-King

Shlomo Angel

# Design Patterns

Elements of Reusable  
Object-Oriented Software

Erich Gamma  
Richard Helm  
Ralph Johnson  
John Vlissides



Cover art © 1994 M.C. Escher / Cordon Art - Baarn - Holland. All rights reserved.

Foreword by Grady Booch

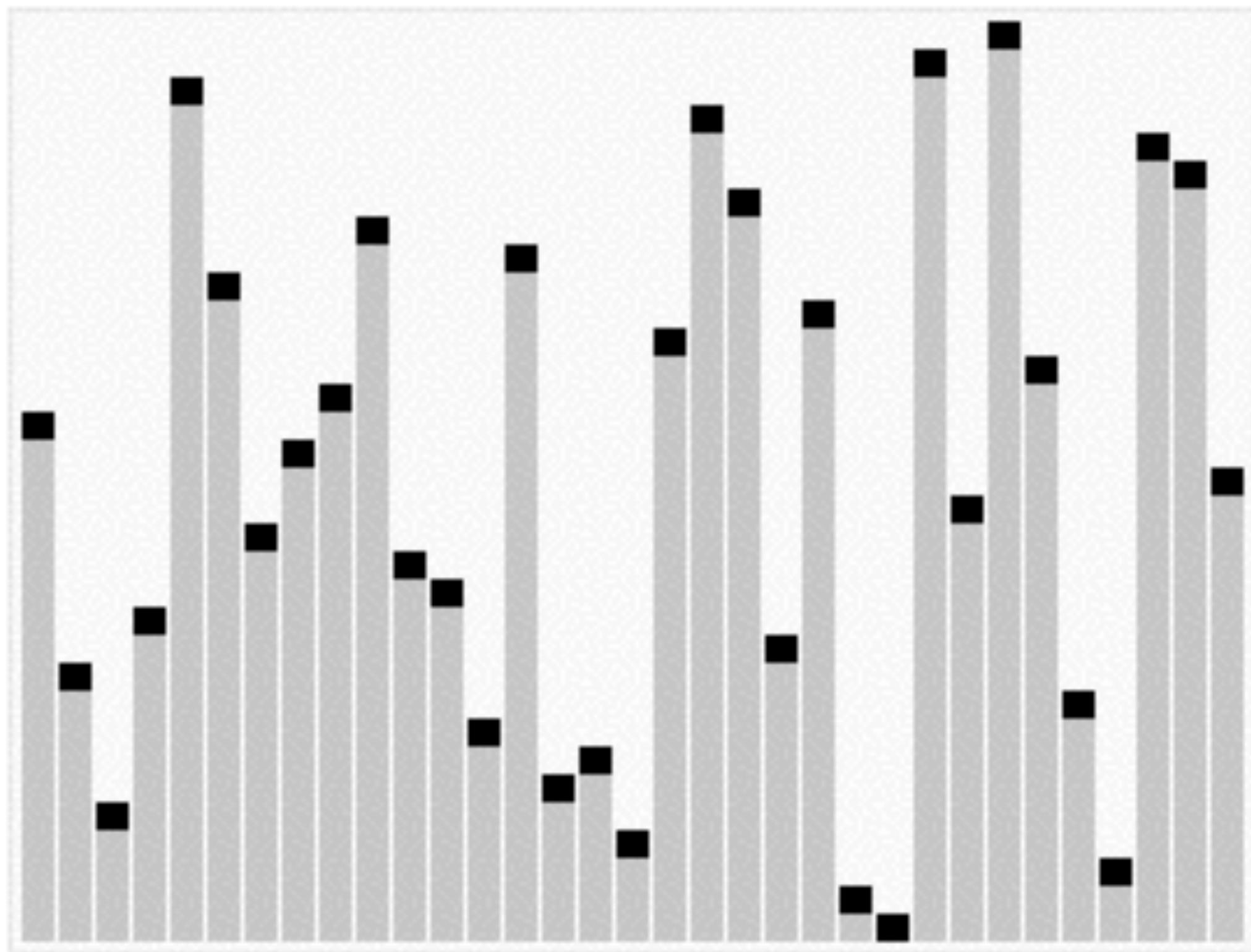
ADDISON-WESLEY PROFESSIONAL COMPUTING SERIES

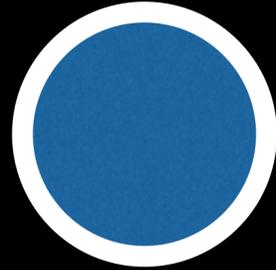


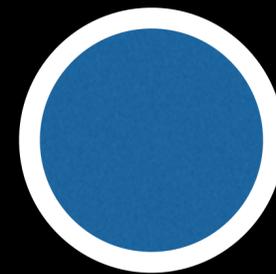
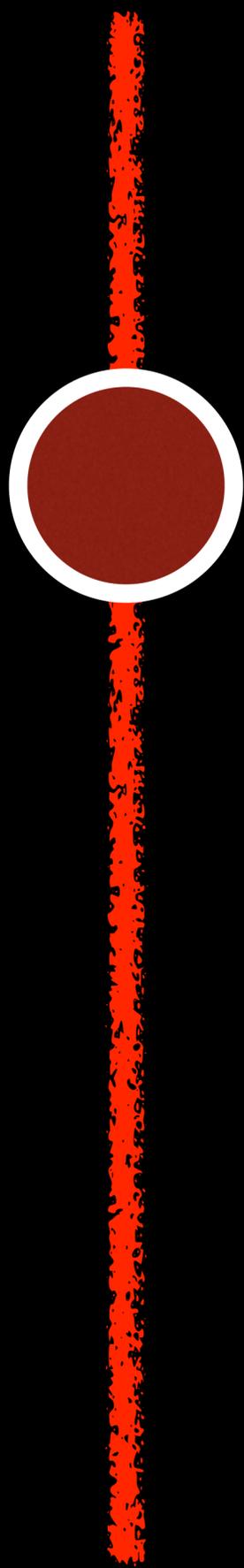
# algorithm

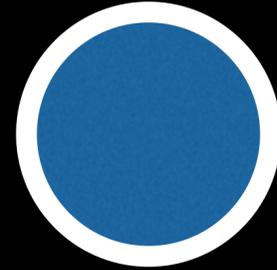
*noun*

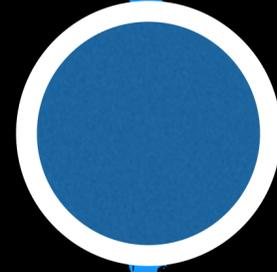
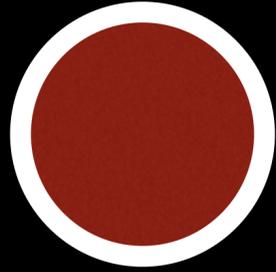
Word used by programmers when they do not want to explain what they did.

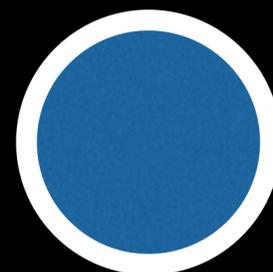
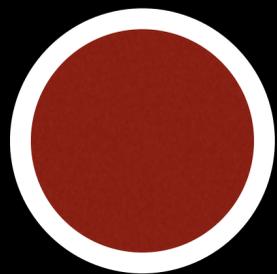


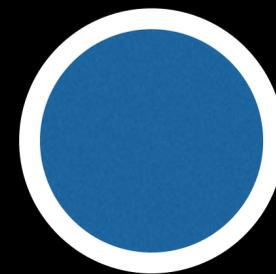
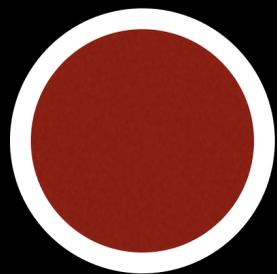


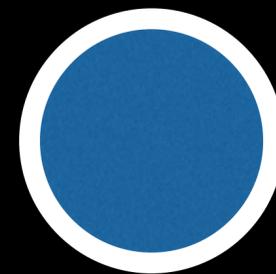
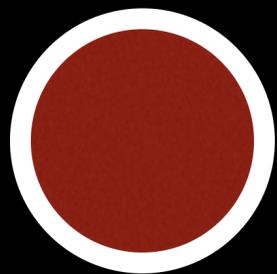


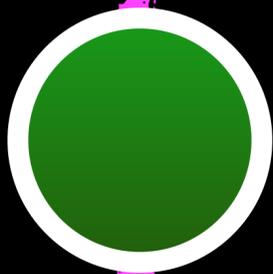
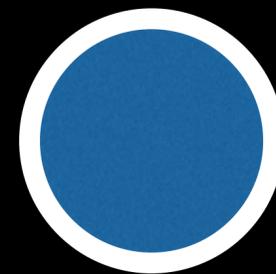
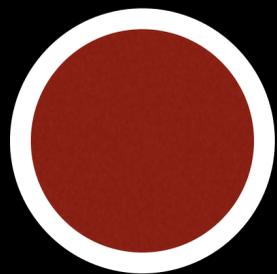


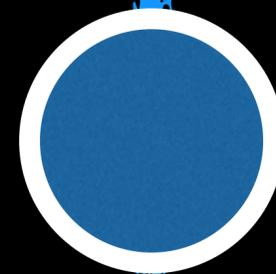
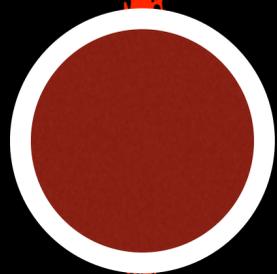






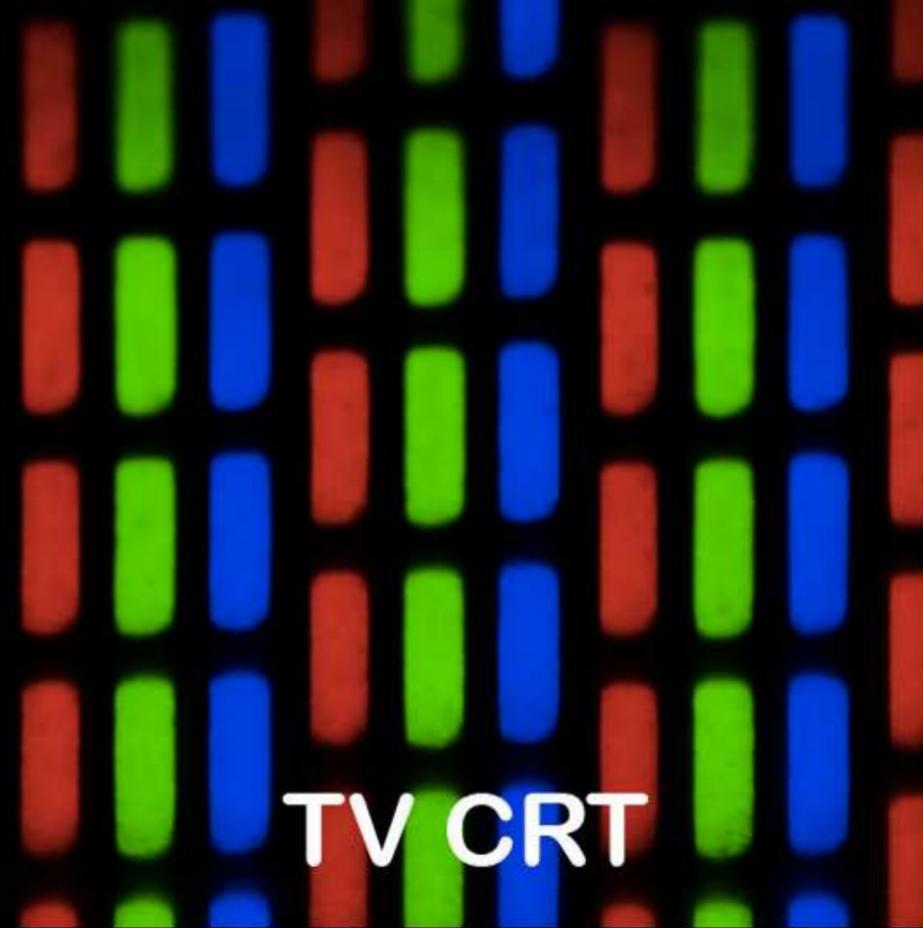




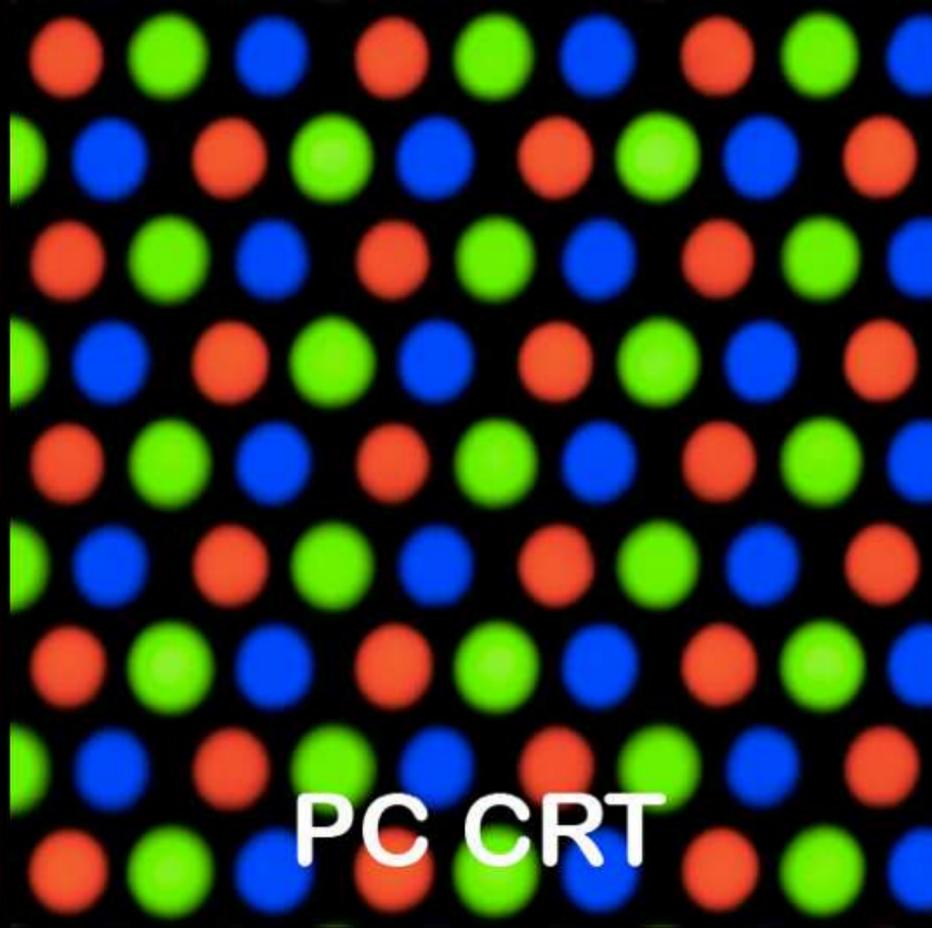


Is magenta real?

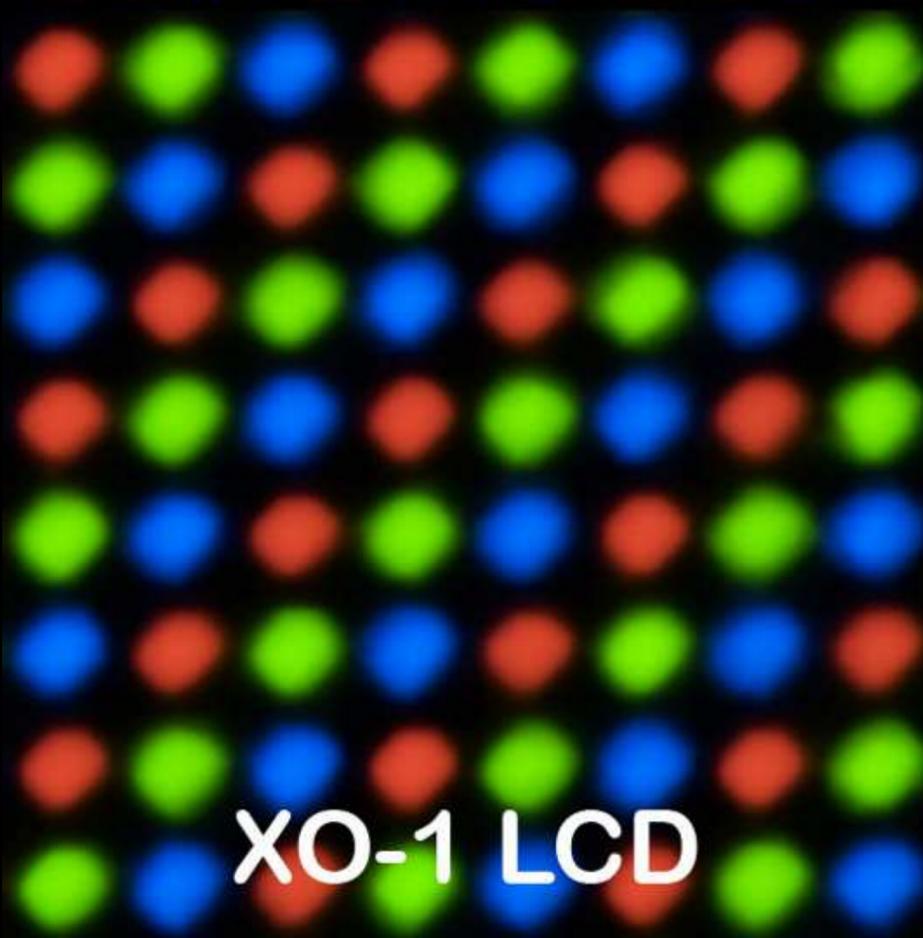
#FF00FF



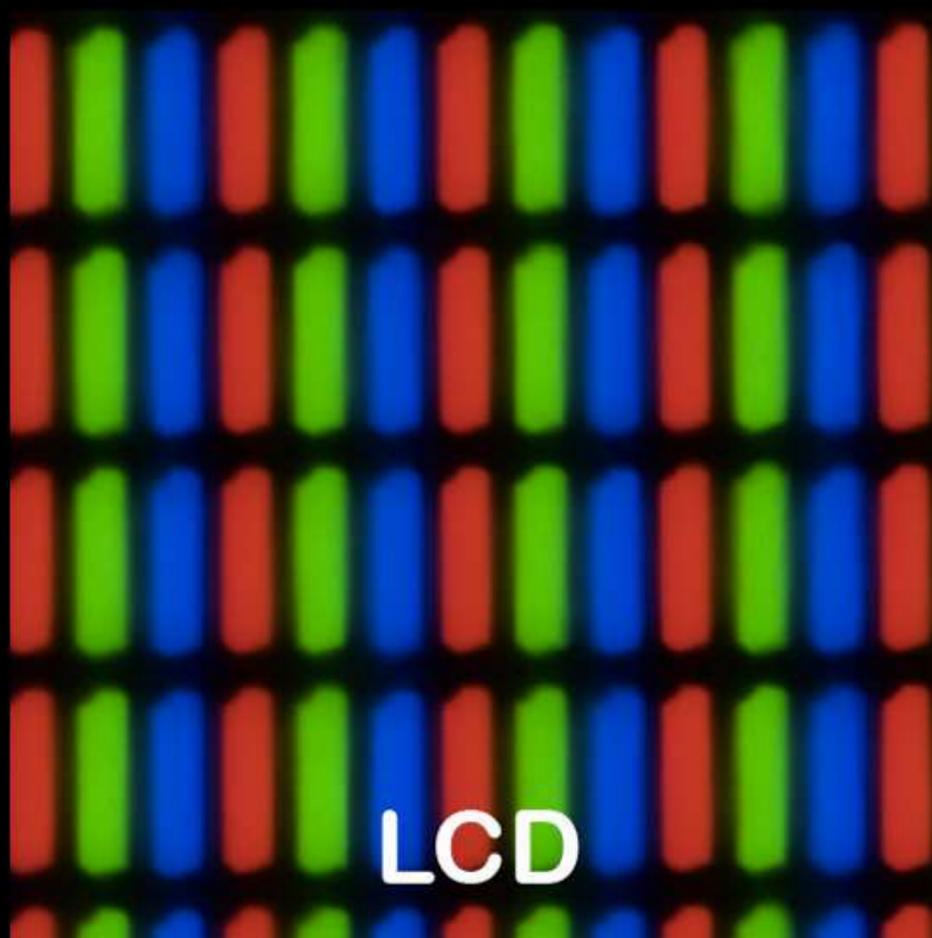
TV CRT



PC CRT



XO-1 LCD



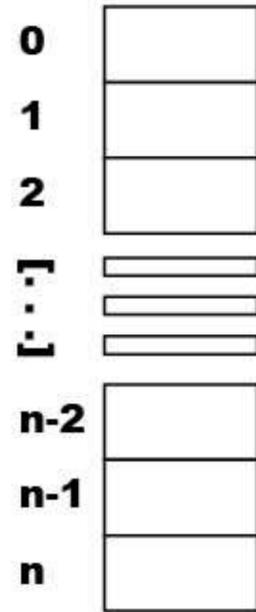
LCD



# Data Abstraction

An Array: array[n]

index elements



Typical features:

- indexing*
- length/size*
- copying*

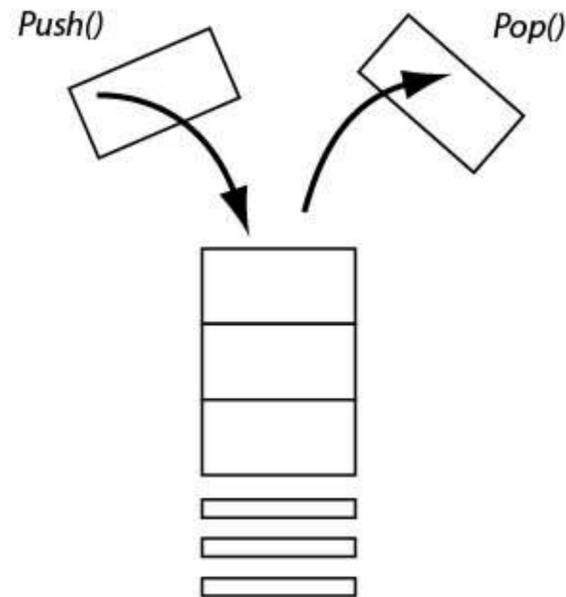
Good For:

*storing a fixed number of things  
and doing something to every one  
of those things*

Bad For:

*Adding or removing elements  
Sorting things, in many cases  
Object Oriented thinking*

A Stack:



Typical features:

- pushing*
- popping*
- size*

Good For:

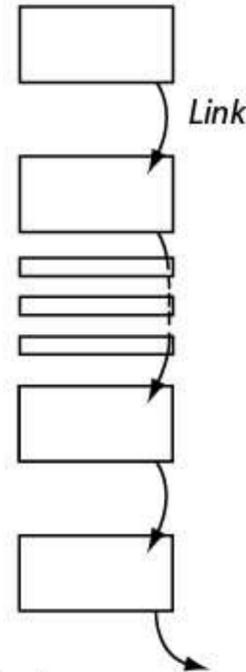
*dealing with a flow of things  
that need to be handled in certain  
groups.*

Bad For:

*Long term storage and access  
of complex data sets -- just as  
piling things on your floor is not a great  
filing system*

A Linked List:

elements



Typical features:

- get "next" element*
- insert element*
- remove element*

Good For:

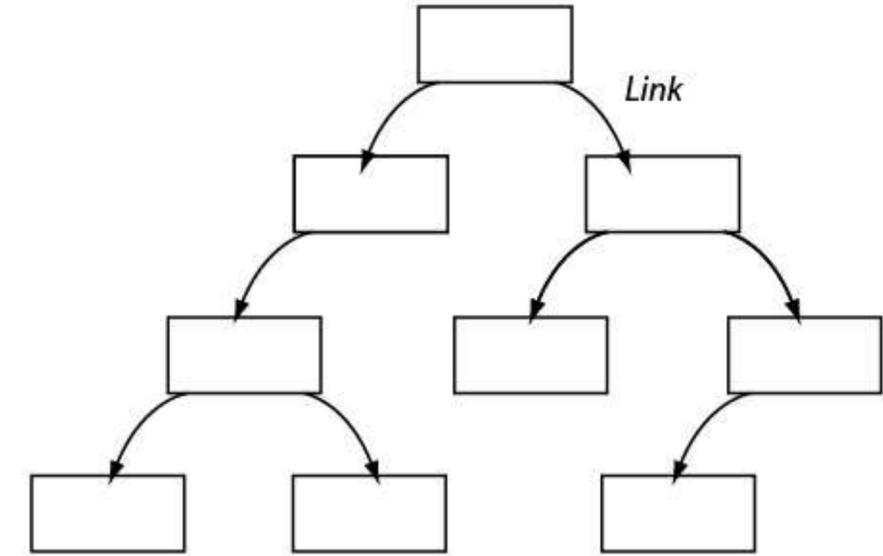
*dealing with a dynamically changing  
list -- i.e. where you may need to insert  
or remove elements from anywhere  
in the list*

Bad For:

*Well, it's still just a list. Almost always  
better than an array*

A Tree:

elements



Typical features:

- get "children"*
- insert child*
- remove element*

Good For:

*storing things that belong in trees  
creating rapidly search-able data  
sets (i.e. decision trees)*

Bad For:

*Well, it's still just a list. Almost always  
better than an array*

# “Dataless Programming”

RM Balzer - 1967

## SUMMARY

A programmer using existing programming languages almost always encounters difficulties because he has to choose a data representation before coding a problem.

The Dataless Programming System is designed to alleviate these difficulties. A separation between the description of a process to manipulate data (a program) and the description of the data being manipulated (the data representation) is achieved by representing all data in a syntactically identical form and treating it in a homogeneous manner.

Space



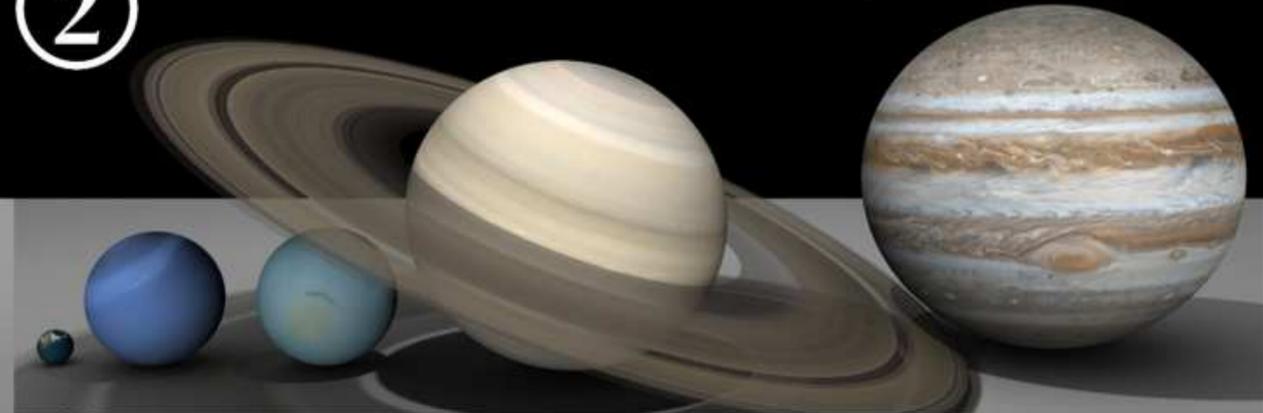
①

Mercury < Mars < Venus < Earth



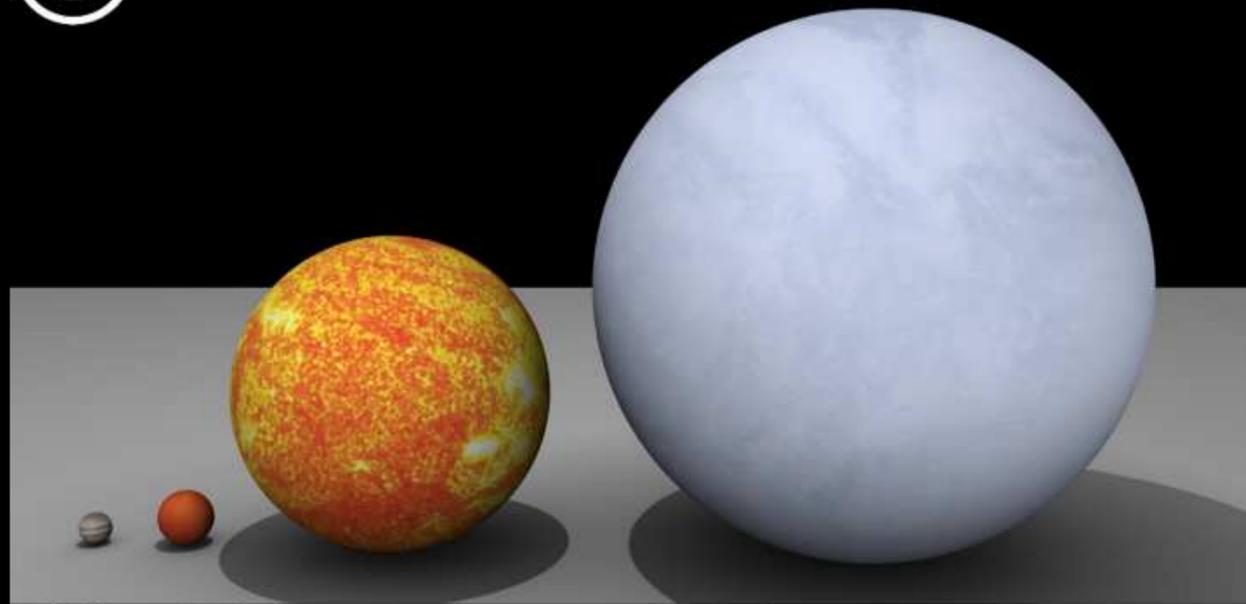
②

Earth < Neptune < Uranus < Saturn < Jupiter



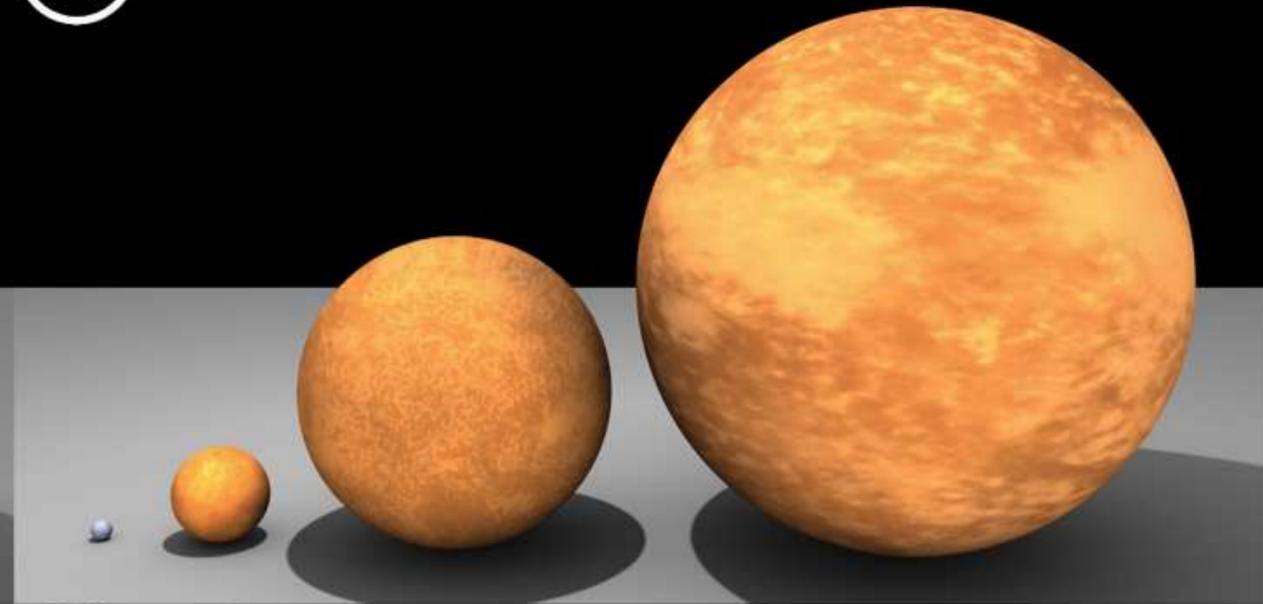
③

Jupiter < Wolf 359 < Sun < Sirius



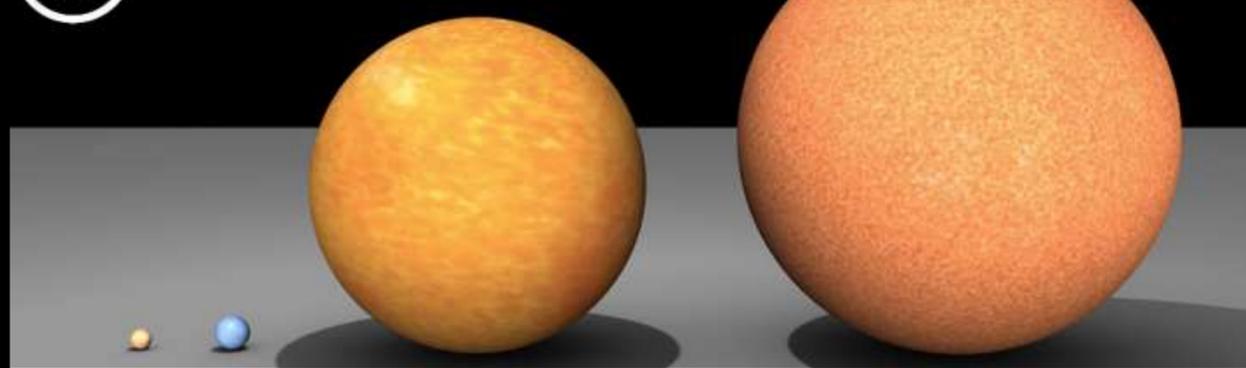
④

Sirius < Pollux < Arcturus < Aldebaran



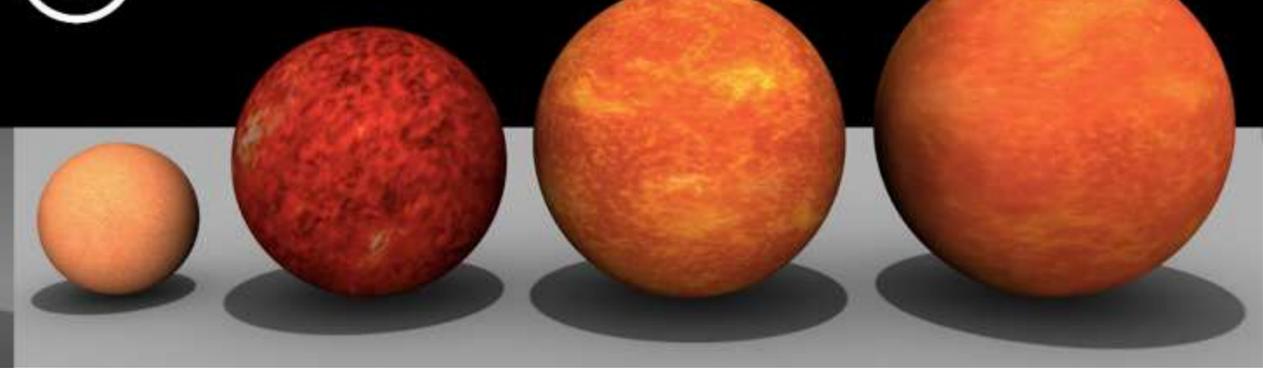
⑤

Aldebaran < Rigel < Antares < Betelgeuse



⑥

Betelgeuse < Mu Cephei < VV Cephei A < VY Canis Majoris



A woman is shown in profile, looking towards the right. She is wearing a dark jacket with a pattern of small, bright white dots on the back, resembling a starry night sky. The background is a dark, starry night sky with a prominent constellation of stars. The text is overlaid on the image in a light blue, sans-serif font.

"THE COSMOS IS ALSO  
WITHIN US, WE'RE MADE  
OF STAR STUFF.  
WE ARE A WAY  
FOR THE COSMOS  
TO KNOW  
ITSELF."

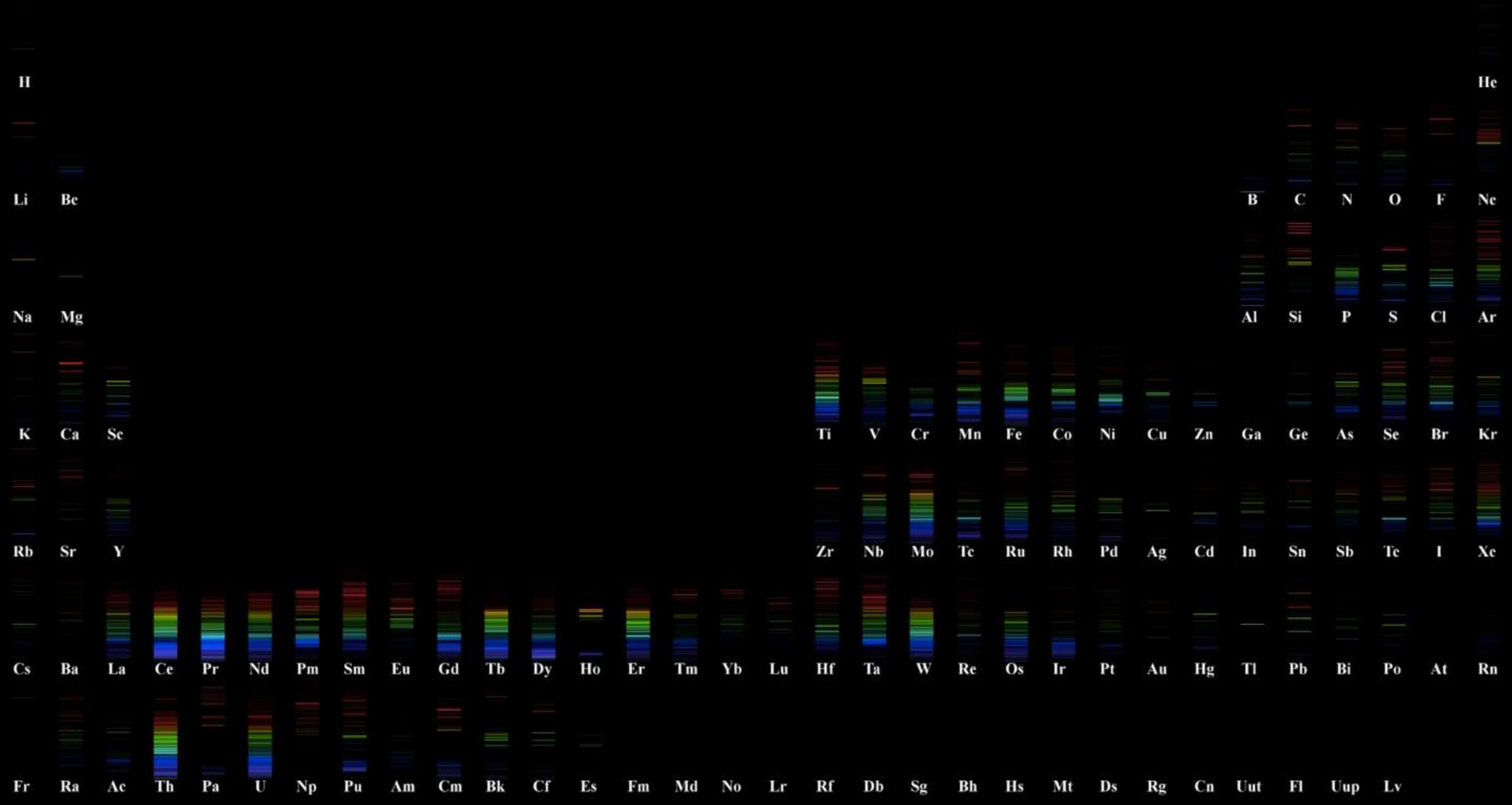
~CARL SAGAN

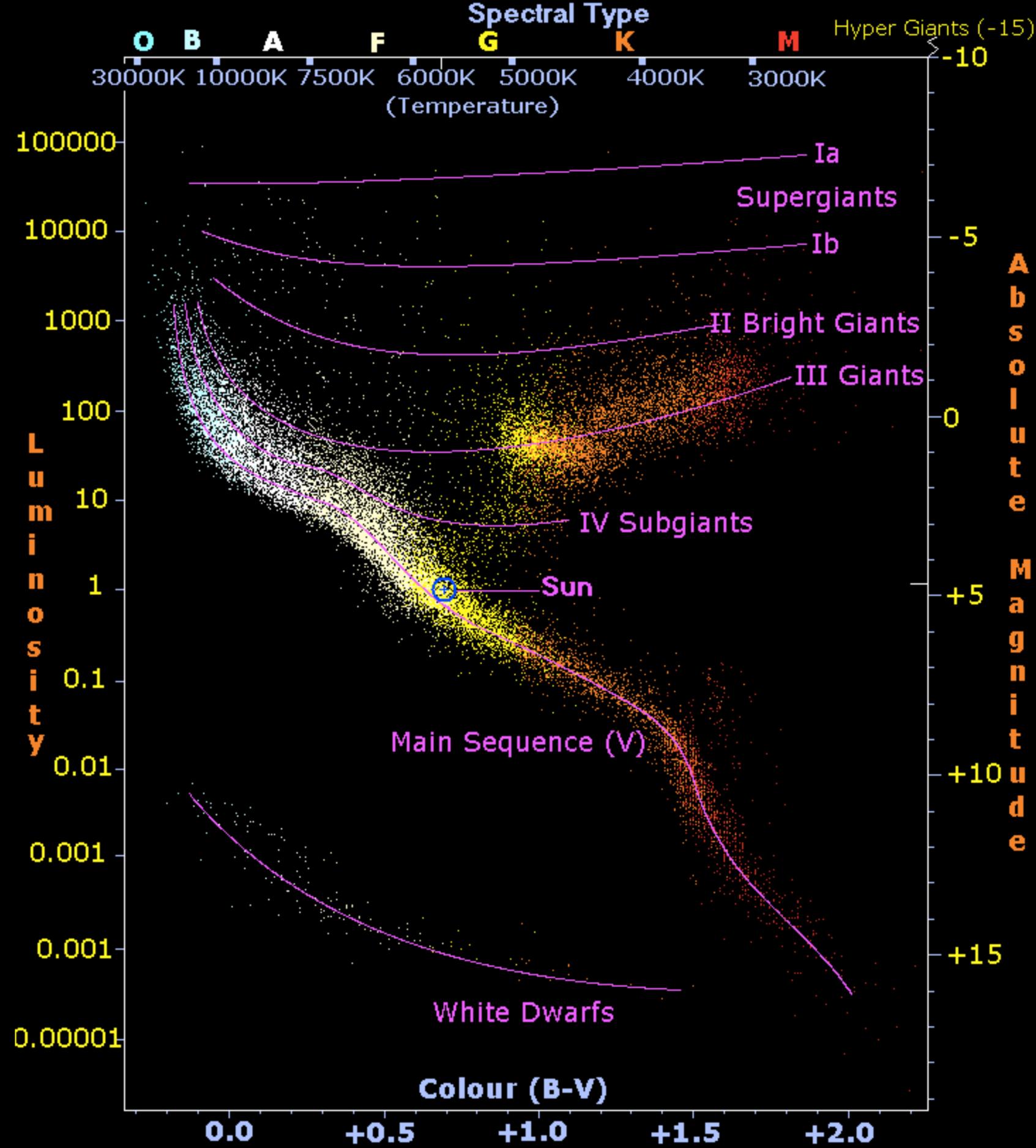
**wait,**

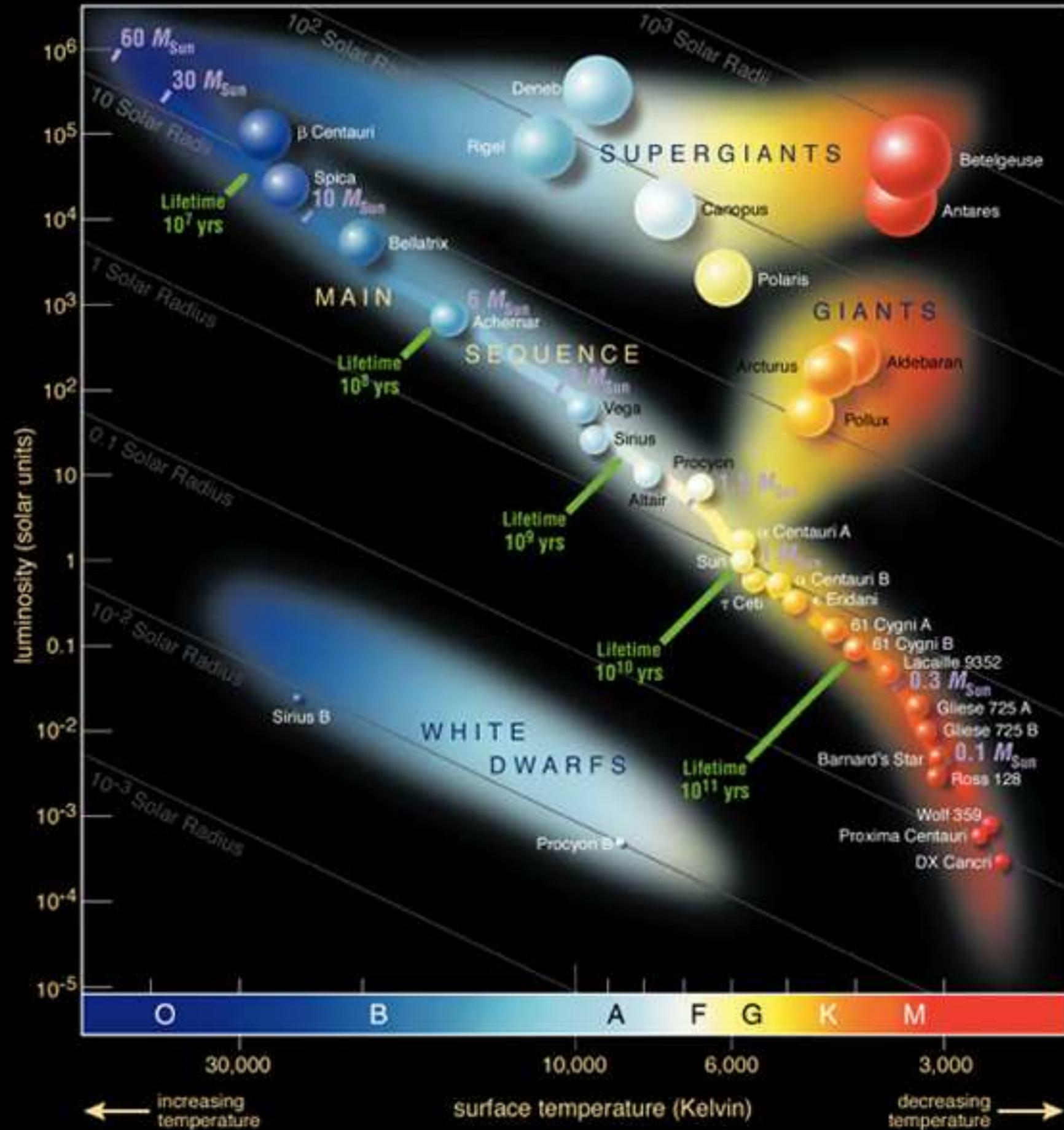
**what?**

Are we still talking  
about abstraction?

Group→	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
↓Period																		
1	1 H																	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	*	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	**	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Uut	114 Fl	115 Uup	116 Lv	117 Uus	118 Uuo
		*	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	
		**	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	







← increasing temperature      surface temperature (Kelvin)      decreasing temperature →

#FF00FF

# Control Abstraction

# Subroutines

“Go To Statement  
considered harmful”

Edsger Dijkstra, 1968

# “Protection in Programming Languages”

James H. Morris Jr., 1973

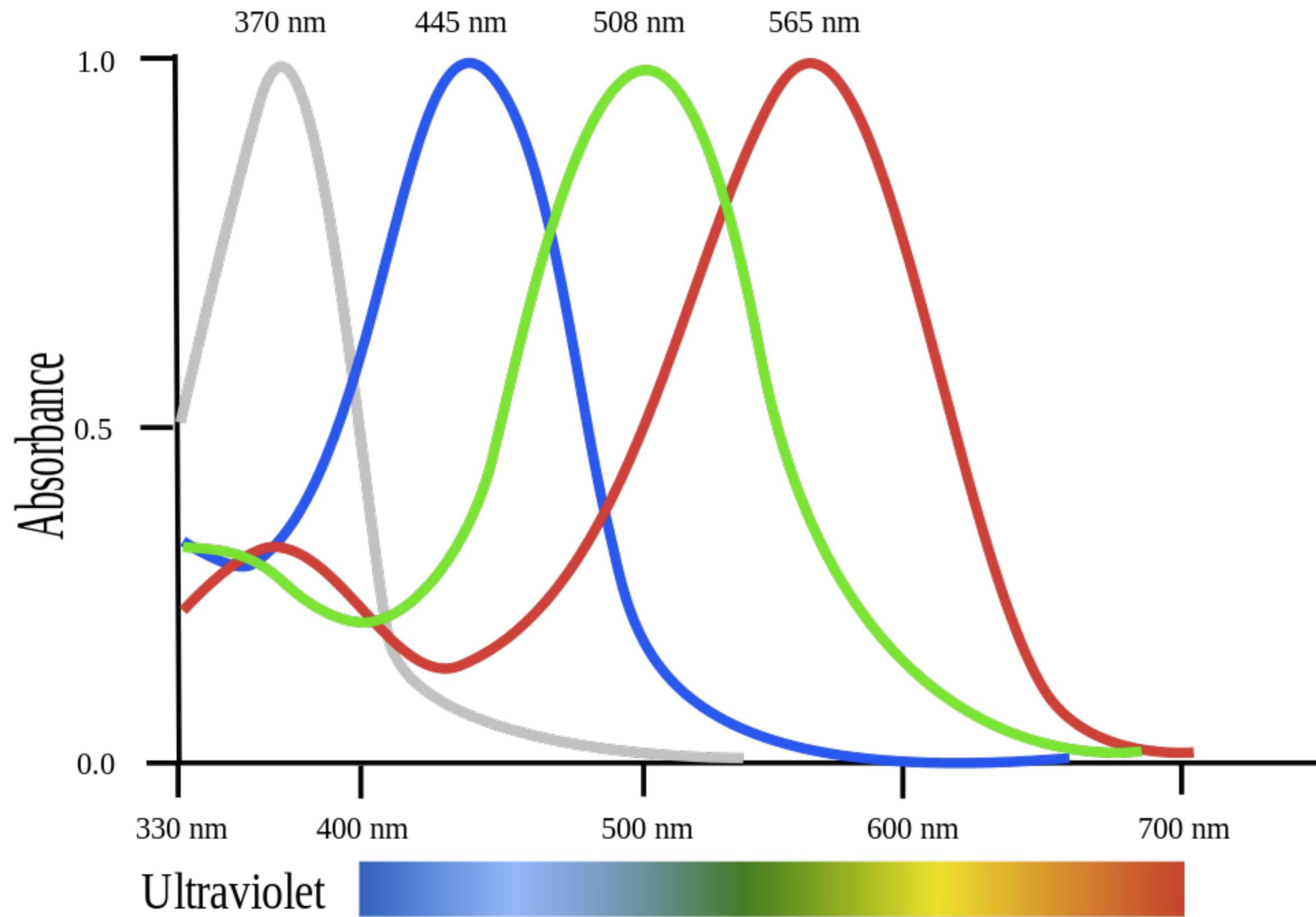
The ability of a programming language or system to protect and isolate program modules is vital. As a set of coexisting and perhaps cooperating programs grows, the proper functioning of any particular program should not be endangered.

You should be able to  
reason about modules in  
isolation

# “Global Variables Considered Harmful”

W.A. Wulf, M. Shaw, 1973

Tetrachromacy



2-3% of all women?

50% of all women?

# Gene on X chromosome

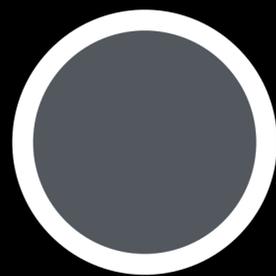
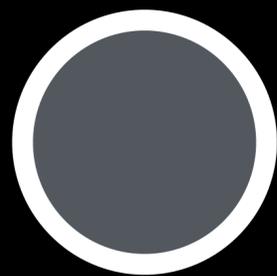
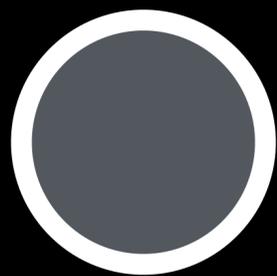
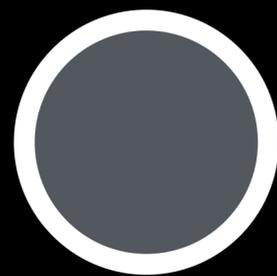
OPN1MW and OPN1MW2

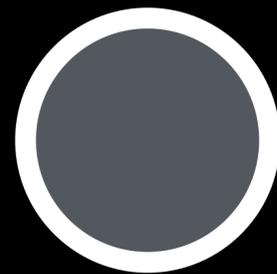
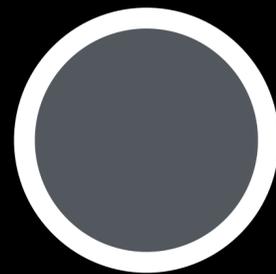
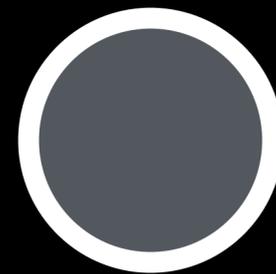
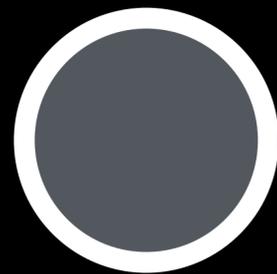
Women could have up  
to six colour cones

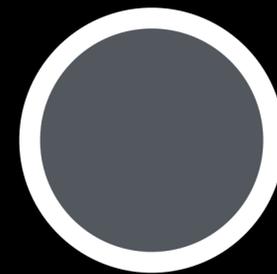
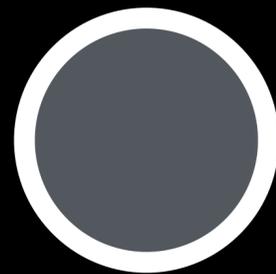
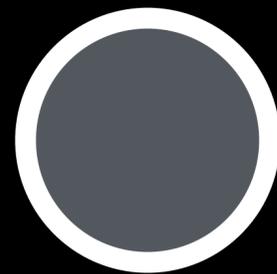
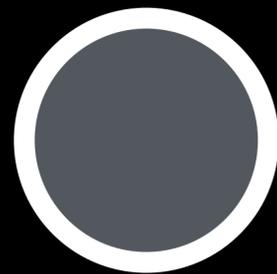
Mostly dysfunctional

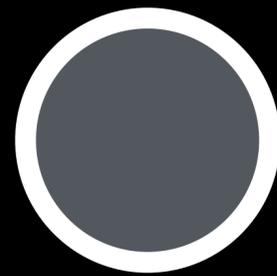
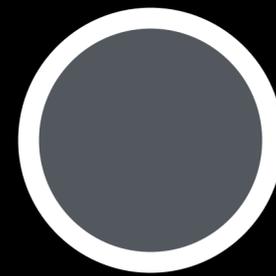
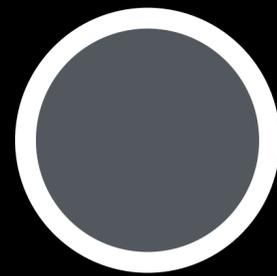
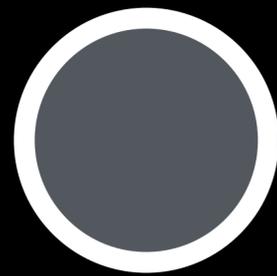
At least two confirmed  
cases

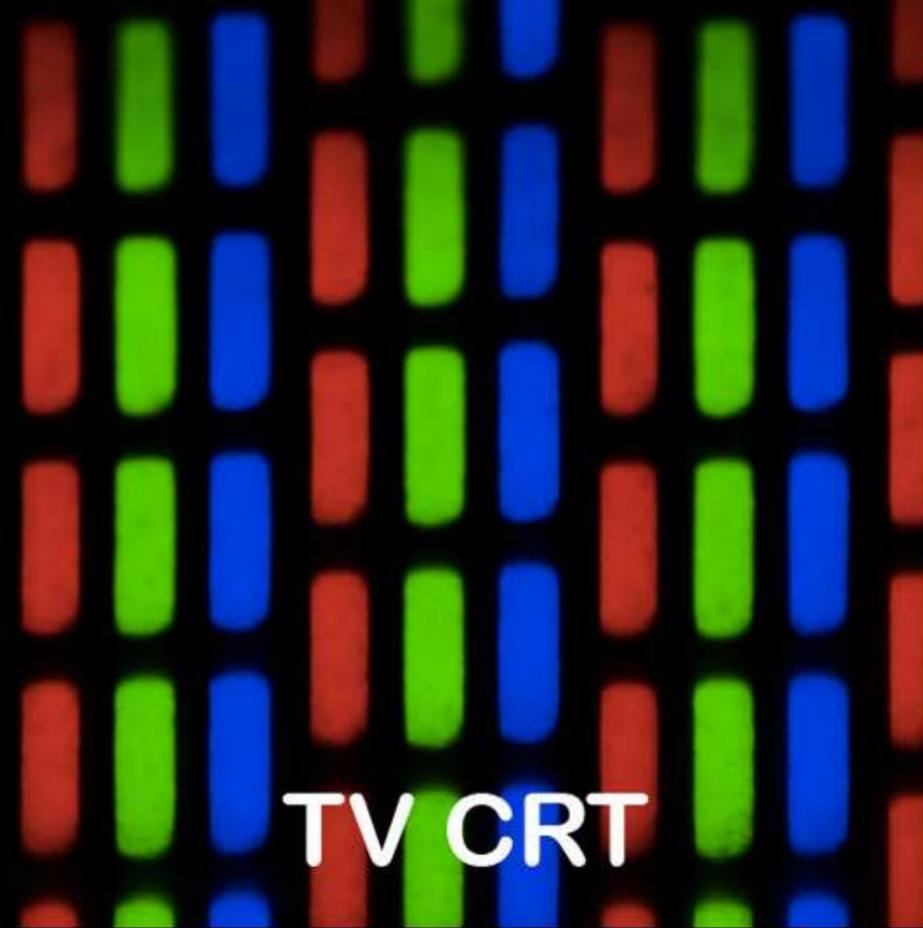
Seeing millions of  
more colours



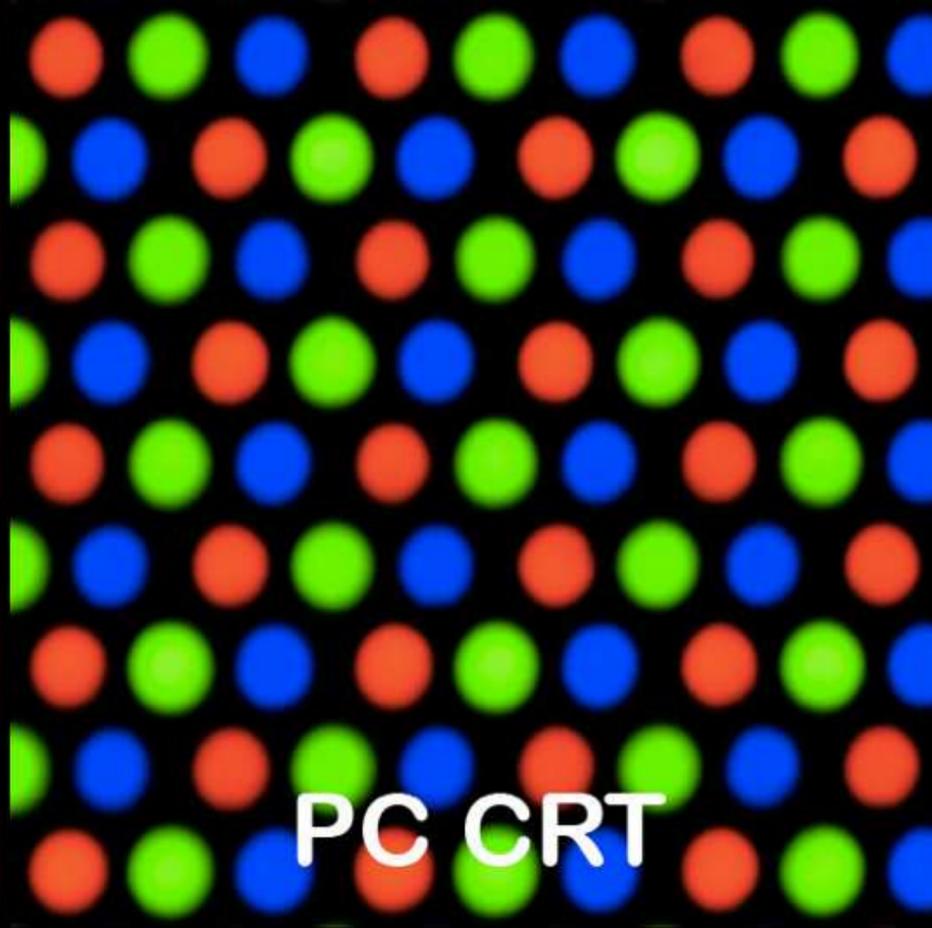




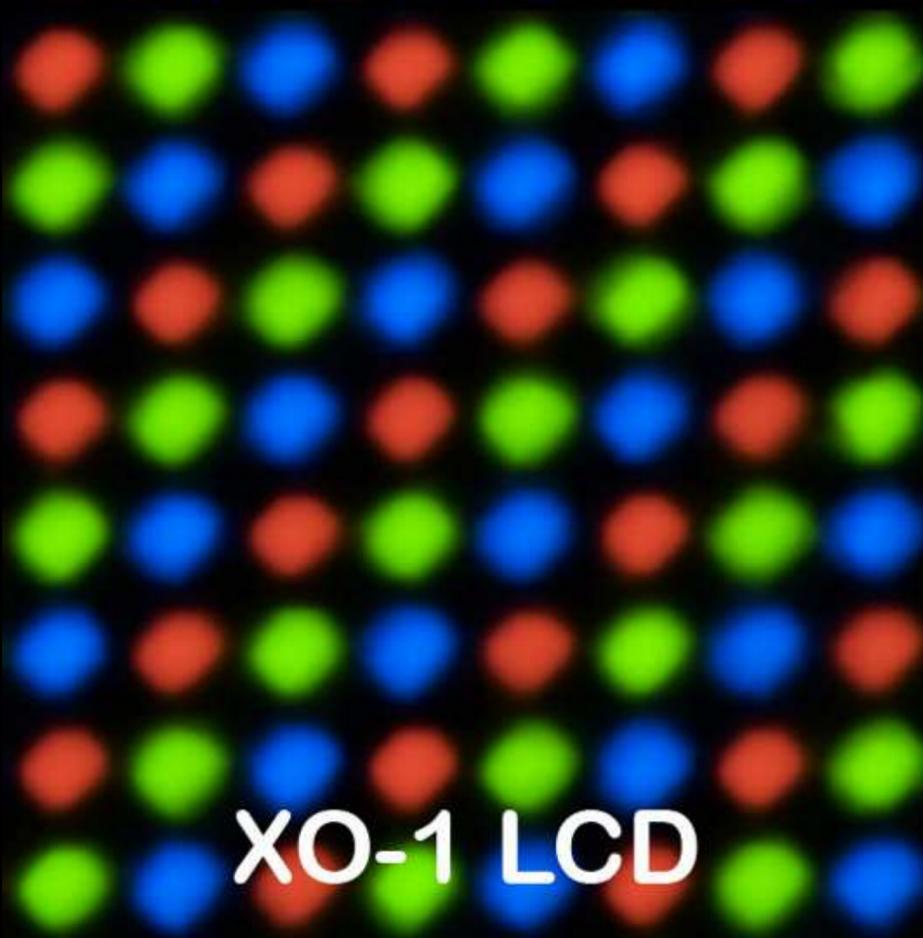




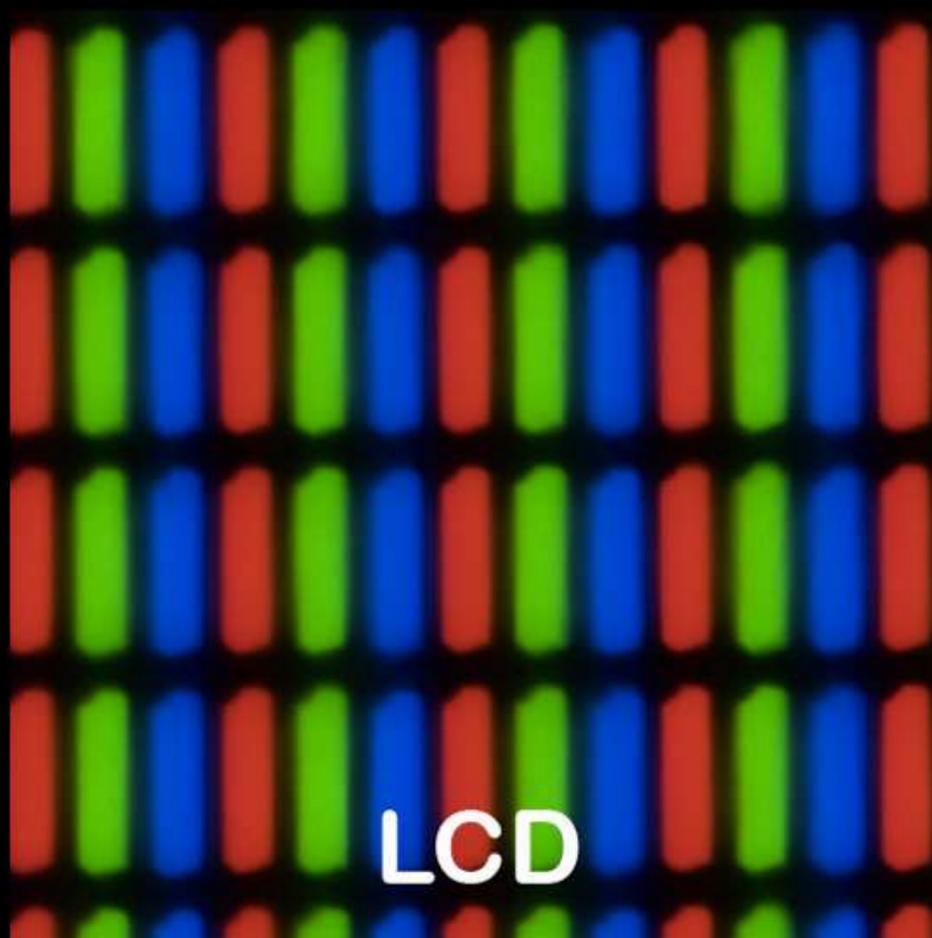
TV CRT



PC CRT

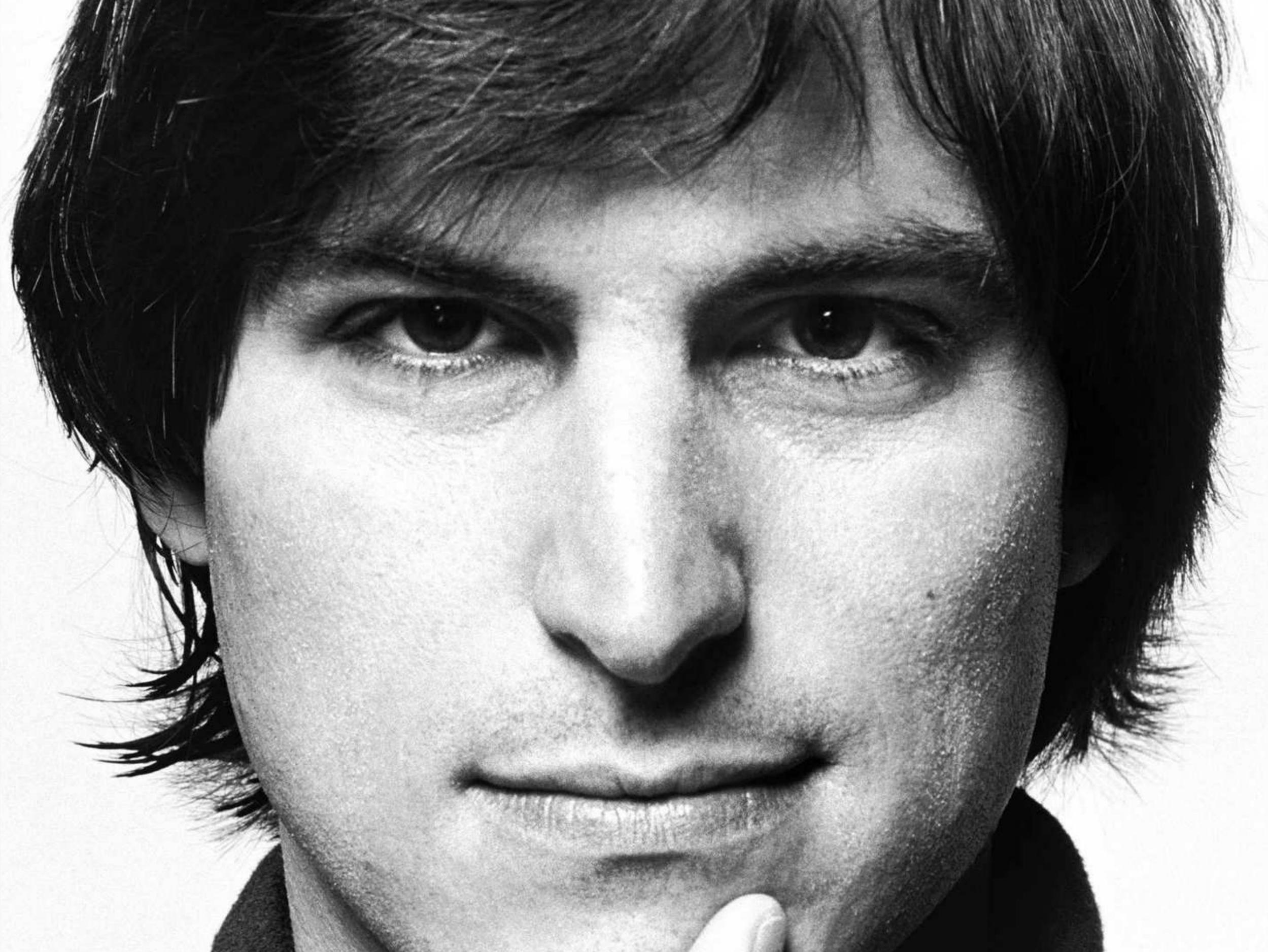


XO-1 LCD



LCD

# Object Oriented Programming





#alankayholdingthings





“OOP to me means only messaging, local retention and protection and hiding of state-process, and extreme late-binding of all things.”

*–Alan Kay*

Data Abstraction +  
Control Abstraction =  
Object Oriented Programming

# Why dysfunctional?

(my own unscientific theory)

We don't see colours  
with our eyes

We see colours with  
our brain

Our brain adjusts  
colours

We don't see colours we  
don't have an abstract  
concept for

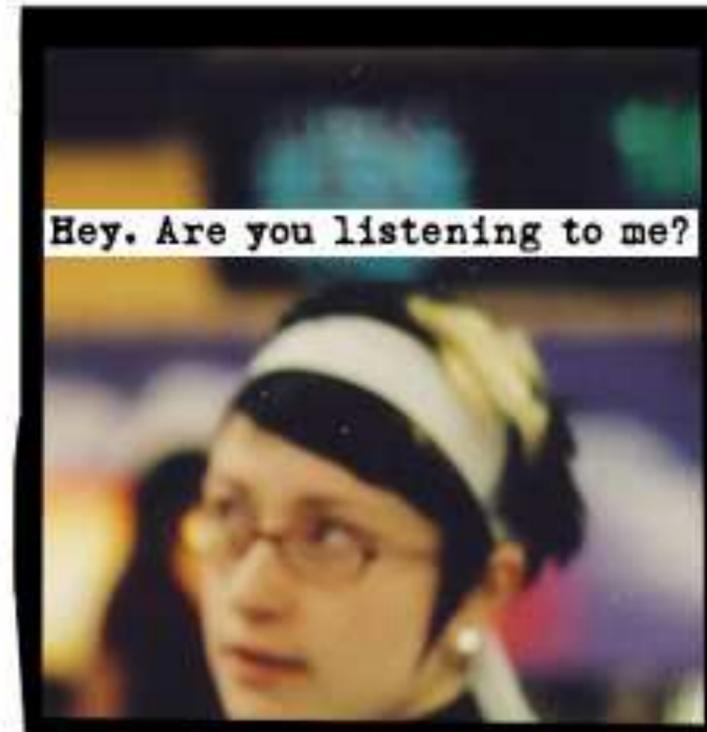
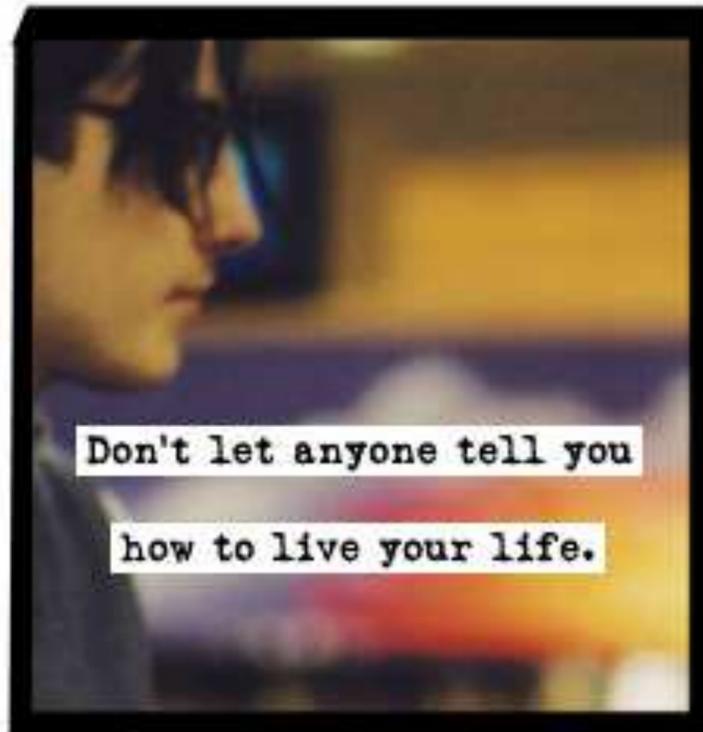


When we learn to speak, colour perception switches from left brain side to right brain side

# We make the rules



e horne and j comeau



asoftworld.com

Some rules enable  
good programs

(For some definition of good.)

# Single Responsibility Principle

# Liskov Substitution Principle

# Law of Demeter

Don't abstract too  
much, too early

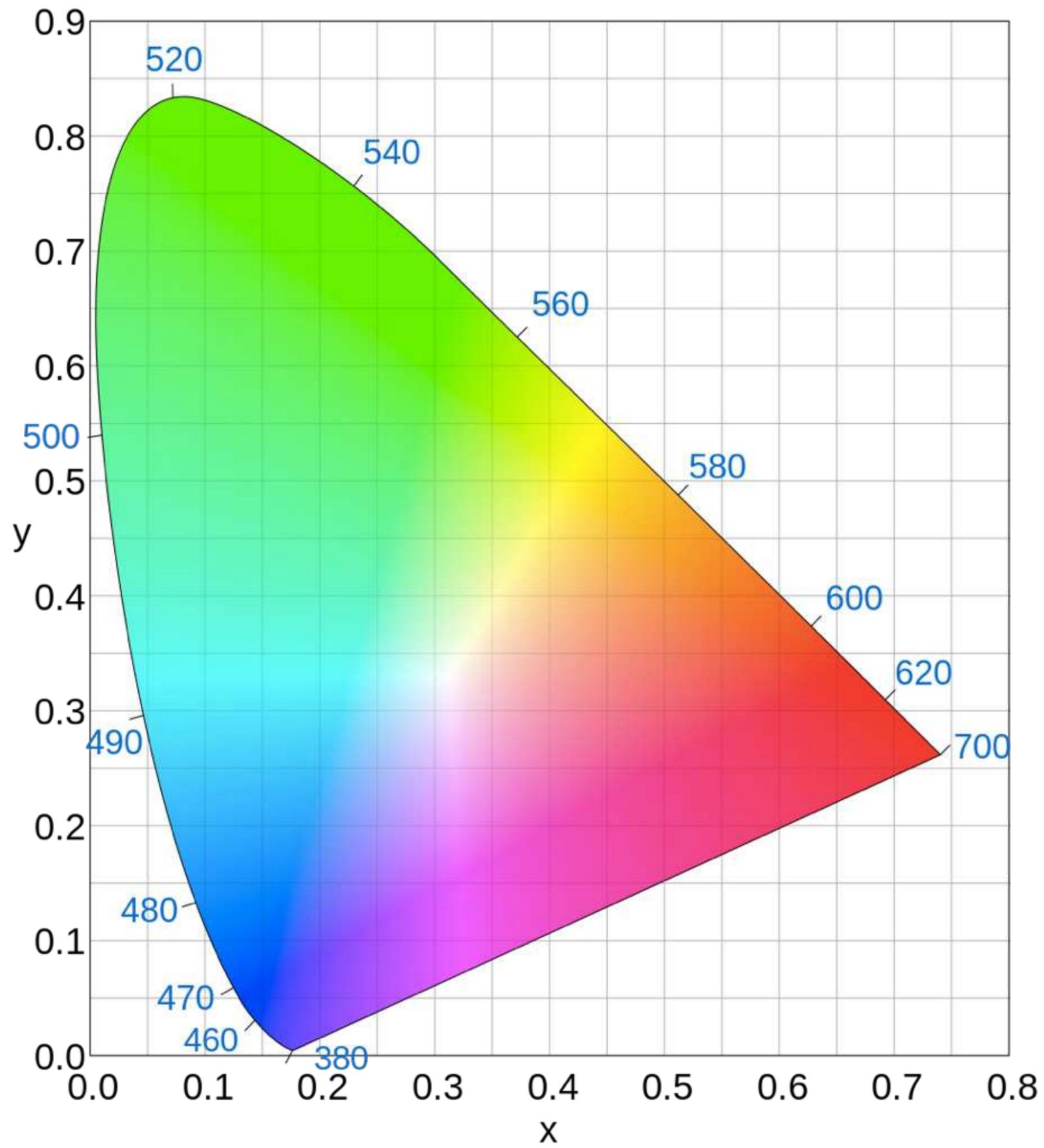
```
def put(path, opts = {}, &bk)      route 'PUT',      path, opts, &bk end
def post(path, opts = {}, &bk)    route 'POST',    path, opts, &bk end
def delete(path, opts = {}, &bk)  route 'DELETE',  path, opts, &bk end
def head(path, opts = {}, &bk)    route 'HEAD',    path, opts, &bk end
def options(path, opts = {}, &bk) route 'OPTIONS', path, opts, &bk end
def patch(path, opts = {}, &bk)   route 'PATCH',  path, opts, &bk end
def link(path, opts = {}, &bk)    route 'LINK',    path, opts, &bk end
def unlink(path, opts = {}, &bk)  route 'UNLINK',  path, opts, &bk end

%w(put post delete head options patch link unlink).each do |method|
  class_eval <<-METHOD, __FILE__, __LINE__ + 1
    def #{method}(path, opts = {}, &block) # de
      route '#{method.upcase}', path, opts, &block #
    end # en
  METHOD
end
```

Strong external  
abstractions allow weak  
internal abstractions

# Distributed Applications

Is magenta a colour?



Yes

# Inheritance

# Type Hierarchy

Liskov Substitution Principle

# Implementation Sharing

Mixins

# Composition

# Duck Typing

Are we doing it right?

Classes  $\neq$  OOP

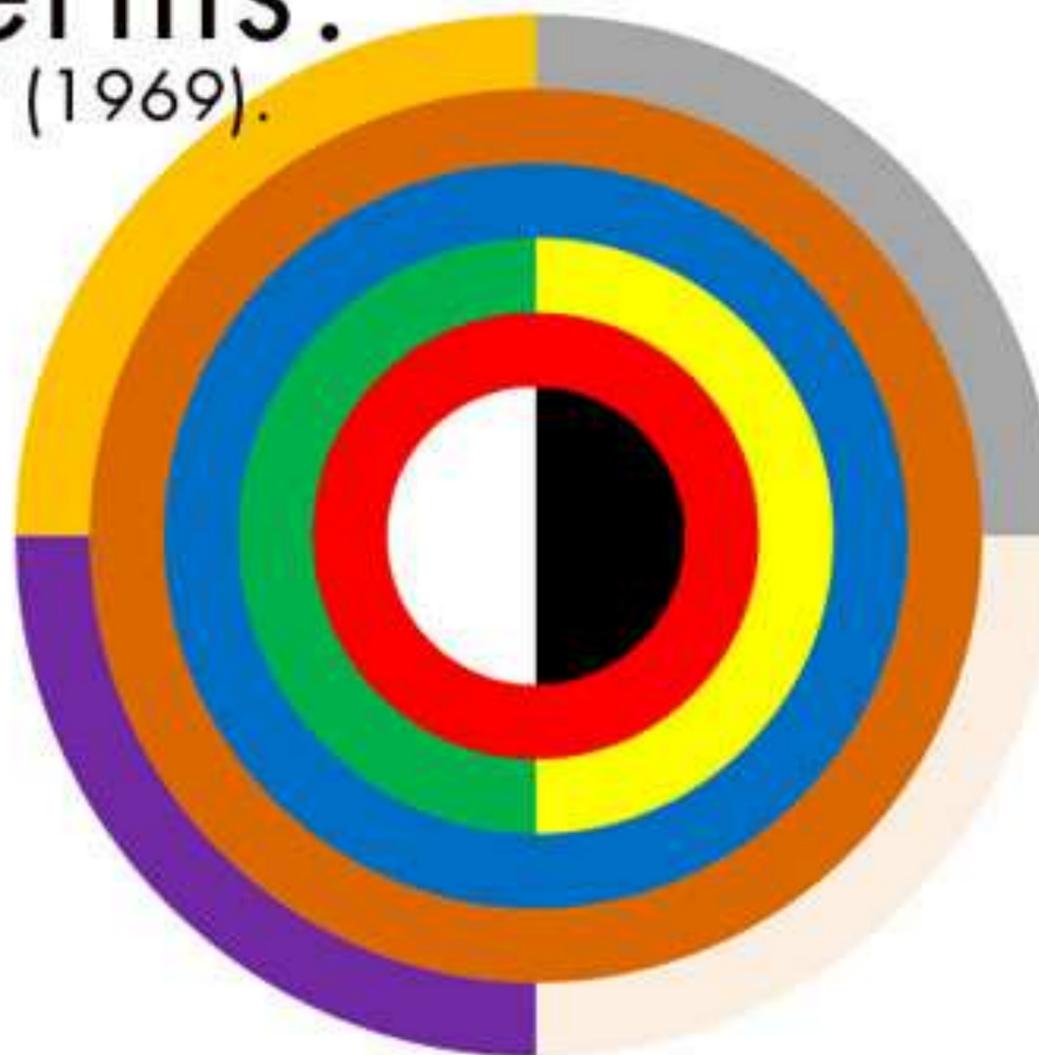
# Colour and Abstraction

# Basic Color Terms:

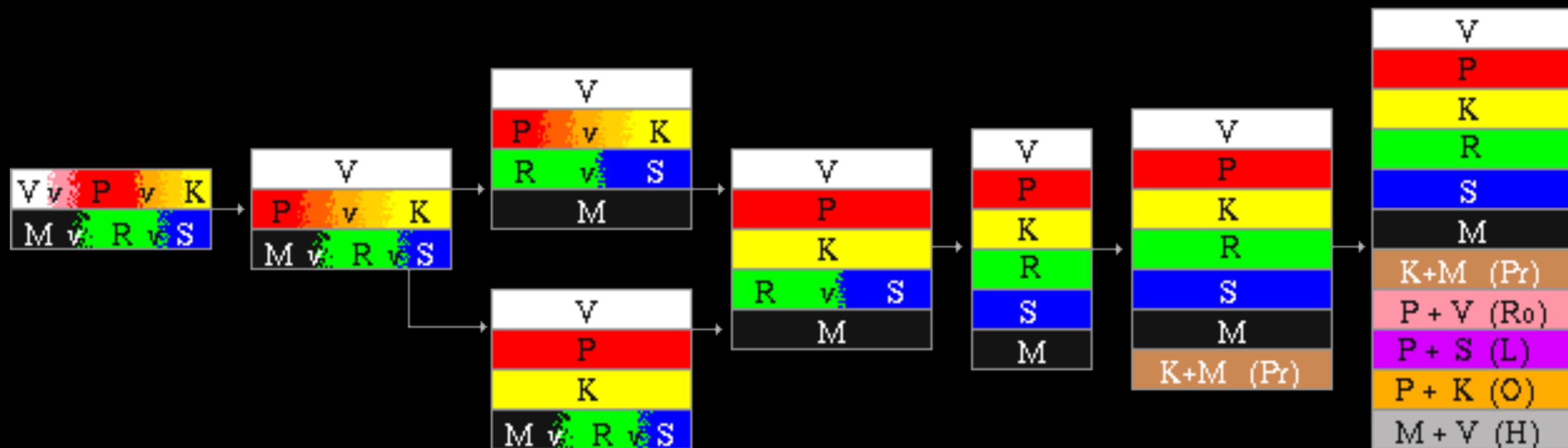
“Their Universality and Evolution” (1969).

LANGUAGE OF COLOR

Berlin and Kay



<http://michaelpetersen.wordpress.com/category/image/>



I

II

III

IV

V

VI

VII

Himba Tribe (Namibia)



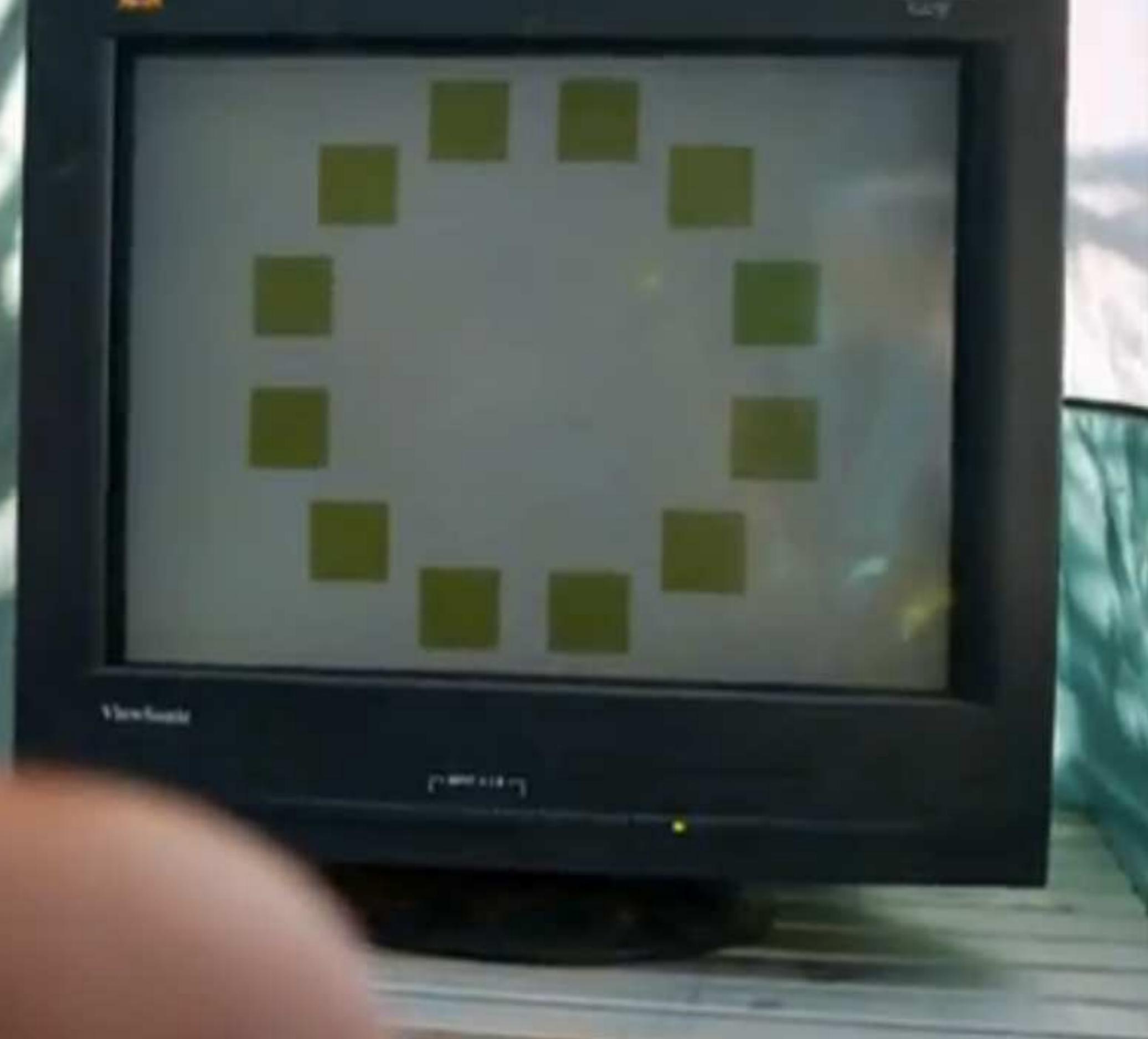
**zuzu:** dark shades of blue, red, green  
and purple

**vapa:** white, some shades of yellow

**buru:** some shades of green and blue

**dambu:** some shades of green, red  
and brown





# Abstractions and Security

Most attacks rely on switching  
up or down abstraction levels



HMM...



BIRD



User Olivia from London wants pages about "the bees in car why". Note: Files for IP 375.381.283.17 are in /tmp/files-3843. User Meg wants these 4 letters: **BIRD**. There are currently 340 connections open. User Brendan uploaded the file selfie.jpg (contents: R34ba952e20eb9ff29b43b5f8)

SERVER, ARE YOU STILL THERE?  
IF SO, REPLY "HAT" (500 LETTERS).



a connection. Jake requested pictures of deer. User Meg wants these 500 letters: HAT. Lucas requests the "missed connections" page. Eve (administrator) wants to set server's master key to "14835038534". Isabel wants pages about snakes but not too long". User Karen wants to change account password to "CoffBast". User



## Sign in to iCloud

Apple ID

Password



Remember me



federal bureau of investigation near San Francisco, CA



List all results

### Federal Bureau of Investigation

450 Golden Gate Ave #13  
San Francisco, CA 94102  
Open today [Open 24 hours](#)



Directions

[fbi.gov](http://fbi.gov)  
(425) 999-8178



Street View

Federal Government Office

[Be the first to review](#) · [Add a photo](#)

[Suggest an edit](#) · [Are you the business owner?](#)

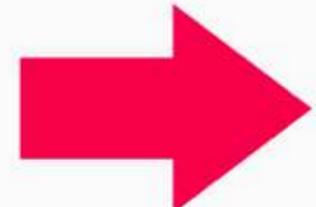
secret service near washington dc



List all results

### US Secret Service

950 H St NW #912  
Washington, DC 20223  
Open today [Open 24 hours](#)



Directions

[secretservice.gov](http://secretservice.gov)  
(425) 249-7794



Street View

[1 review](#) · Federal Government Office

[Add a photo](#)

[Suggest an edit](#)

The Olympic Club

TPC Harding  
Merced Blvd

Annandale  
Lincolnia  
North Springfield  
Burke  
Fairfax Station  
Braddock Rd  
Clifton Rd  
654  
620  
638  
617

Abstraction  
CRASH RULES  
EVERYTHING  
AROUND ME



# Business Logic

only exists in our minds

# Object Oriented Programming

only exists in our minds

# Colours

only exist in our minds

# UI elements

only exist in our minds

# Countries

only exist in our minds

Conclusion

Abstraction happens  
in our minds

All abstraction

Abstractions shape  
how we perceive things

Changing abstractions is  
a basic principle of  
innovation and progress

# Thanks!

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[me@rkh.im](mailto:me@rkh.im)