

As We May Program

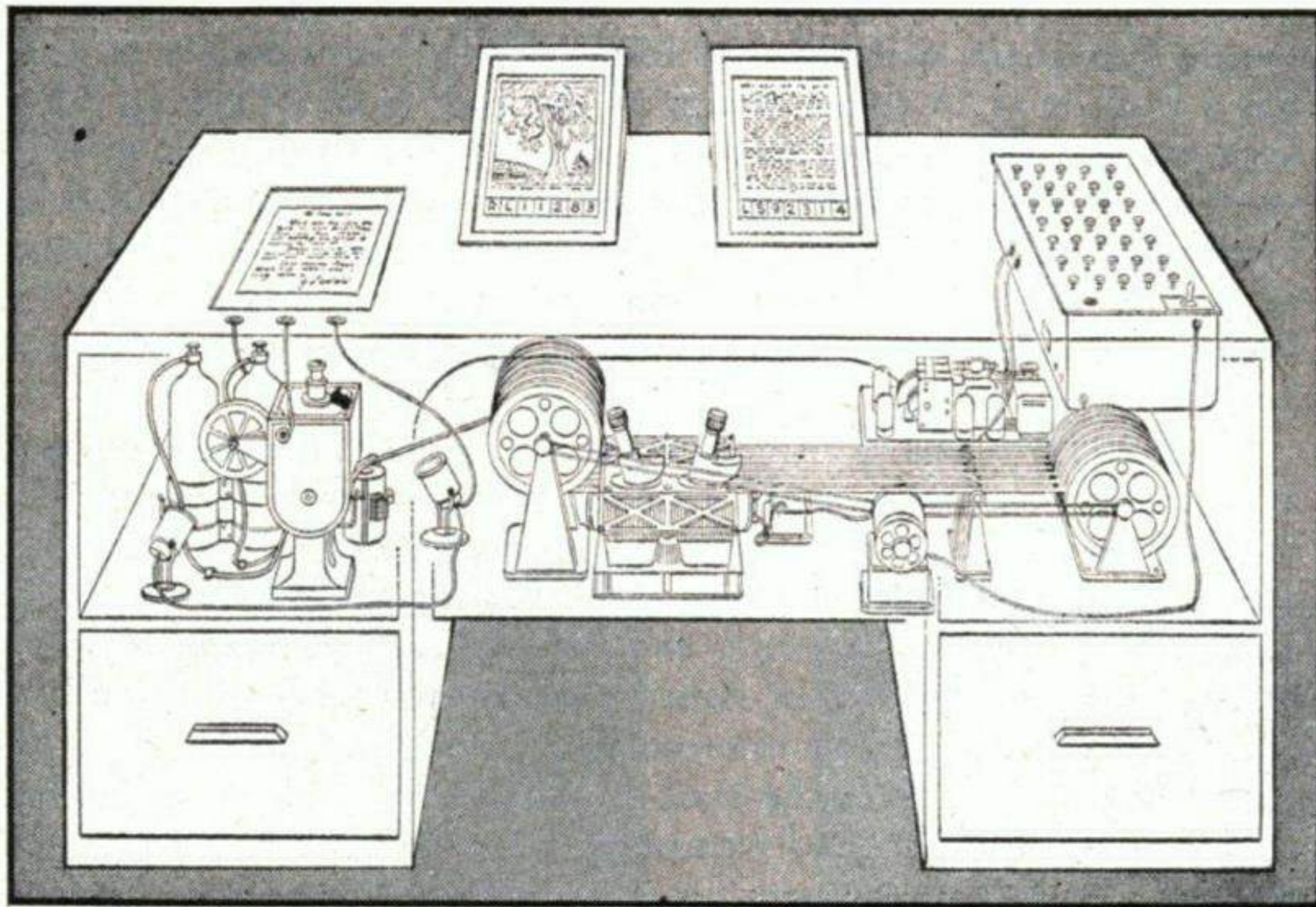
Peter Norvig

Google

**Vannevar Bush
As We May Think
1945**

*wholly new forms of encyclopedias will appear, ready made with a mesh of associative trails running through them, ready to be dropped into the **memex** and there amplified ...*





MEMEX in the form of a desk would instantly bring files and material on any subject to the operator's fingertips. Slanting translucent viewing screens magnify supermicrofilm filed by code numbers. At left is a mechanism which automatically photographs longhand notes, pictures and letters, then files them in the desk for future reference.

Back



If someone from the 1950s suddenly appeared today, what would be the most difficult thing to explain to them about life today?



self.AskReddit • 10637 comments

Back



If someone from the 1950s suddenly appeared today, what would be the most difficult thing to explain to them about life today?



self.AskReddit · 10637 comments

▼ nuseramed

+3411 · 8h

I possess a device, in my pocket, that is capable of accessing the entirety of information known to man.

Back



If someone from the 1950s suddenly appeared today, what would be the most difficult thing to explain to them about life today?



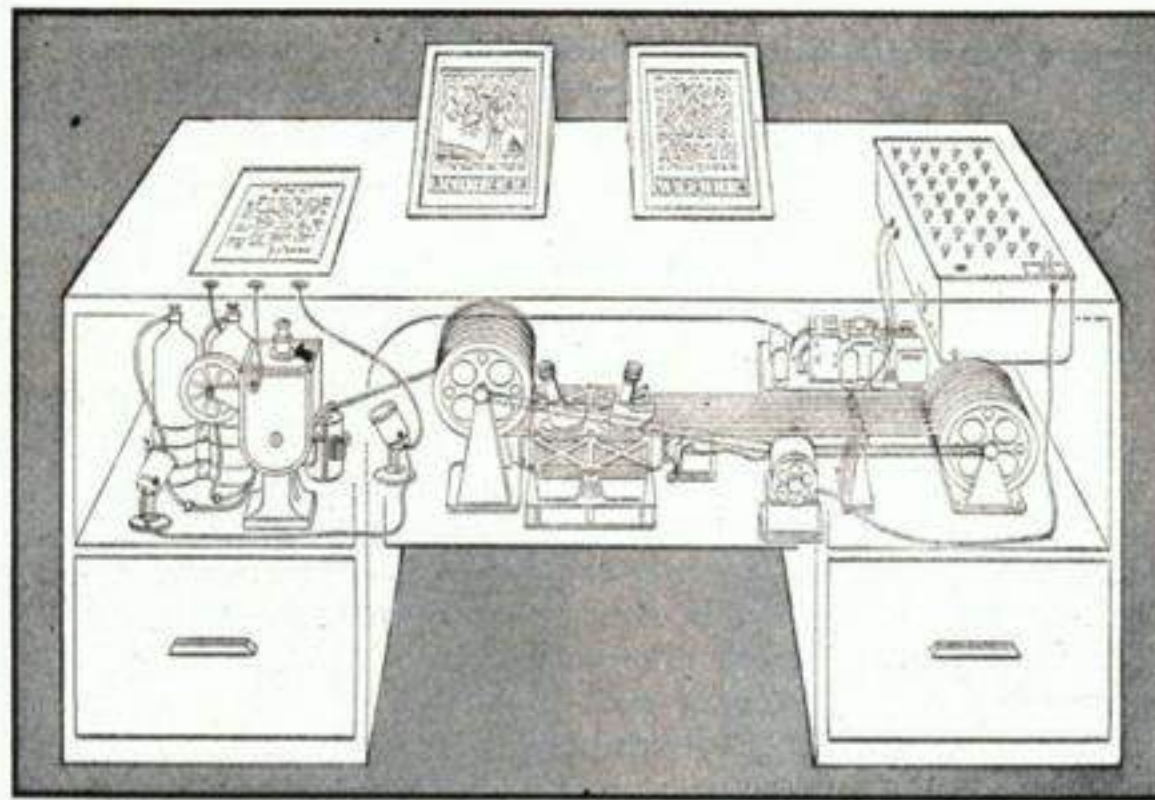
self.AskReddit · 10637 comments

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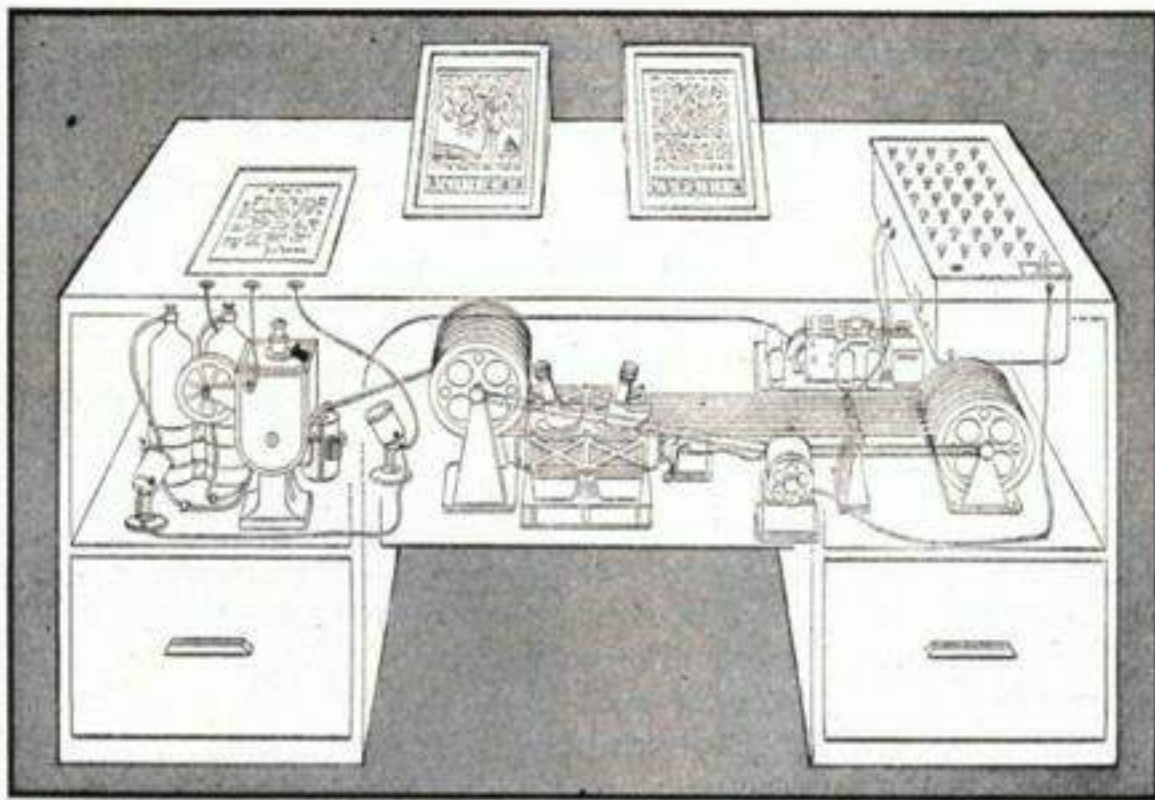
+3411 · 8h

I possess a device, in my pocket, that is capable of accessing the entirety of information known to man.

I use it to look at pictures of cats and get in arguments with strangers.



- Explore/Organize Thoughts
- Express Thoughts
- Follow Implications

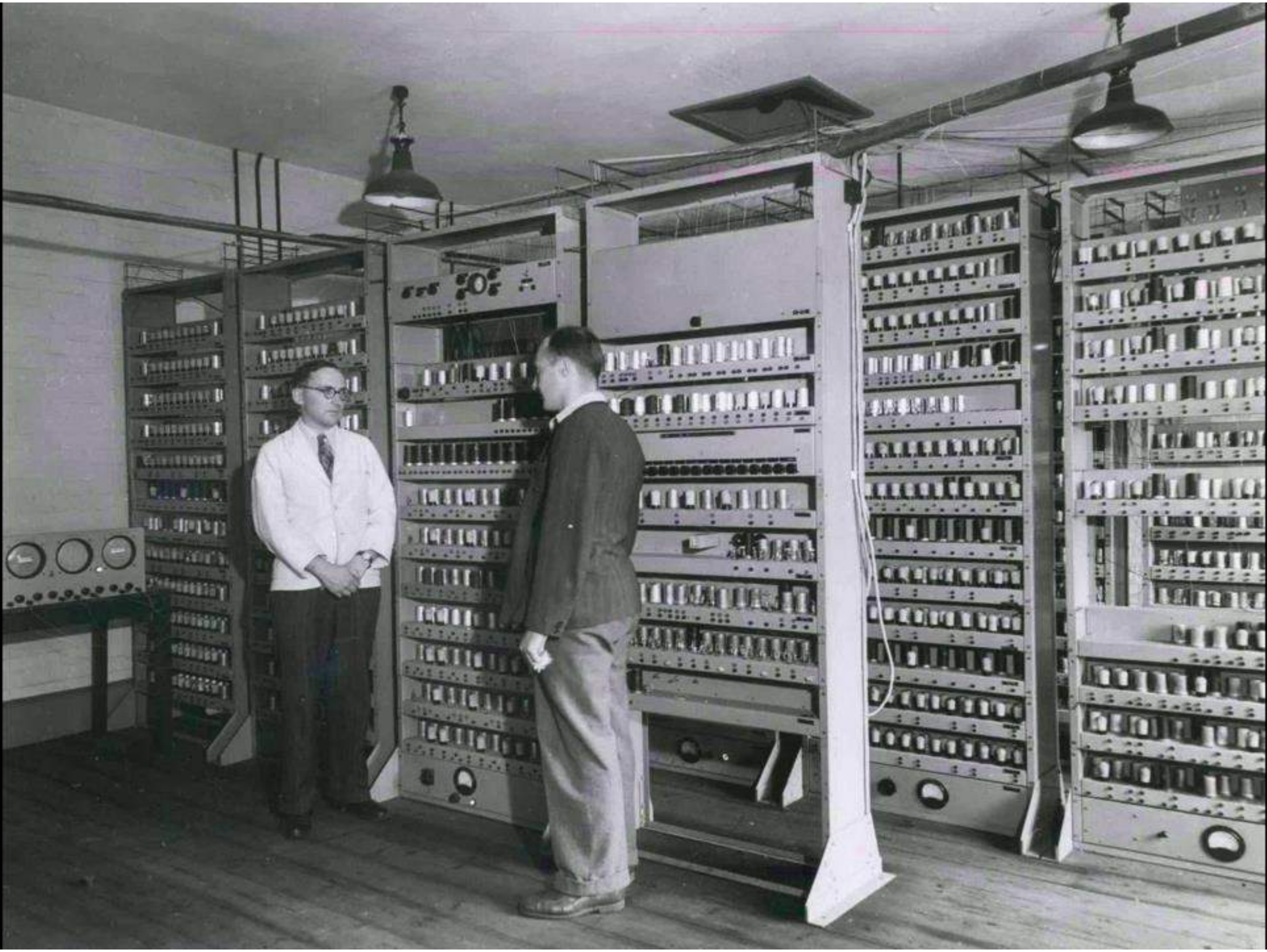


- Explore/Organize Thoughts
- Express Thoughts
- Follow Implications



- Jupyter Notebooks
- Github
- Cloud TPU/GPU Run

AS





Relays
in Relay

Relays changed

1100

Started

Cosine

Tape

(S)

1525

Started

Mult +

Adder

1545



Rel
(mott)

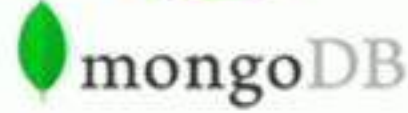
First actual case of

~~1630~~ 1630

arrangement started.

1700

closed down.



We









4all



PROGRAM

5045

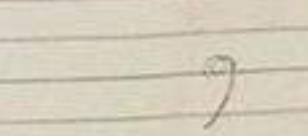
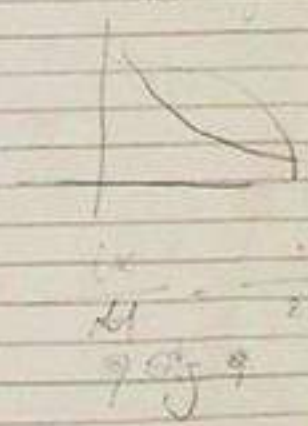
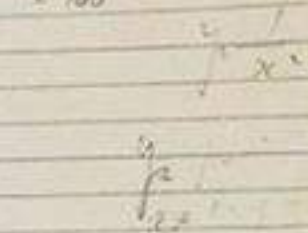
```

1 C PAIK STUDB 1
2 DIMENSION LOVE(4), HATE(4), GOD(3), DOG(3)
3 DATA LOVE/1H,1H,1HV,1HE/, HATE/1HM,1HA,1HT,1HE/, GOD/1HG,1HO,1HD/,
4 1DOO/1HO,1HO,1HO/
5 CALL ROLL(1)
6 CALL REFNO(=512,917,1024,1024)
7 DO100J=1,16
8 JH=MOD(J-1,4)+1
9 R=J+15
10 IR=R
11 I=2, NR+1.
12 DO100I=1,11
13 X=1+256*IR
14 LY=SORT(R=2-(X+256,0)**2)
15 LXX
16 CALLTSP(LX,LY,LOVE(JH),1)
17 LY=LY
18 CALLTSP(LX,LY,LOVE(JH),1)
19 DO300J=1,16
20 JH=MOD(J-1,4)+1
21 R=J+15
22 IR=R
23 I=2, NR+1.
24 DO300I=1,11
25 X=1+256*IR
26 LY=SORT(R=2-(X+256,0)**2)
27 LXX
28 CALLTSP(LX,LY,HATE(JH),1)
29 LY=LY
30 300 CALLTSP(LX,LY,HATE(JH),1)
31 DO200J=1,16
32 JH=MOD(J-1,3)+1
33 R=J+15
34 IR=R
35 I=2, NR+1.
36 DO200I=1,11
37 Y=1+256*IR
38 LY=Y
39 LX=SORT(R=2-(Y+256,0)**2)
40 CALLTSP(LX,LY,GOD(JH),1)
41 LXX=LX
42 200 CALLTSP(LX,LY,GOD(JH),1)
43 DO400J=1,16
44 JH=MOD(J-1,3)+1
45 R=J+15
46 IR=R
47 I=2, NR+1.
48 DO400I=1,11
49 Y=1+256*IR
50 LY=Y
51 LX=SORT(R=2-(Y+256,0)**2)
52 CALLTSP(LX,LY,DOG(JH),1)

```

$R = 2.1015$
 $R2 = 6.2815931$
 $R = R2 / \pi = 2.000$
 $ANGLE = \pi - ASIN(R)$
 $V = -256 - R$
 $SE = 16 - R2 / R$
 $ASIN = ASIN(R)$
 $ANGLE = ANGLE + ASIN$
 $V = -256 - R + COS(ANGLE)$

$R = 15$ $C = 6.28 - 15$
 ≈ 100



$$Y = \sqrt{R^2 - (X+256)^2}$$

*Hello.java AL.java HelloRunnabl... HelloCallabl... FileMatcher... Employee.java

```
public class Hello {  
    interface HelloService {  
        String hello(String firstname, String lastname);  
        //String hello();  
    }  
  
    public static void main(String[] args) {  
        String hello;  
        int i;  
        HelloService helloService = (String firstname, String lastname) -> {  
            hello = "Hello " + firstname + " " + lastname;  
            // throw new Exception();  
            System.out.println(i);  
            return hello;  
        };  
  
        /** HelloService helloService = () -> {  
            hello = "Hello " + firstname + " " + lastname;  
            return hello;  
        };*/  
    }  
}
```

The local variable i may not have been initialized

Press 'F2' for focus







 stackoverflow



```
1  def Calculator()
2  def addition(a,b,c):
3      return a+b+c
4  end
5
6  /** Create a list of 2 numbers */
7  def newFraction(numerator, denominator)
8      return [numerator, denominator]
9  end
10
11 /** Warning: Don't use original fraction! */
12 def multiplyFrac(frac, otherFrac)
13     frac[0] *= otherFrac[0]
14     frac[1] *= otherFrac[1]
15     return frac
16 end
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Method

Class



Method



 stackoverflow



```
1  def Calculator()
2  def addition(a,b,c):
3      return a+b+c
4  end
5
6  /** Create a list of 2 numbers */
7  def addFraction(numerator, denominator)
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```

Method

Class

INPUT



OUTPUT

$$\lim_{x \rightarrow 0} \frac{\sin(x)}{x} = 1$$

$$e^{i\pi} + 1 = 0$$

$$a^2 + b^2 = c^2$$

$$x_{n+1} = r x_n (1 - x_n)$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$y'_1 = y_2, \quad y'_2 = \beta_1 + \beta_2 y_1 + y_1^2 \pm y_1 y_2$$

$$\frac{df}{dx} = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

$$f(x) = \sum_{n=0}^{\infty} \frac{f^{(n)}(a)}{n!} (x-a)^n$$

$$\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s} = \prod_p \frac{1}{1-p^{-s}}$$

$$\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}$$

$$\log(xy) = \log(x) + \log(y)$$

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$$



Software =
 Mathematical
 Science
 (Logic, Proofs)



PROGRAMMER



PROGRAMMER = MICROMANAGER

Standard ML Model

1. Labelled Data

cat:



Standard ML Model

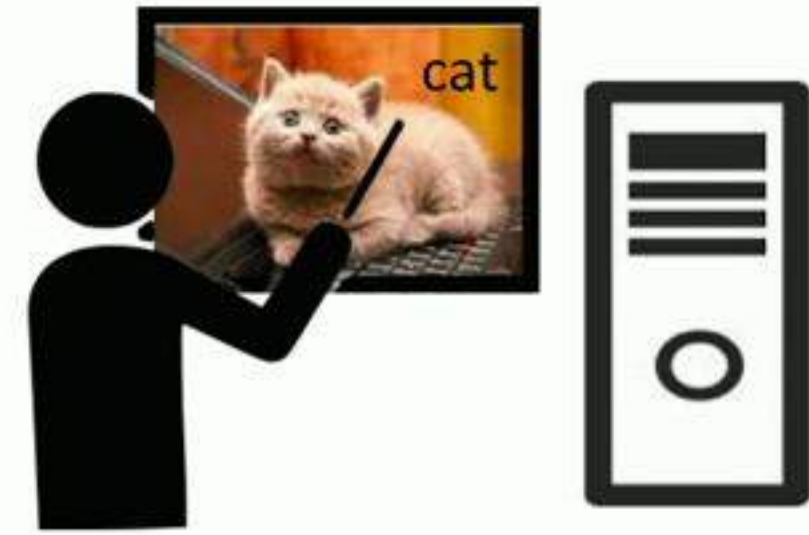
1. Labelled Data
2. Deep Learning
3. Profit!

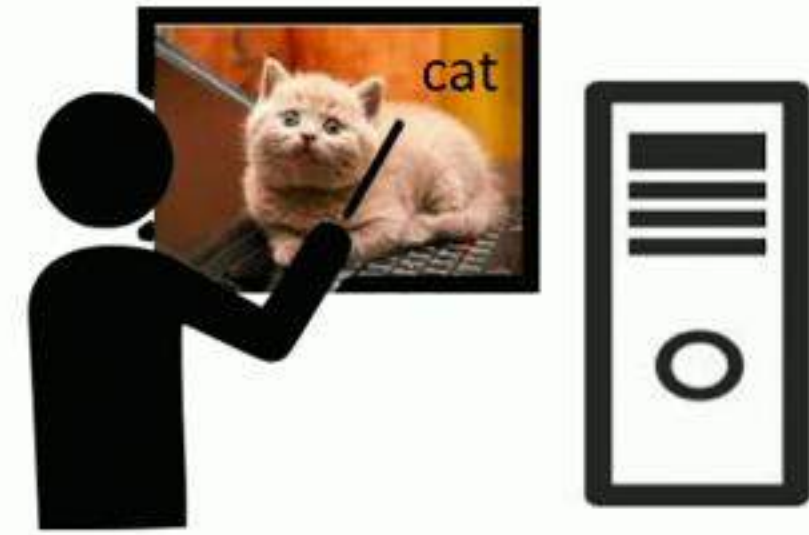
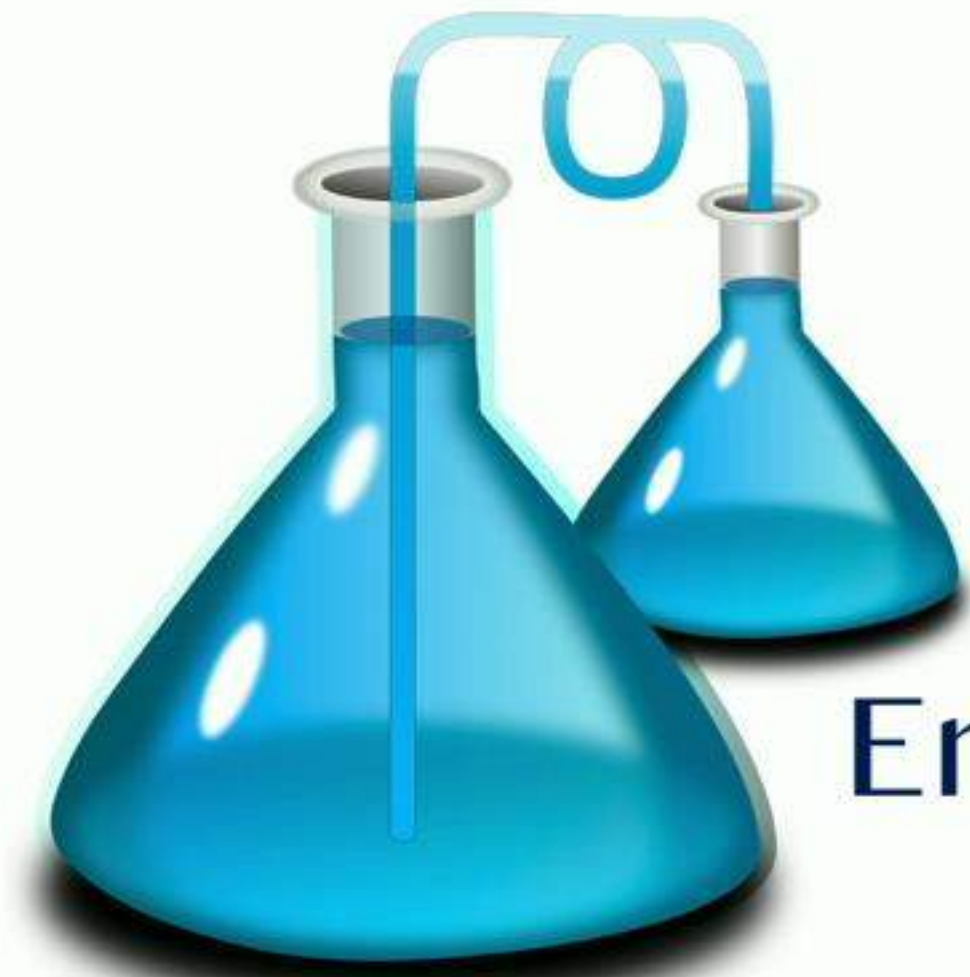
cat:



 TensorFlow

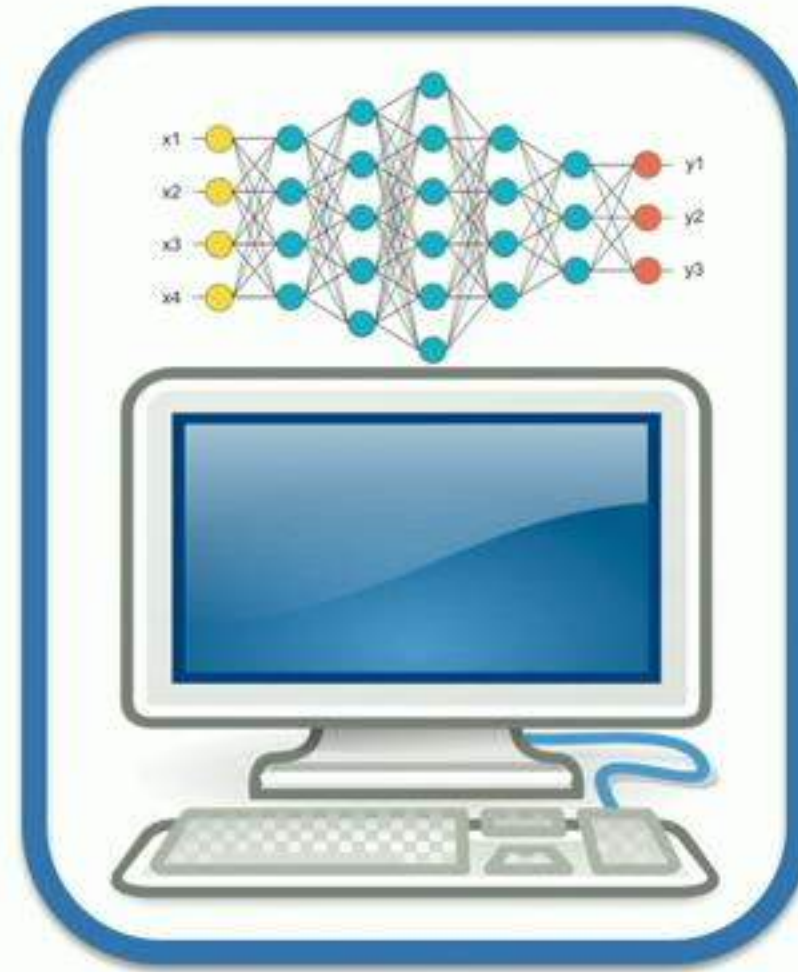
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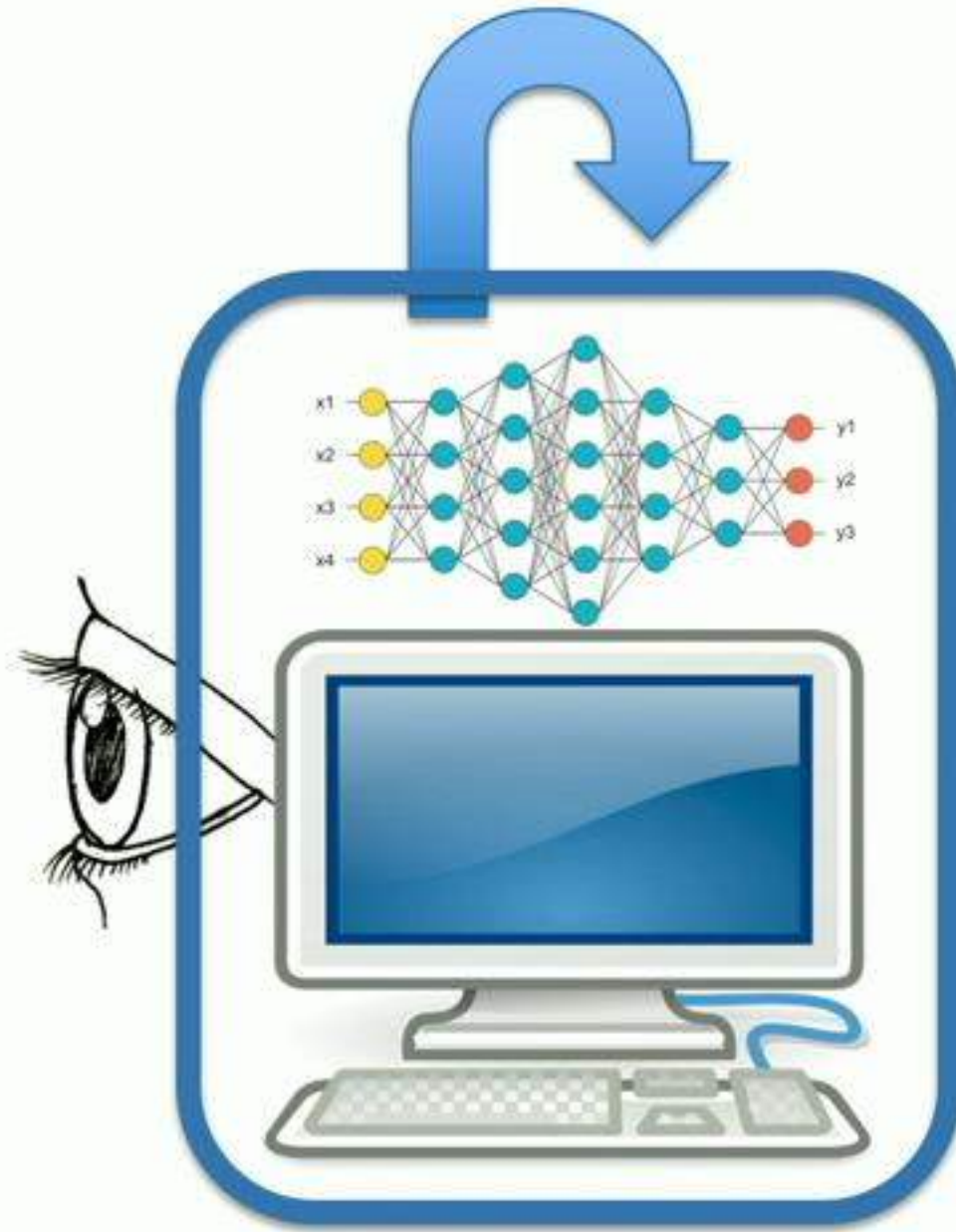


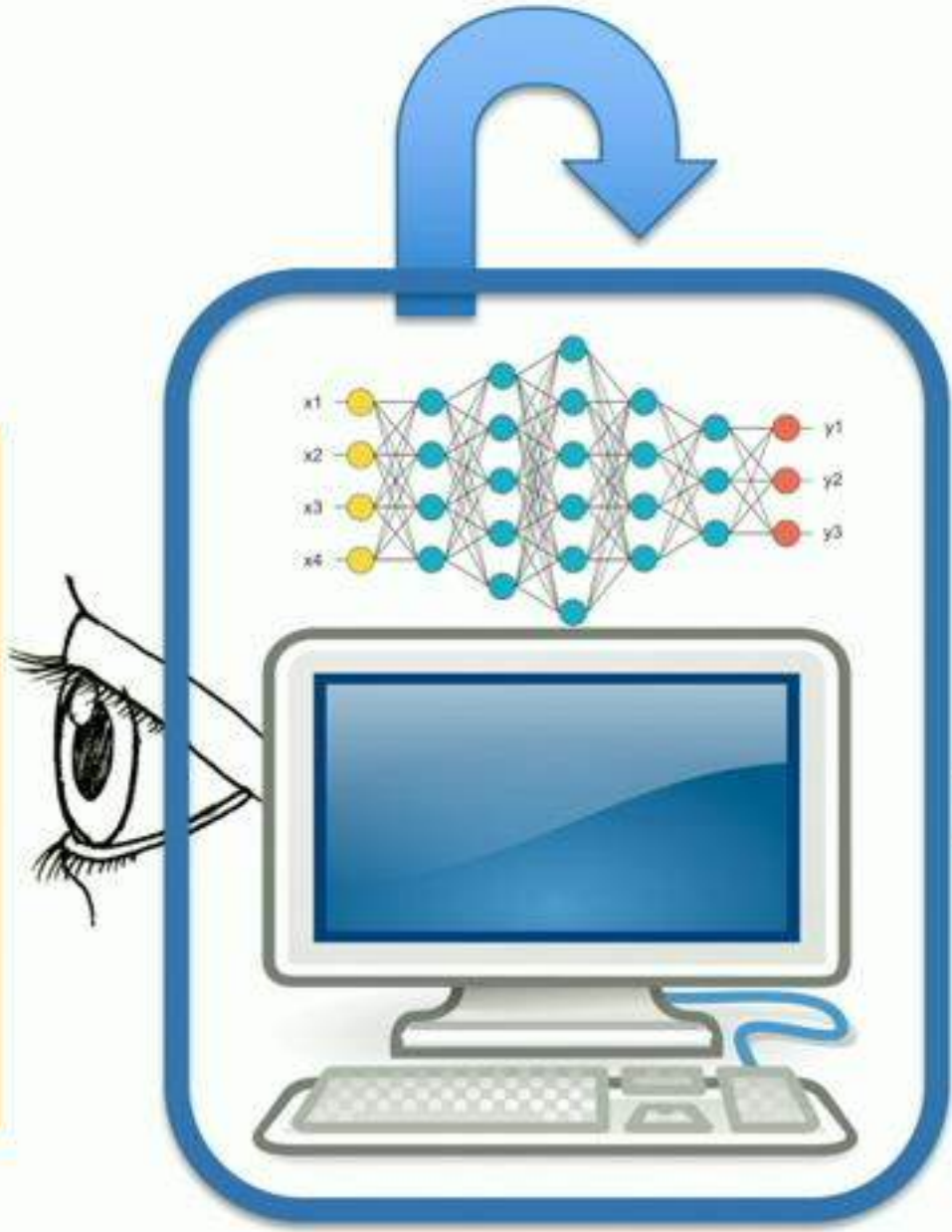
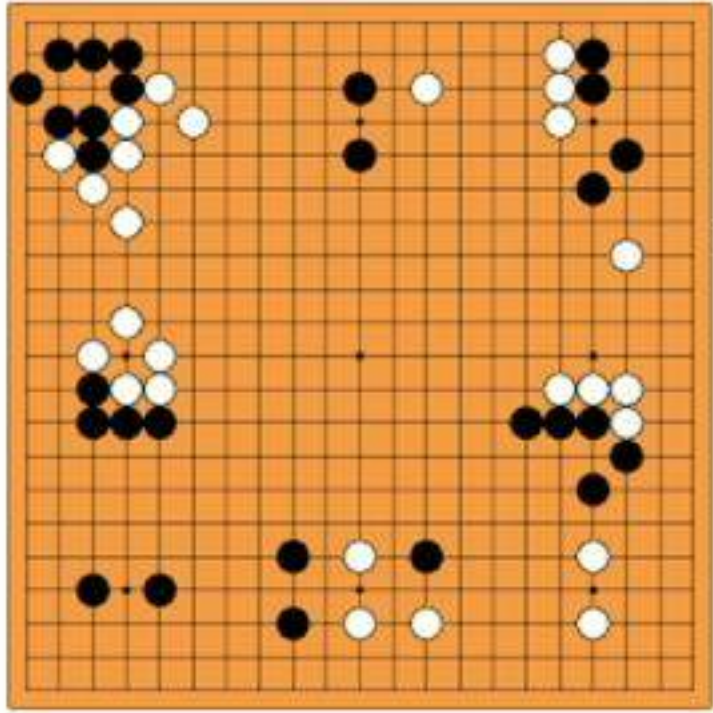


Software =
Empirical / Natural
Science
(Probabilistic, Uncertain,
Observational)

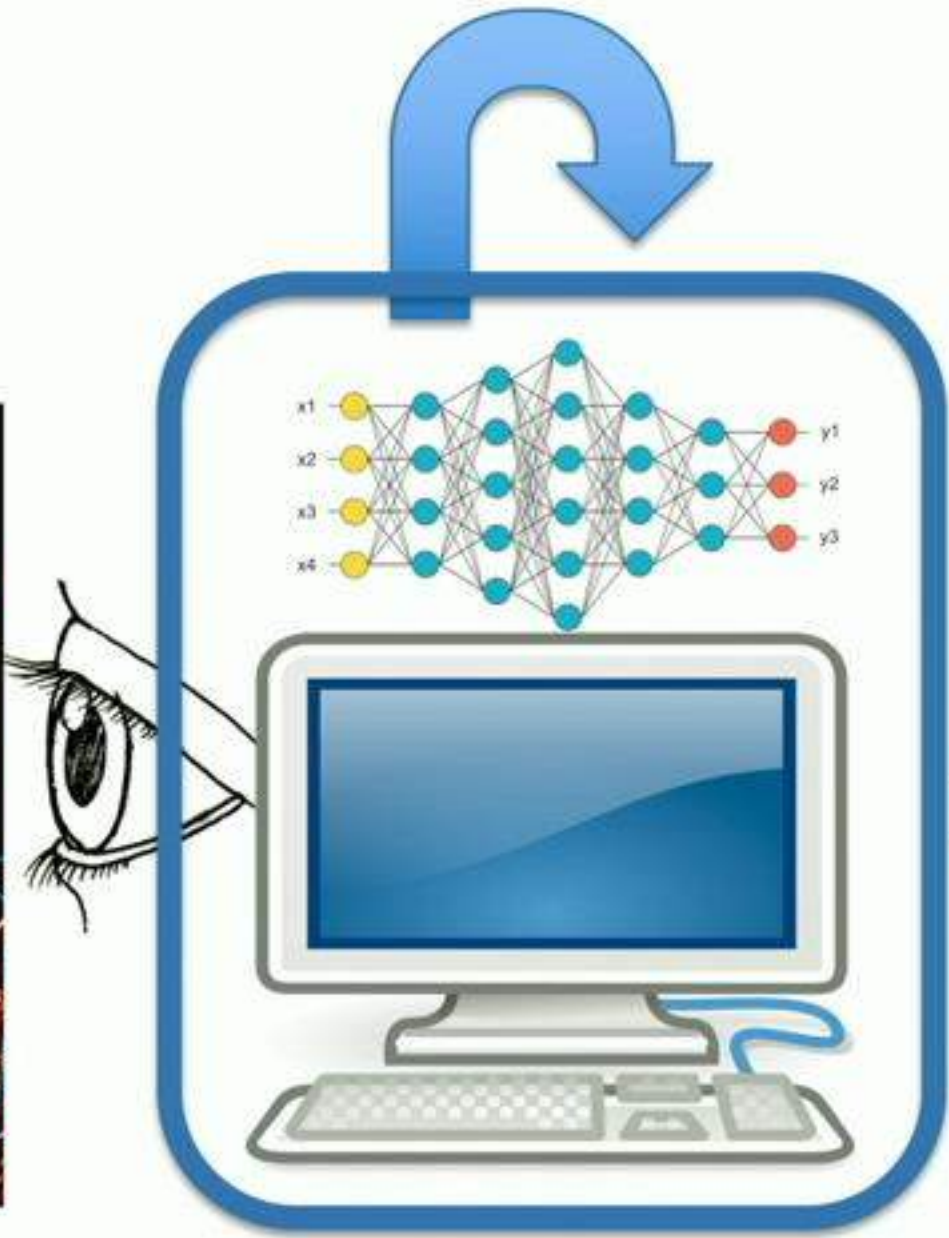






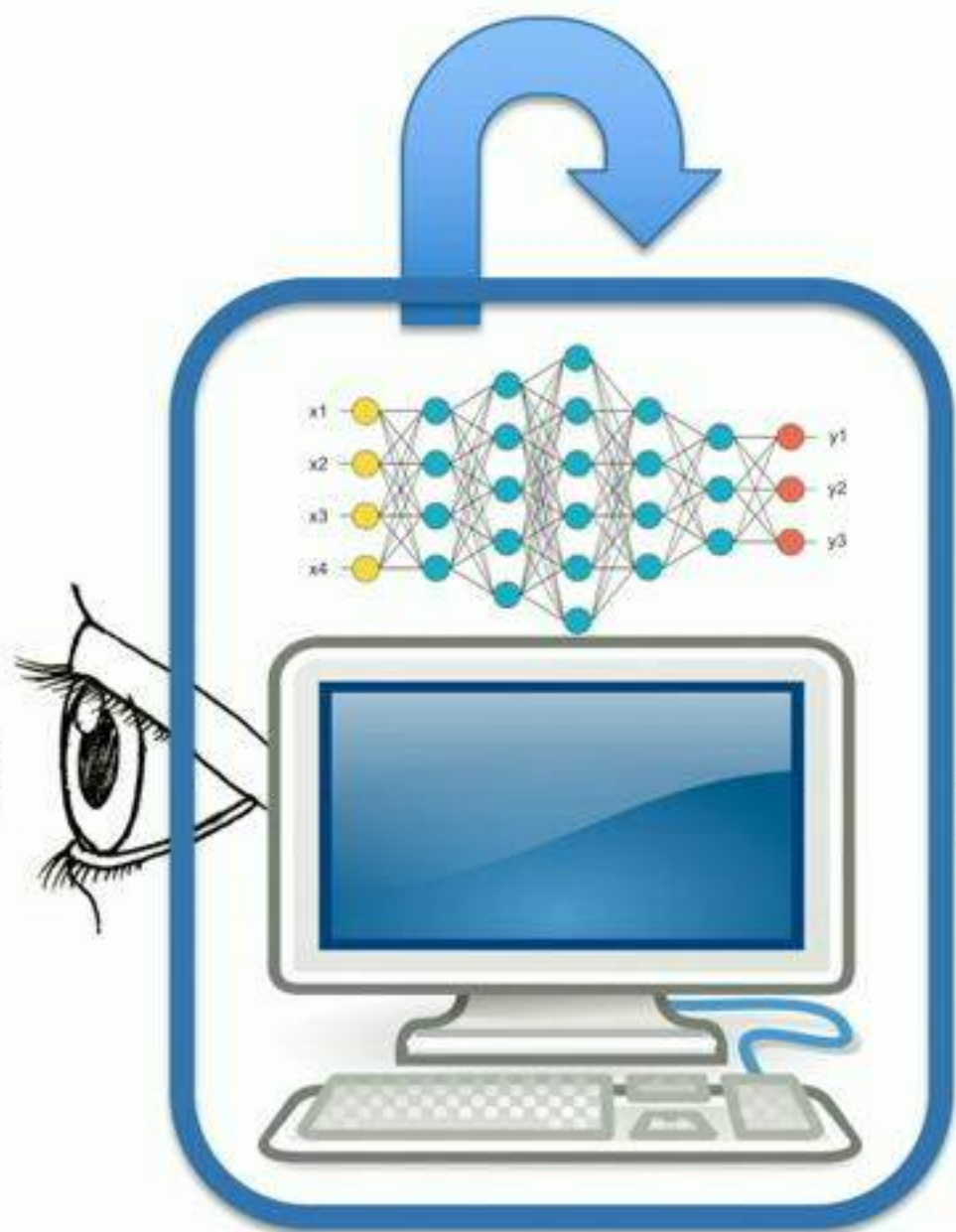


● K3



turn right 2°

神經機器翻譯

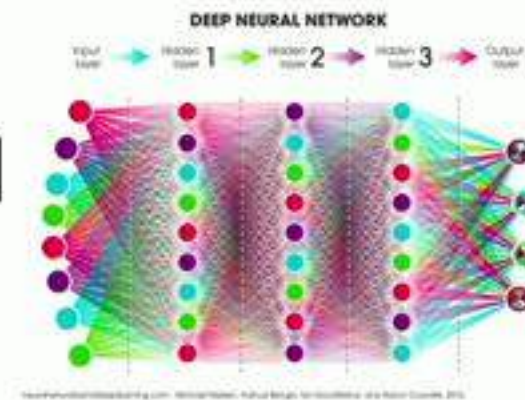


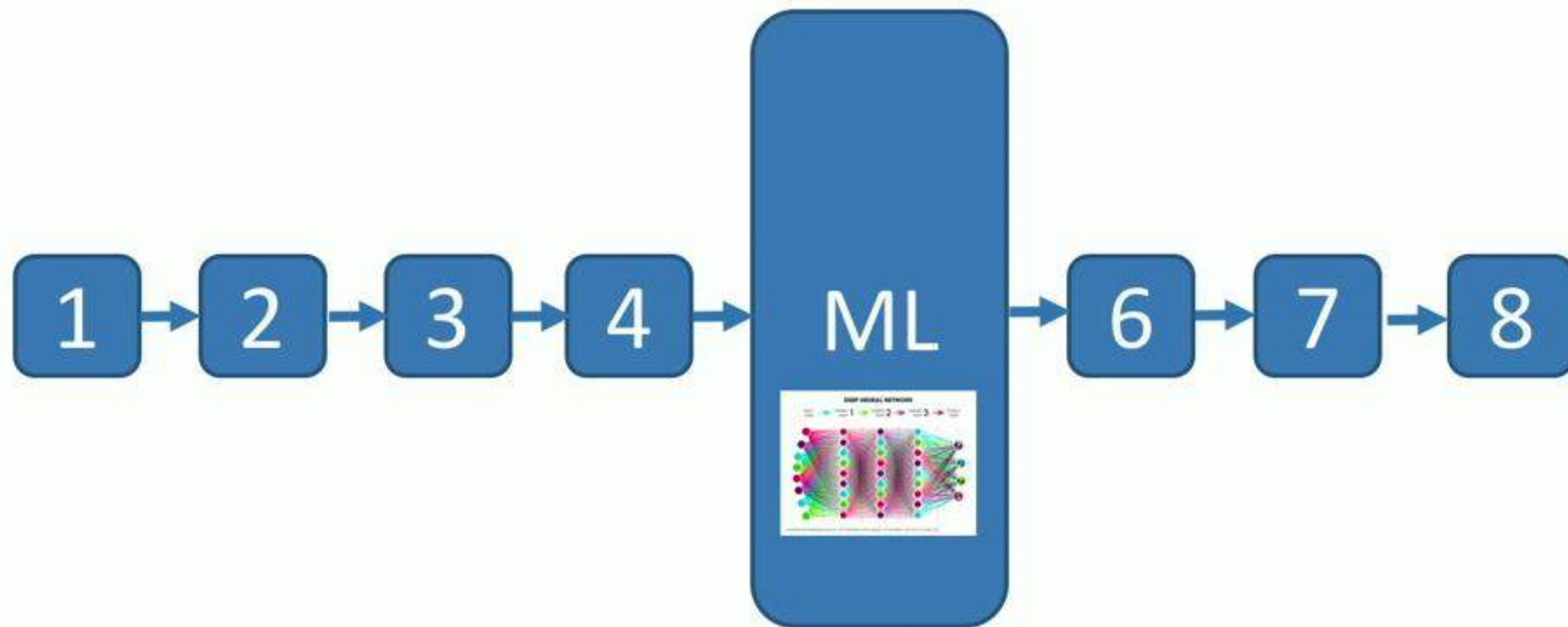
“neural
machine
translation”

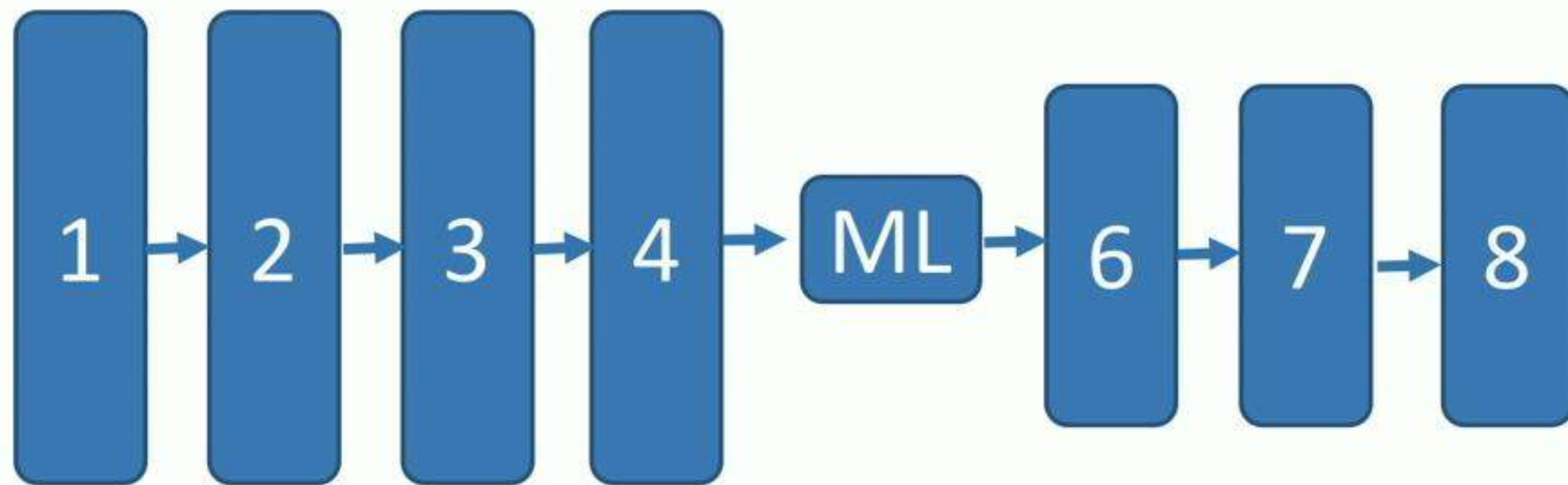


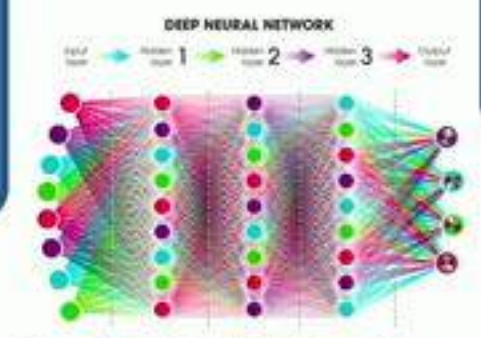
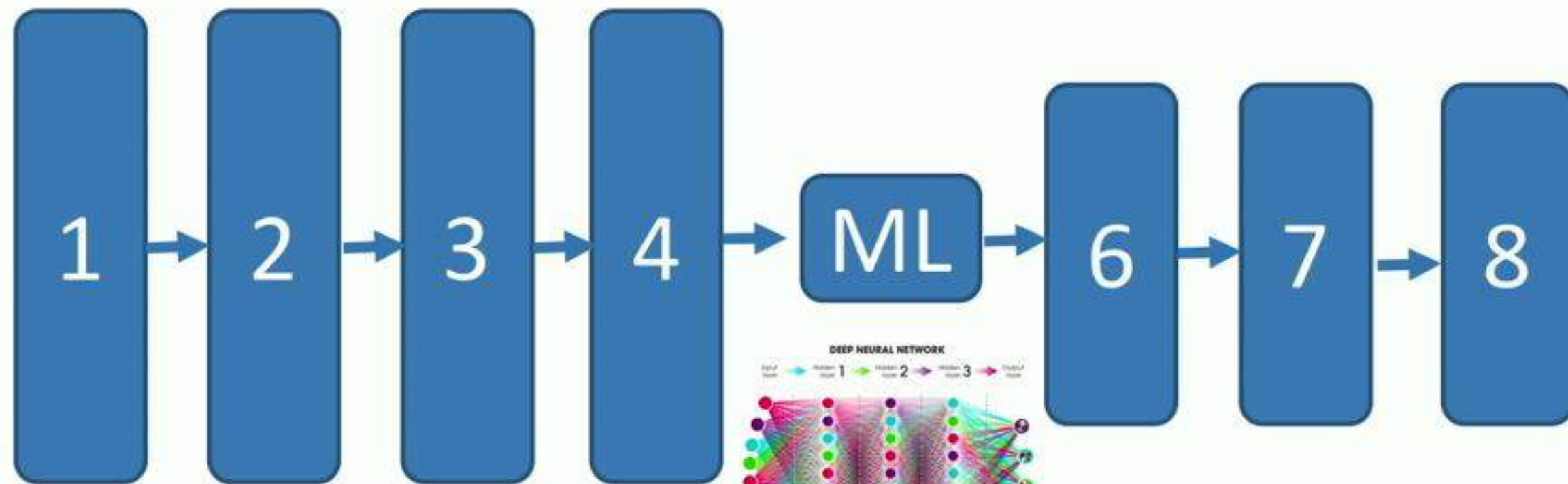
~~Standard~~ Realistic ML Model

- 1) Explore kinds of data
- 2) Identify data sources
- 3) Curate data
- 4) Supervise data
- 5) **Evaluate and debug / modify model**
- 6) Adapt to business needs
- 7) Deploy, serve, monitor
- 8) Continually repeat: modify and improve

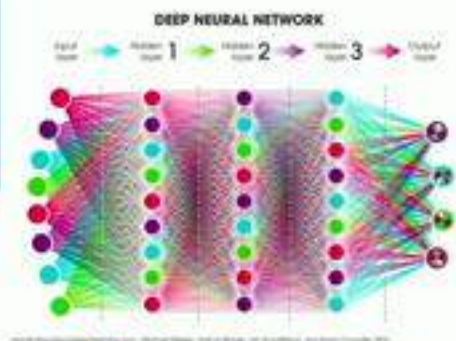
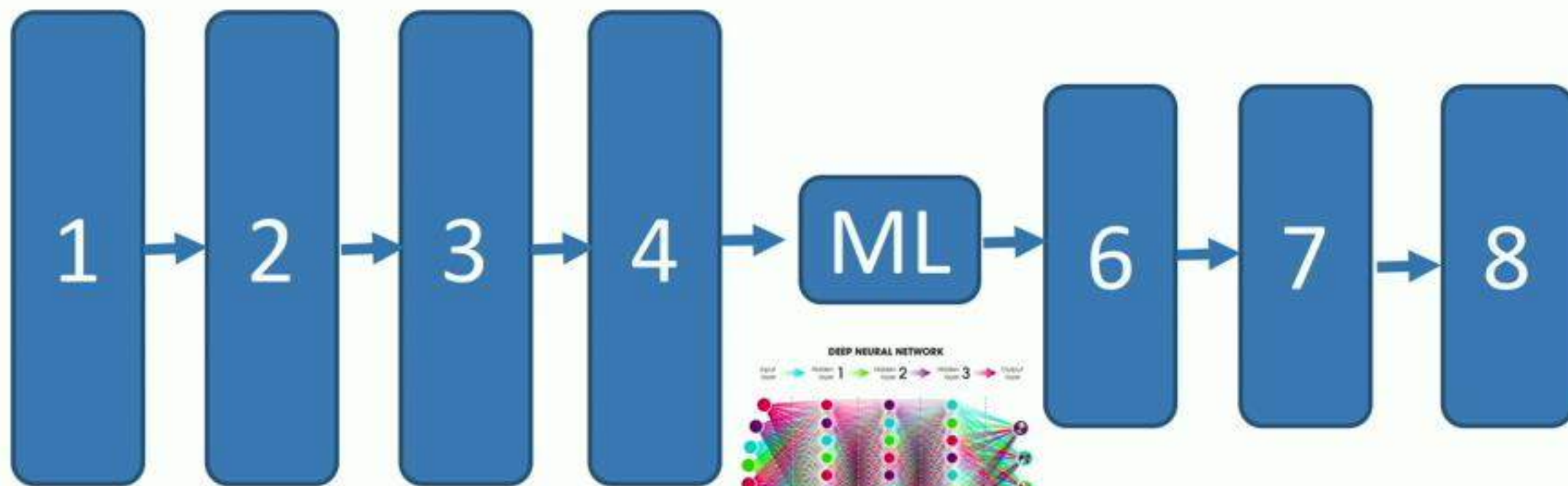








←
differentiable



differentiable



EXPLORE/ORGANIZE THOUGHTS
EXPRESS THOUGHTS
FOLLOW IMPLICATIONS

DATA SCIENCE

MODERN DATA SCIENTIST

Data Scientist, the coolest job of the 21st century, requires a mixture of interdisciplinary skills ranging from an understanding of mathematics, statistics, computer science, communication and business. Finding today's scientists hard. Finding people who understand these disciplines is, to quote Ford, "to find is a little more than to find".

MATH & STATISTICS

- Multivariable
- Linear algebra
- Probability
- Bayes theorem
- Statistical learning
- Linear models
- Regression
- Optimization

PROGRAMMING & DATABASE

- Python
- R
- SQL
- Hadoop
- MapReduce
- NoSQL
- Data warehousing
- Data mining
- Data visualization

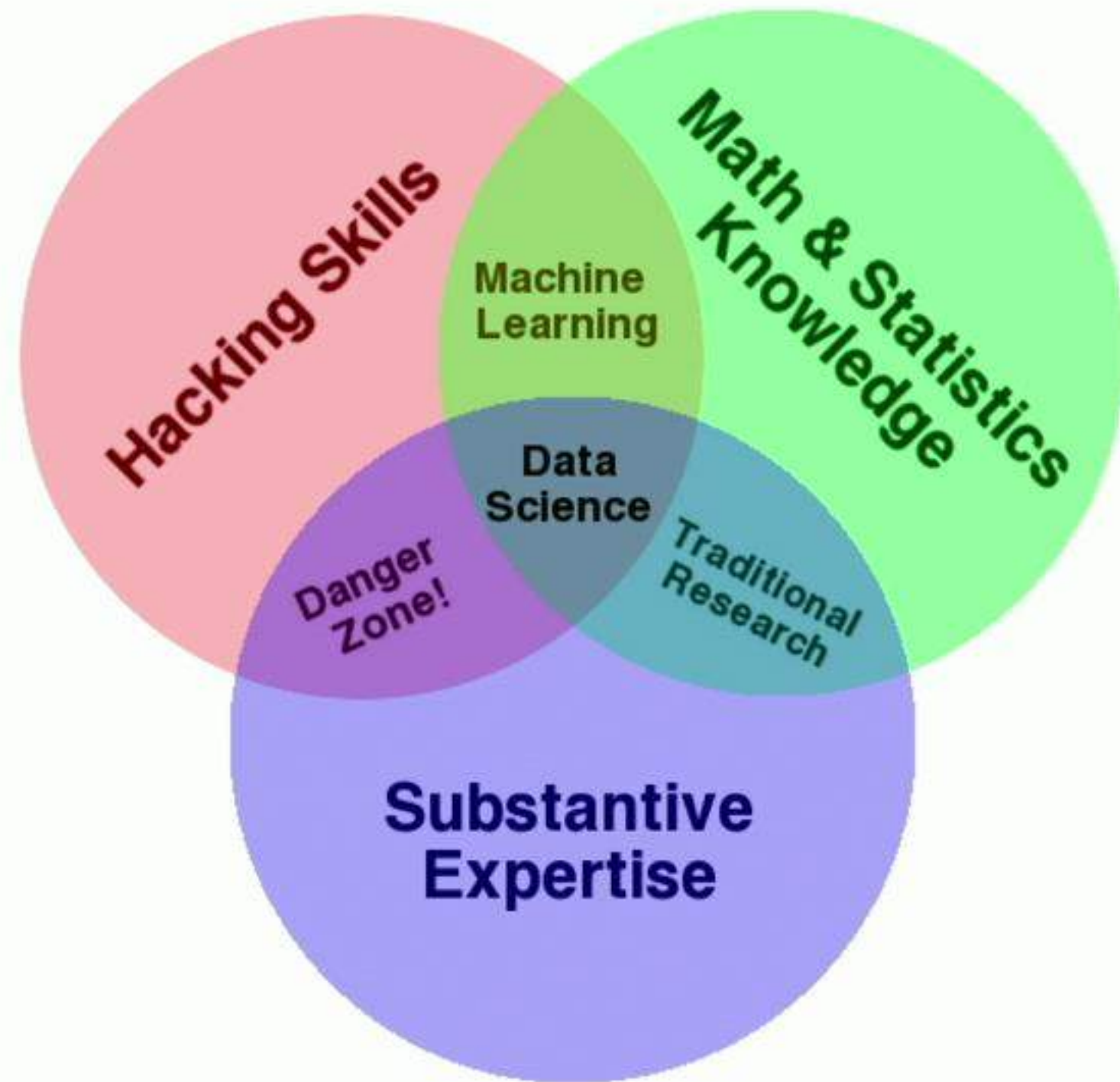
DOMAIN KNOWLEDGE & SOFT SKILLS

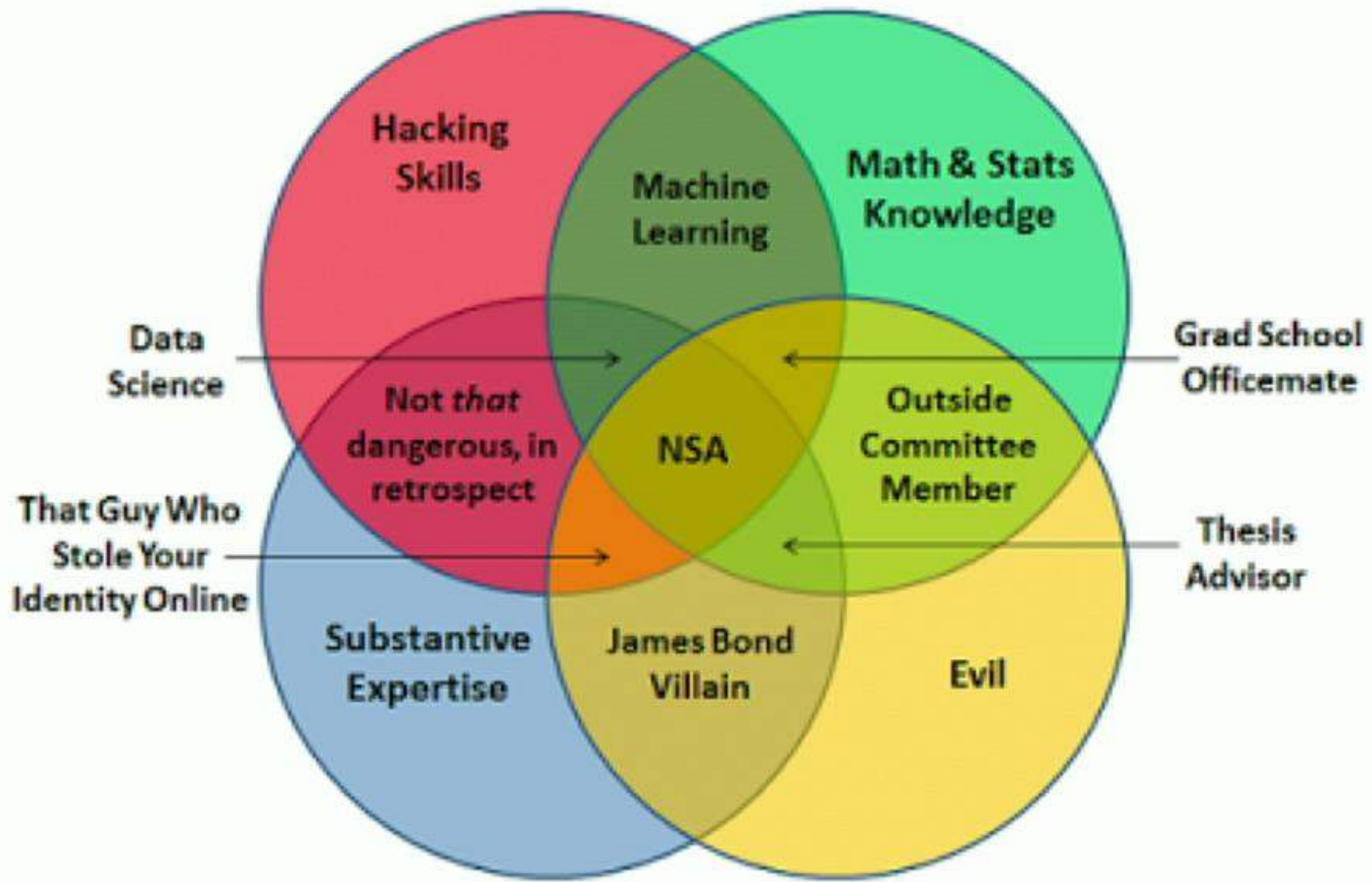
- Business acumen
- Communication
- Problem solving
- Teamwork
- Critical thinking
- Creativity
- Adaptability

COMMUNICATION & VISUALIZATION

- Storytelling
- Data visualization
- Presentation skills
- Writing
- Public speaking
- Collaboration
- Networking

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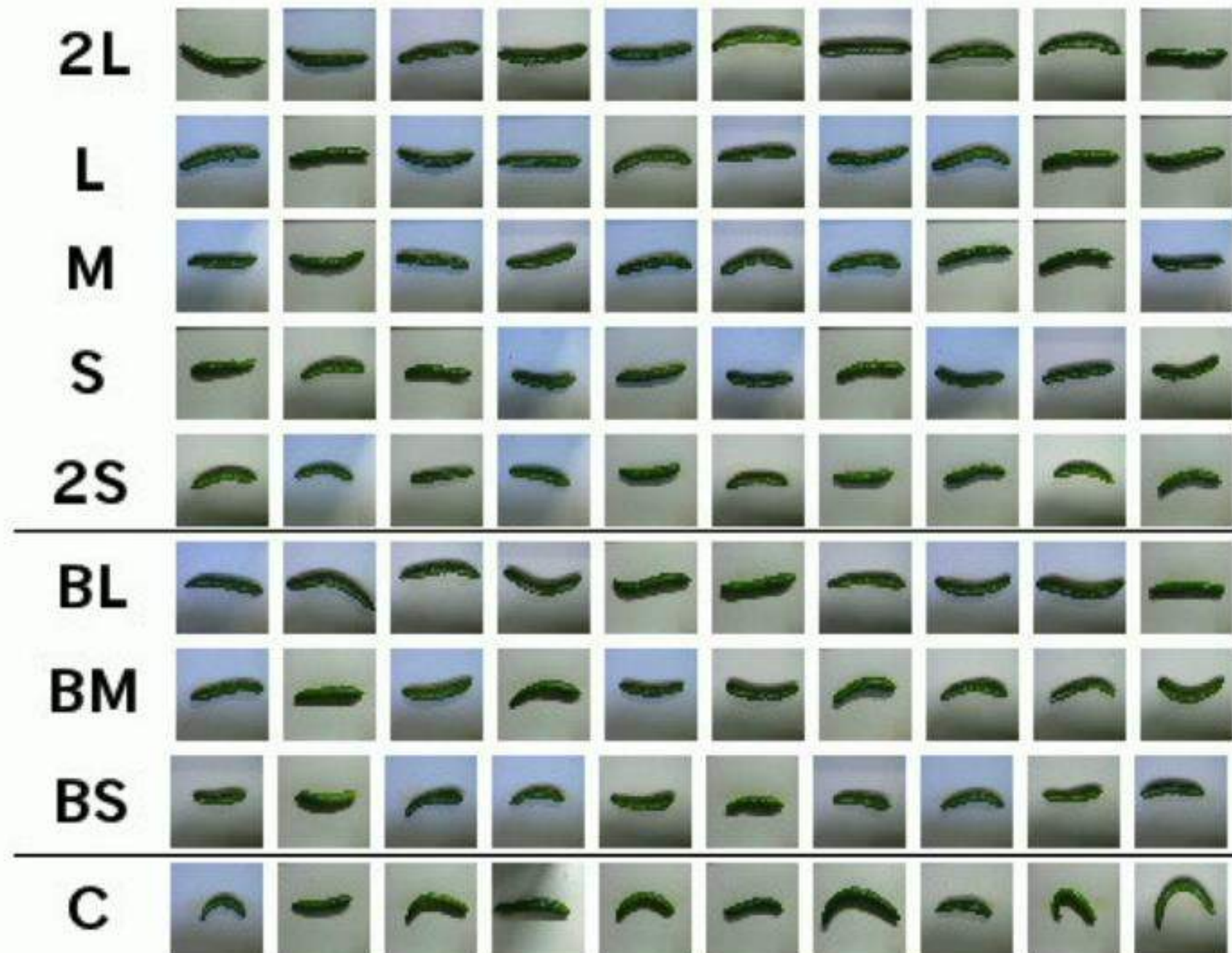




Joel Grus



“I myself only recently learned to sort cucumbers well” – Makoto Kolke



Things I Want to Say

- Here are examples of the nine classes
- The sorting station has electric lights, and also sunlight on some days
- The worst mistake is to classify a C as something else. These are ok to confuse: ...
- Look at not only the size and thickness, but also the color, texture, small scratches, whether or not they are crooked and whether they have prickles
- Prickles and scratches are less important
- This was classified wrong because ...
- Sometimes if the camera is directly above the curve, it makes the curve hard to see
- The background doesn't matter

Things I Don't Want to Have to Say

- There should be 17 convolution layers, then ...
- The learning rate should be ...
- The batch size should be ...
- Use L2 loss ...
- To reduce training time, ignore these features ...

Things I Don't Want to Have to Say

- Augment the training images in the usual ways
- Correct mislabels in the training data
- Correct for minority class distribution skew
- Check for biases in calibration and balance
- Use an existing general-purpose vision model, and transfer that knowledge to my specific data
- Optimize my hyperparameters
- Handle one-shot, few-shot, transfer, semi-supervised learning automatically

PROBABILISTIC PROGRAMMING



The current BayesDB interface is a Python API

```
In [6]: # Load the bayeslite client library
import bayeslite
import bdbcontrib

# Load the satellites snapshot into a local instance of bayeslite
satellites_bdb = bayeslite.bayesdb_open(pathname='satellites.bdb')

# Define a utility procedure to conveniently query satellites_bdb
def q(query_string):
    res = satellites_bdb.execute(query_string)
    return bdbcontrib.cursor_to_df(res)

# Plots will appear automatically
import matplotlib.pyplot as plt
%matplotlib inline
```

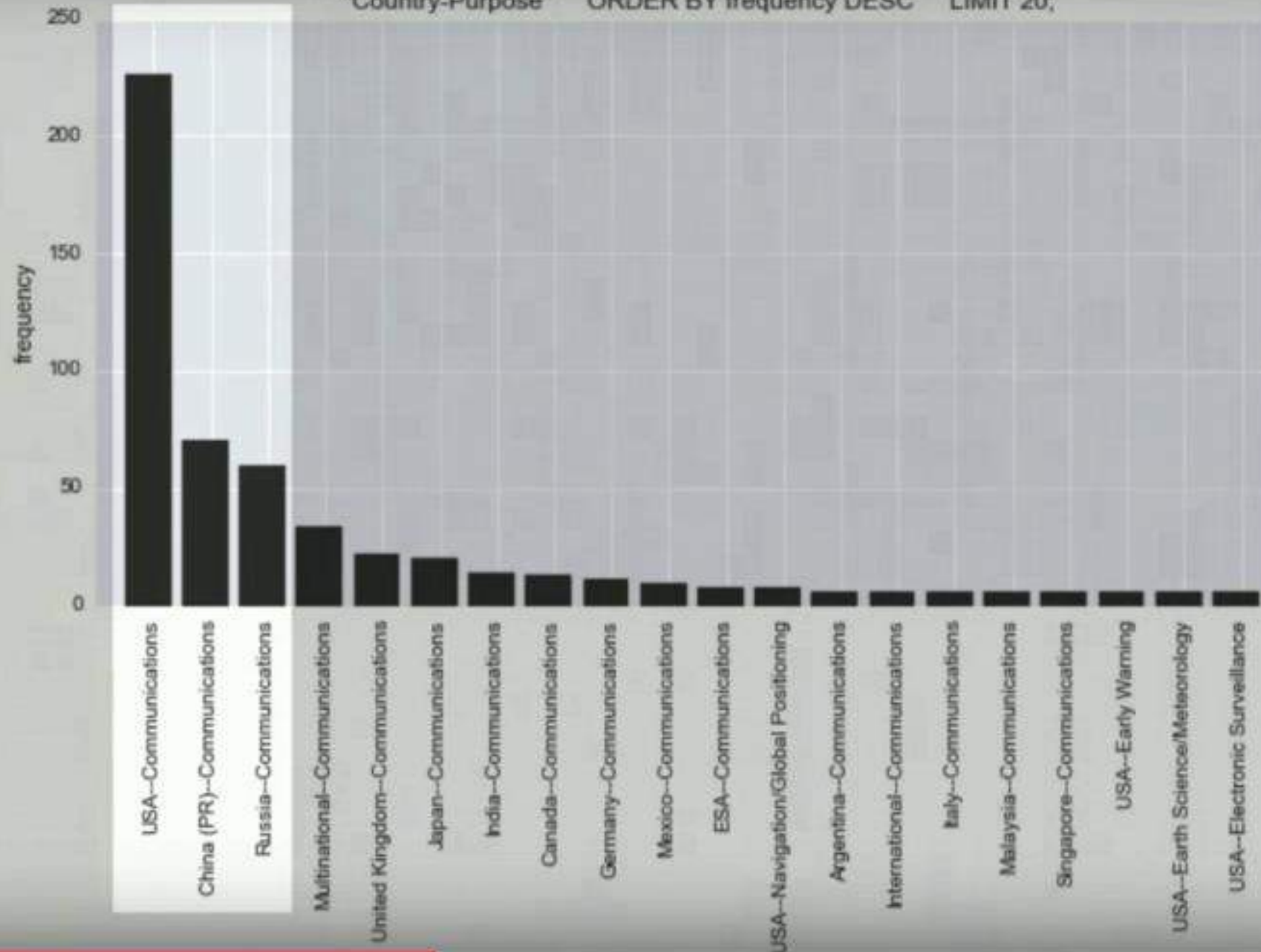
BQL is a probabilistic extension of SQL

```
In [8]: q('''
SELECT * FROM satellites
WHERE Name LIKE 'International Space Station%'
```

MORE VIDEOS ^

BayesDB: Query the Probable Implications of Data

```
SELECT country_of_operator || "--" || purpose AS "Country-Purpose",  
COUNT("Country-Purpose") AS frequency FROM satellite_purpose GROUP BY  
"Country-Purpose" ORDER BY frequency DESC LIMIT 20;
```



MORE VIDEOS ^

2:05 / 5:00

CC HD YouTube

SQL 4 all?

SQL 4 all?

- `select name, email from database where age > 24 and age < 36 and income > 70000`

SQL 4 all?

- `select name, email from database where age > 24 and age < 36 and income > 70000`
- Infer name, age from examples
- But ...
- `select diagnosis, treatment from EMR where id = 123456`

SQL 4 all?

- `select name, email from database where age > 24 and age < 36 and income > 70000`
- Infer name, age from examples
- But ...
- `select diagnosis, treatment from EMR where id = 123456`
- Monte Carlo of local code, with summarization?
- “find treatments with no bad effects that are an approximate cover for the diagnoses”

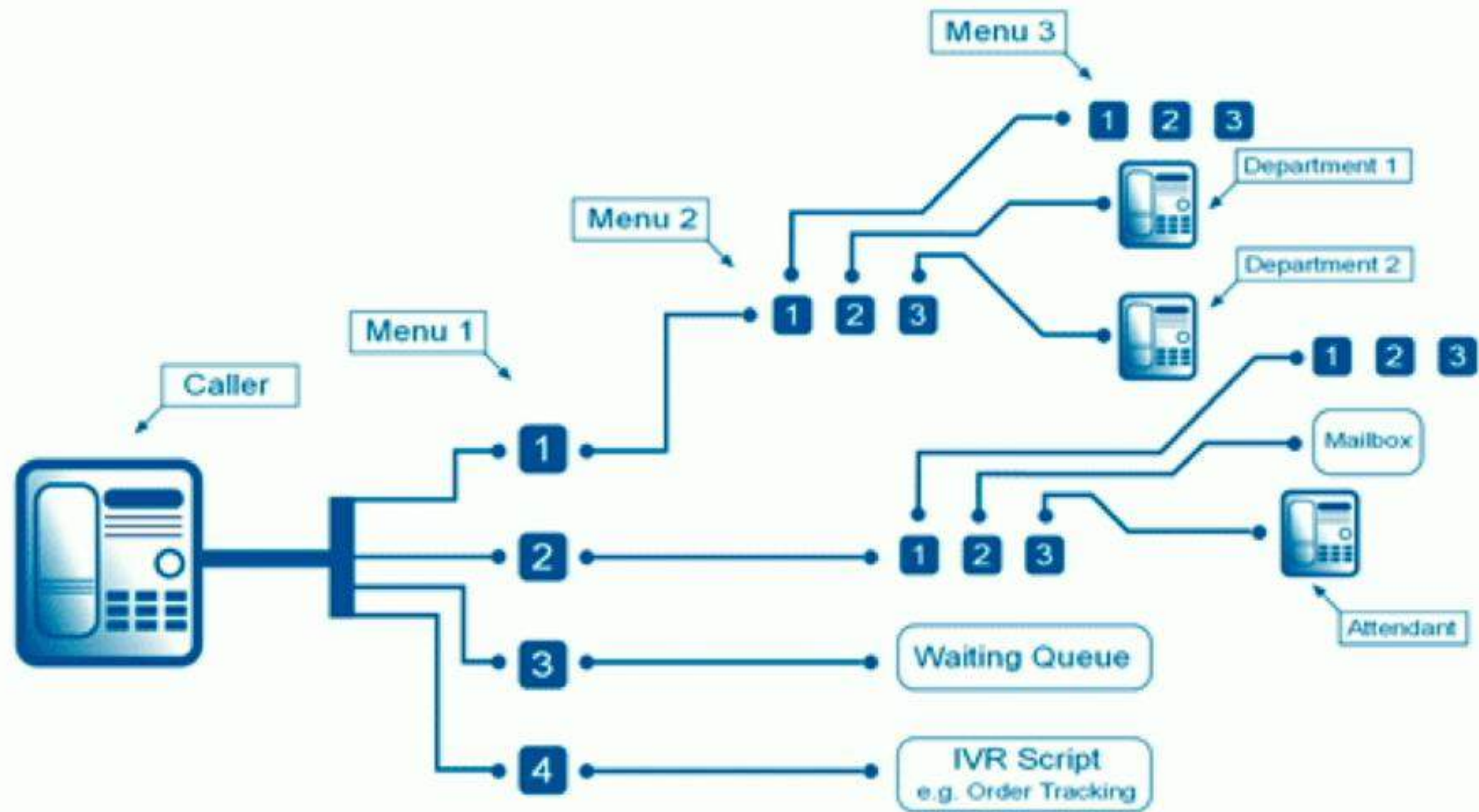
CONVERSATION



How To Create a Voice Menu Your Customers Will Love



DON'T



JOAQUIN
PHOENIX

AMY
ADAMS

ROONEY
MARA

OLIVIA
WILDE

SCARLETT
JOHANSSON

her


A SPIKE JONZE LOVE STORY

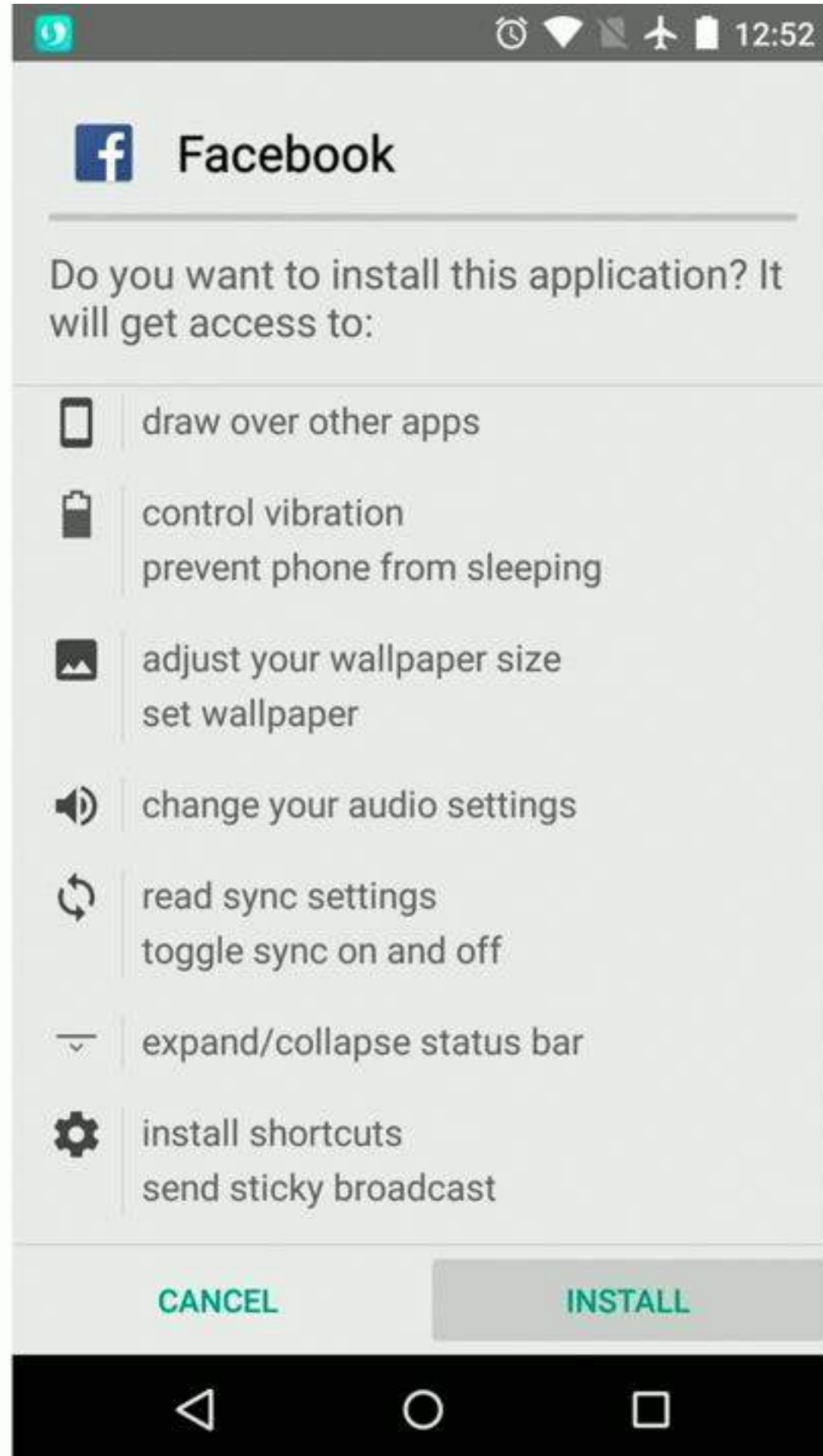




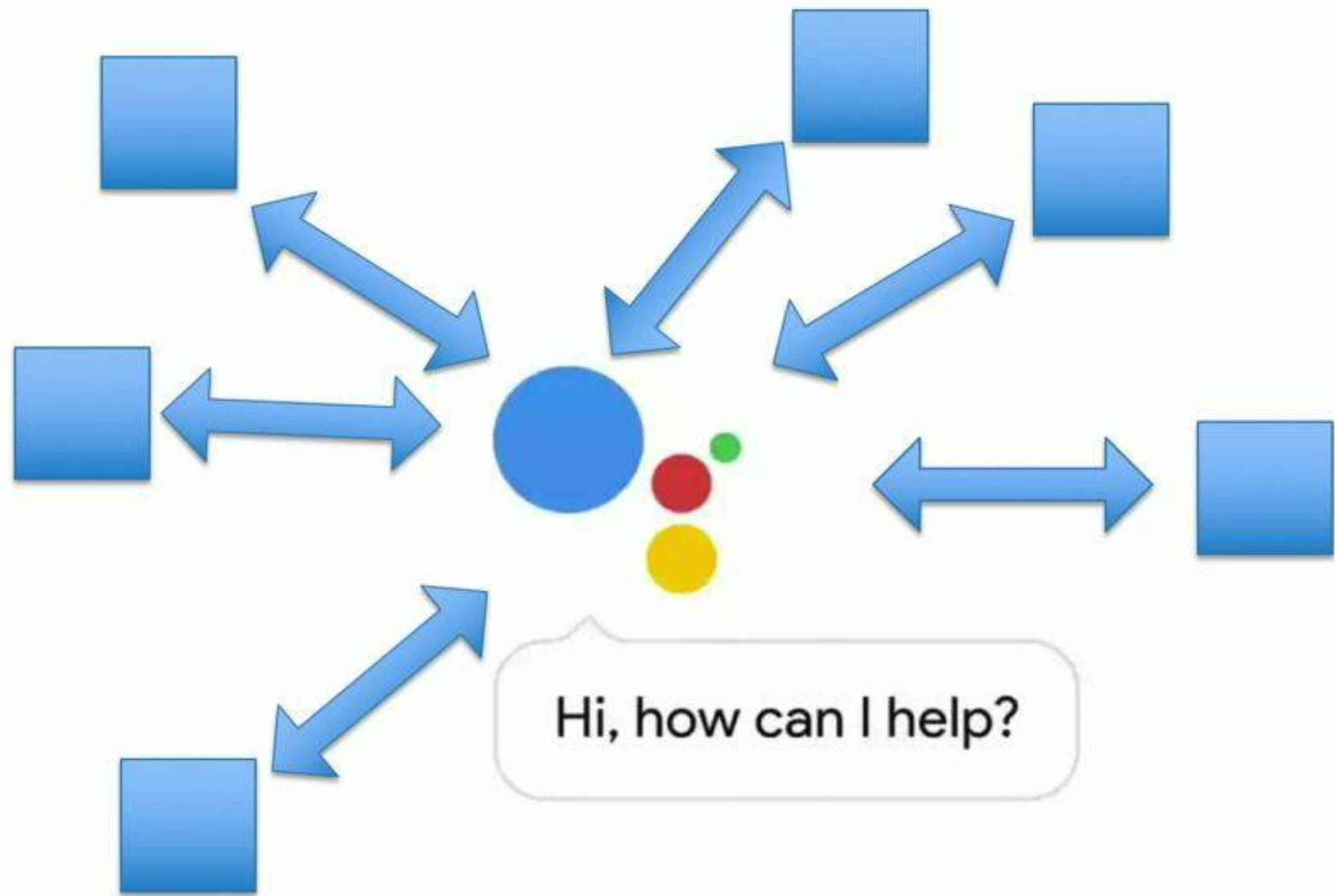


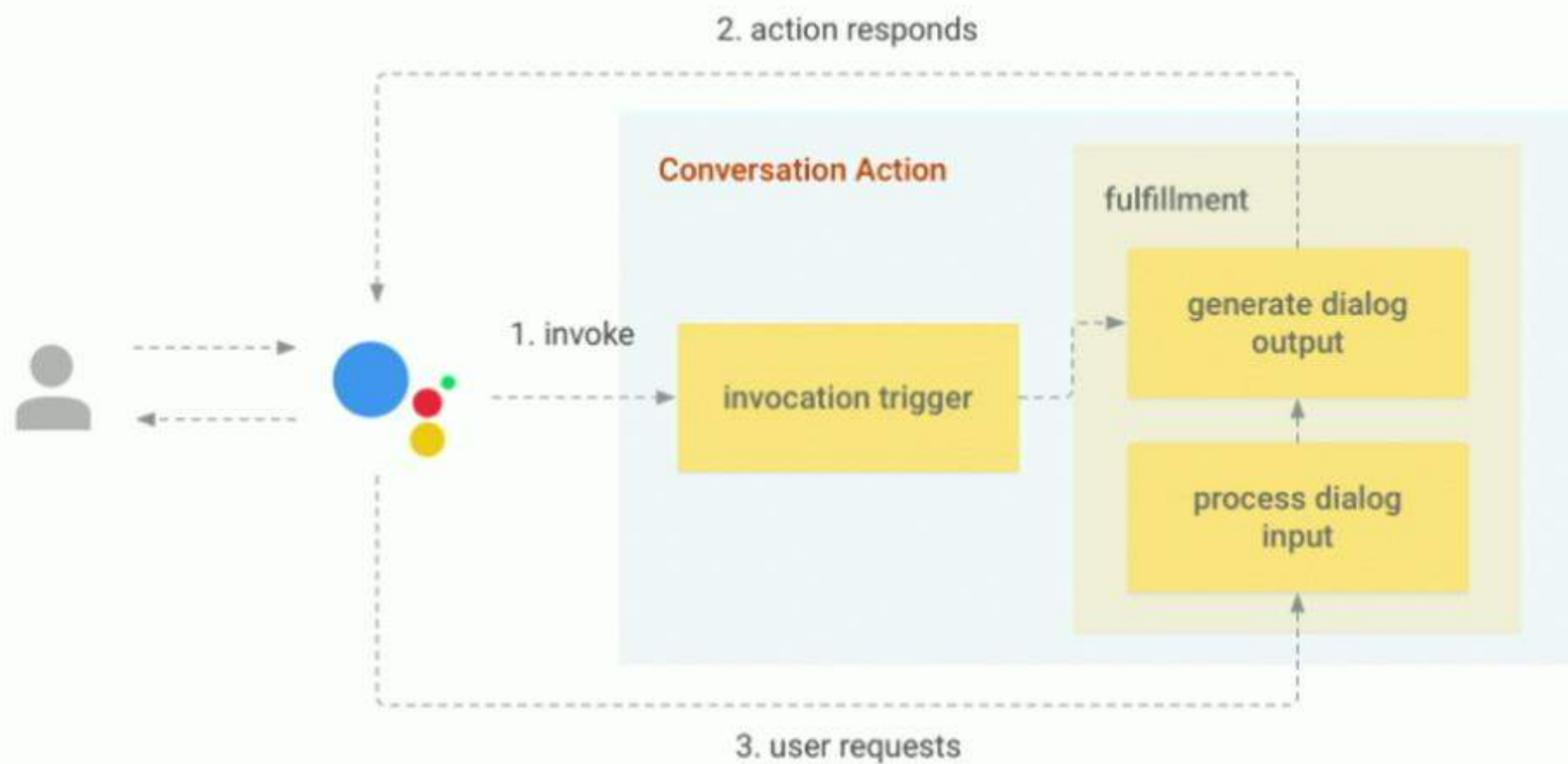
 **ANDROID APP ON**
Google play

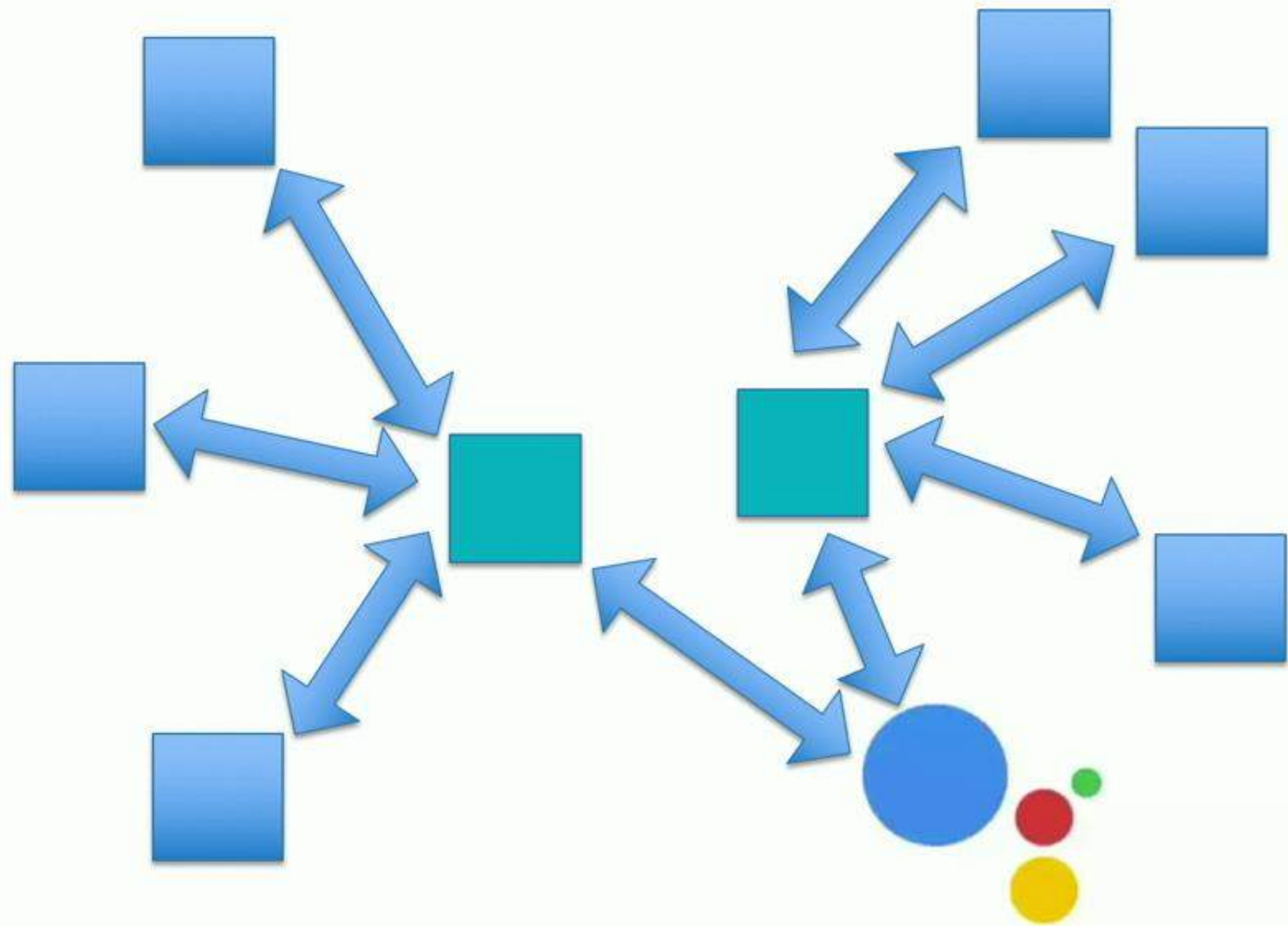
 Available on the
App Store



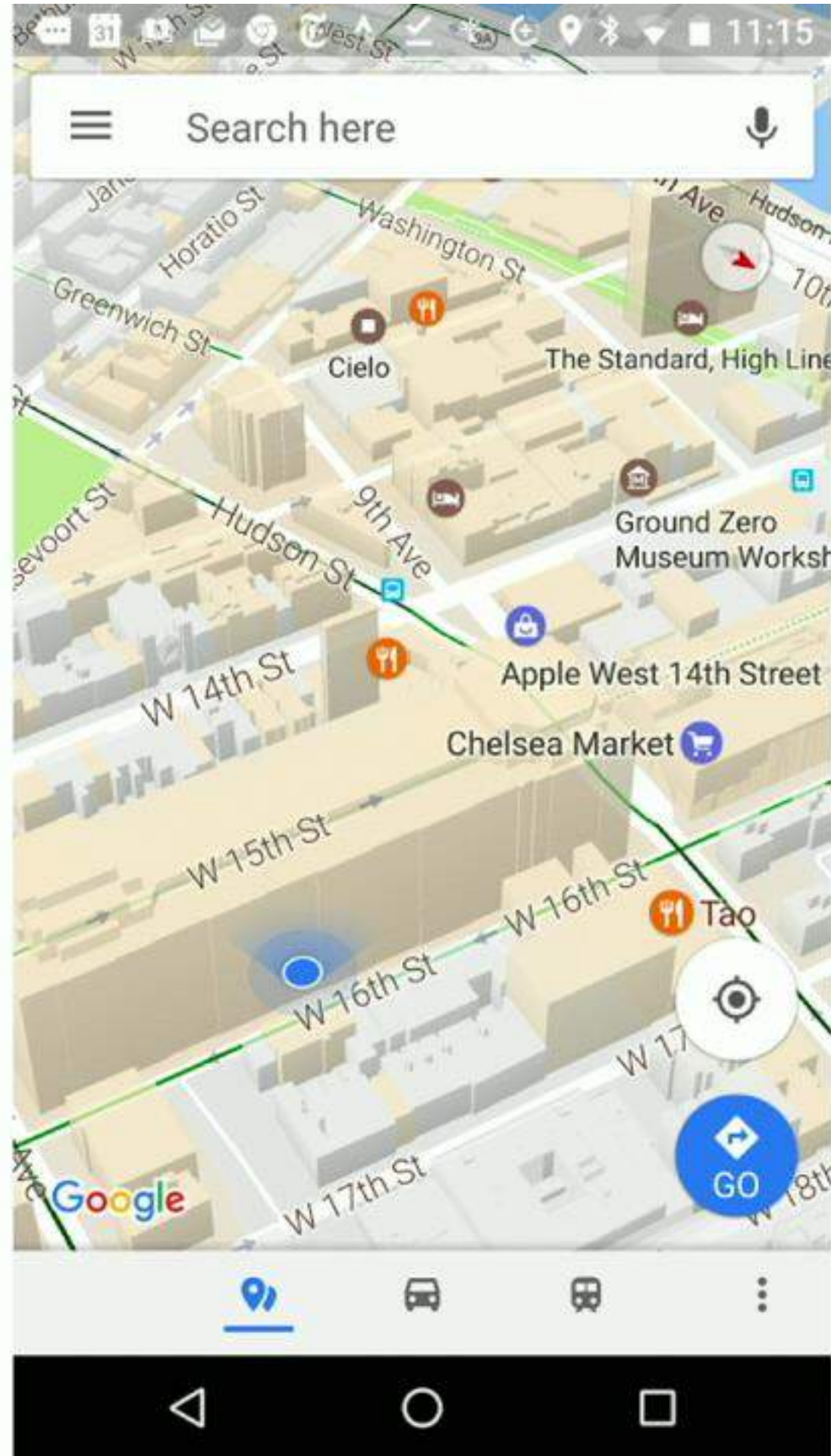
PRIVACY
SECURITY
FAIRNESS
ACCOUNTABILITY
TRANSPARENCY



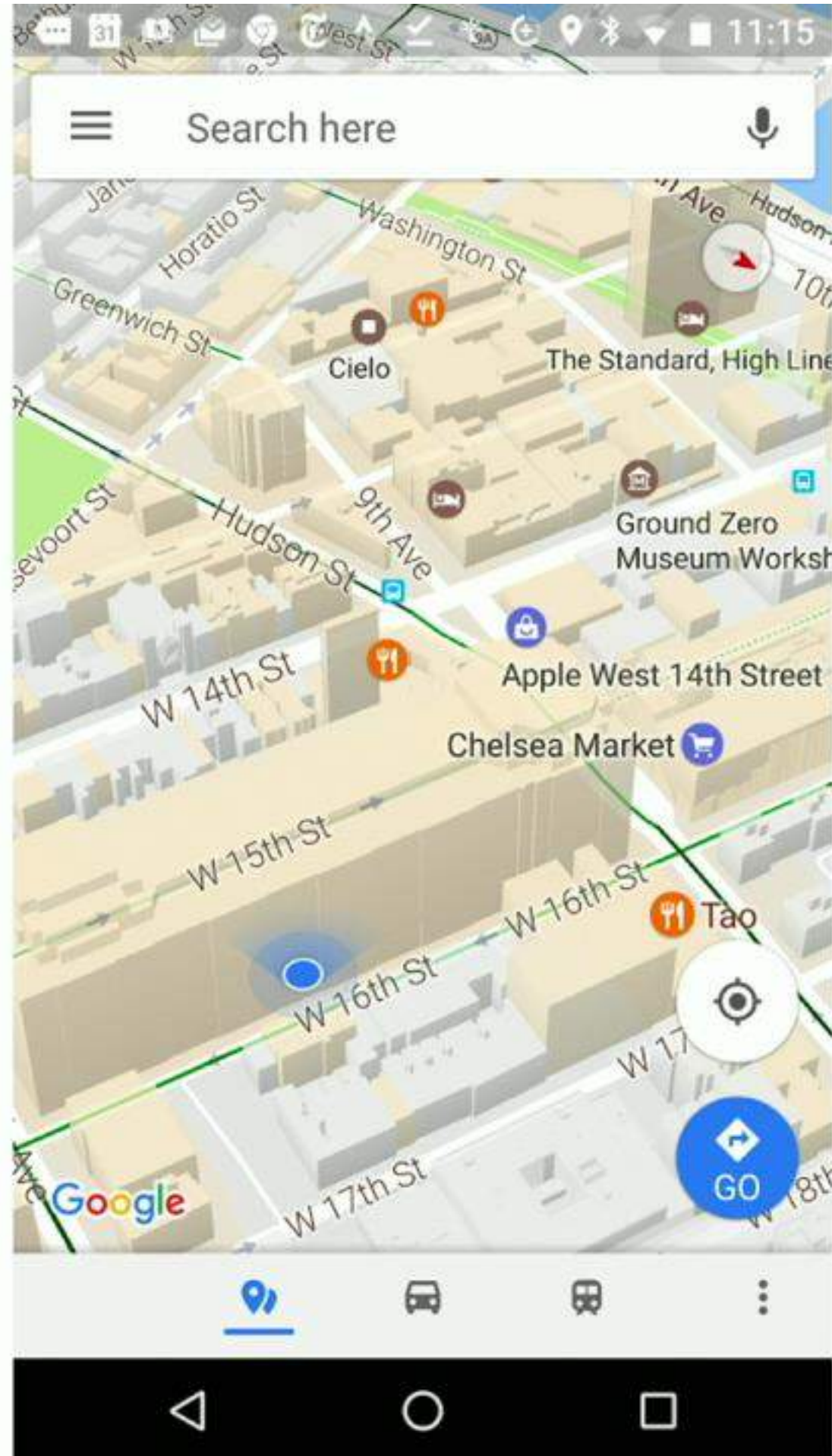




Hi, how can I help?



Scale bar?



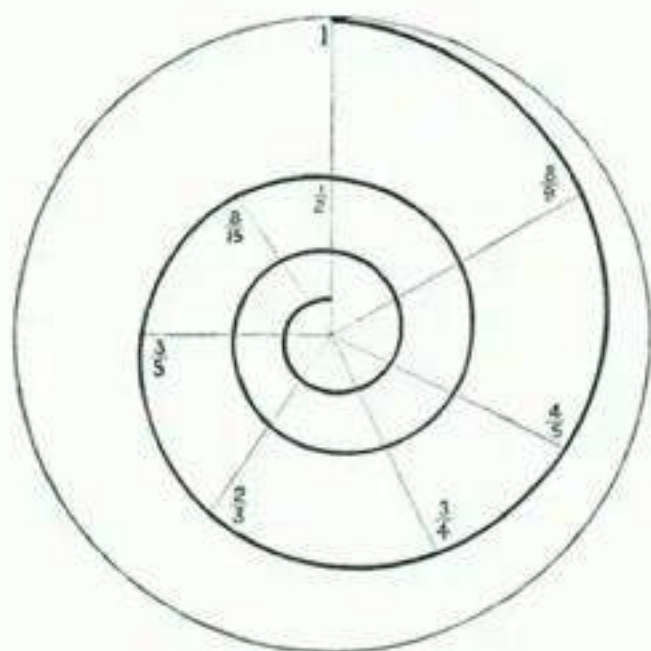
Answer:

- (1) Google
- (2) Stack Overflow
- (3) Root phone
- (4) 200 lines of Java
- (5) 20 lines of config

Scale bar?

Design Document Template

Version X.x • 06 December 2016



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If you have issues, comments, or questions about specific information or procedures, please include the title and, if available, the part number, the revision, the page numbers, and any other details that will help us locate the subject that you are addressing.

Depart now for:

Return Rental Car to Logan Airport
156 Tomahawk Dr,
Boston MA

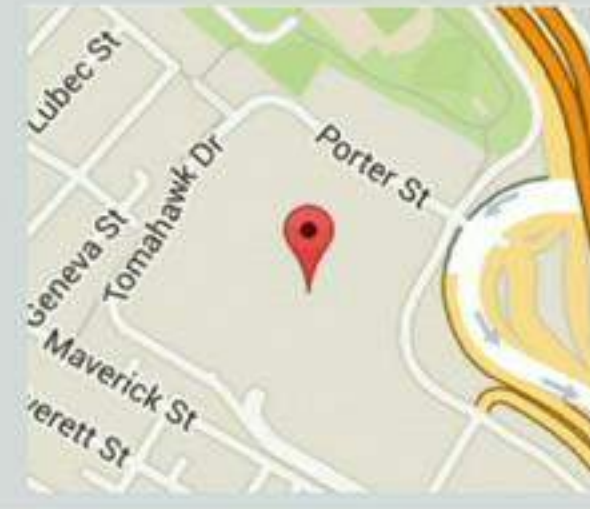


Depart now for:

Return Rental Car to Logan Airport
156 Tomahawk Dr,
Boston MA

Time of travel:

23 minutes by bicycle

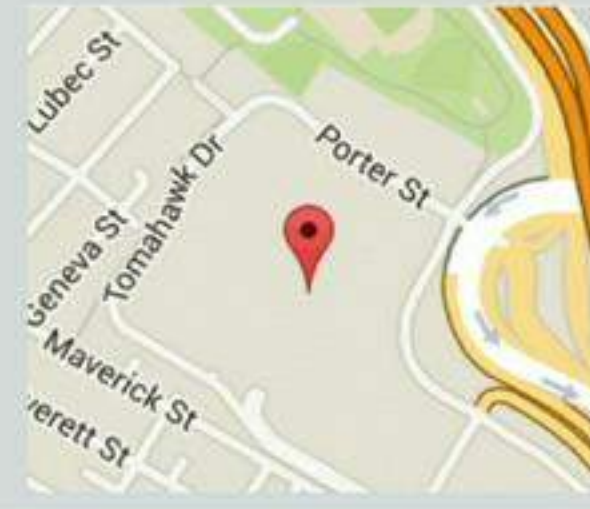


Depart now for:

Return Rental Car to Logan Airport
156 Tomahawk Dr,
Boston MA

Time of travel:

23 minutes by bicycle



```
event = ExtractEvent(email.body)
trip = Travel(current.location, event.location,
              event.time, event.title)
CreateAlert(trip)
```



Name
Email
Zipcode





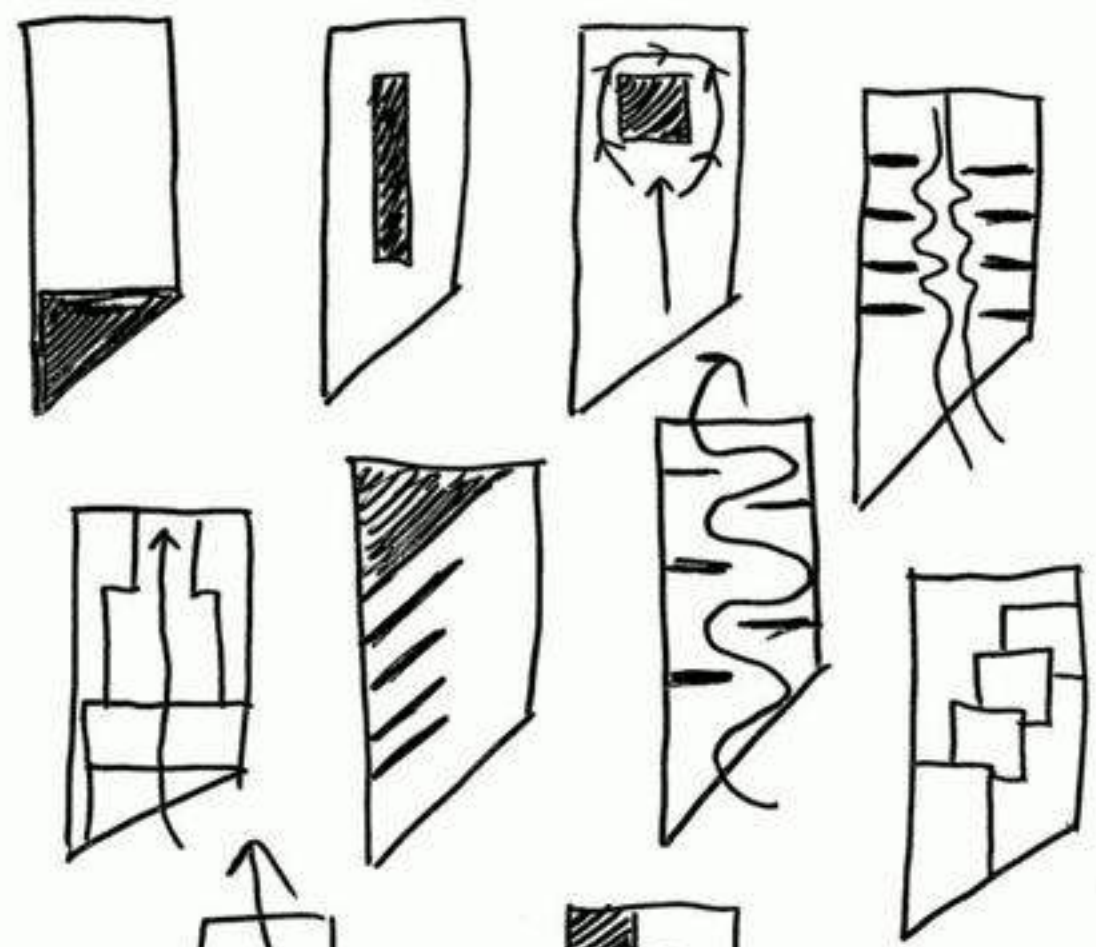
If you have a procedure with 10
parameters, you probably missed
some.

— *Alan Perlis* —



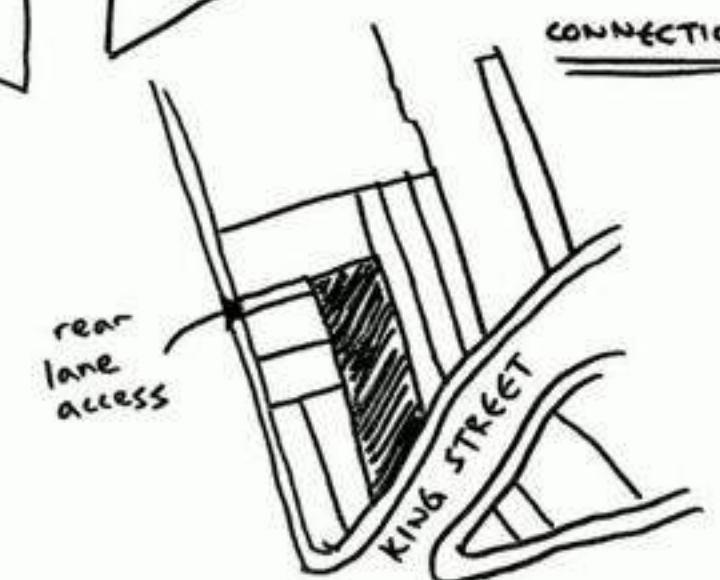


DESIGN THINKING

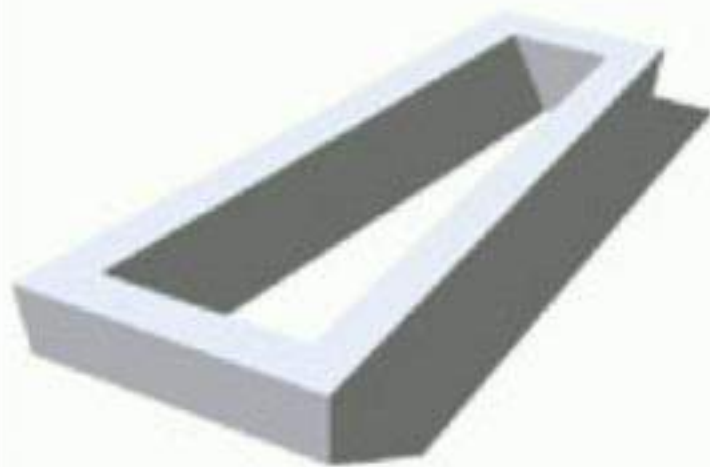


WEAVING
through
space ◊
o

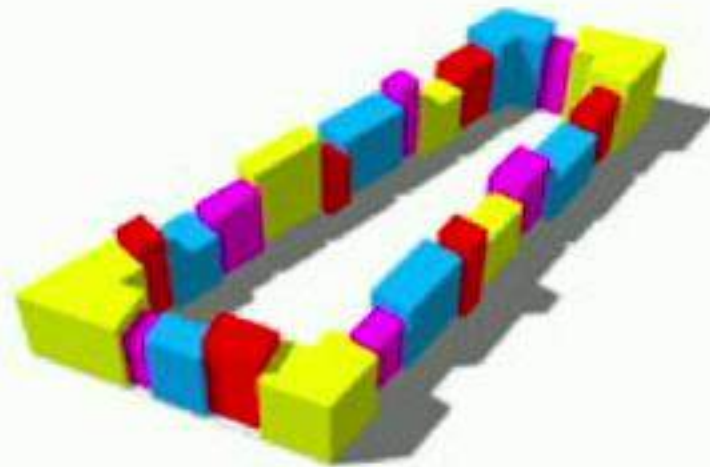
CONNECTION



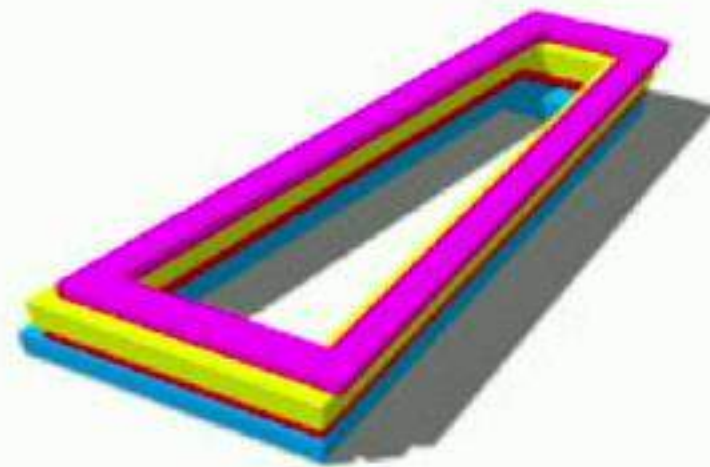
CONCEPTS



Basic Perimeter Block



Wanted: Variety like a city in a building



Layered functions according to needs: commercial first floor, residential above



Master Plan requirement:
Passageway through to Hien Hensens Square
Twist into a bowtie: 2 courtyards defined

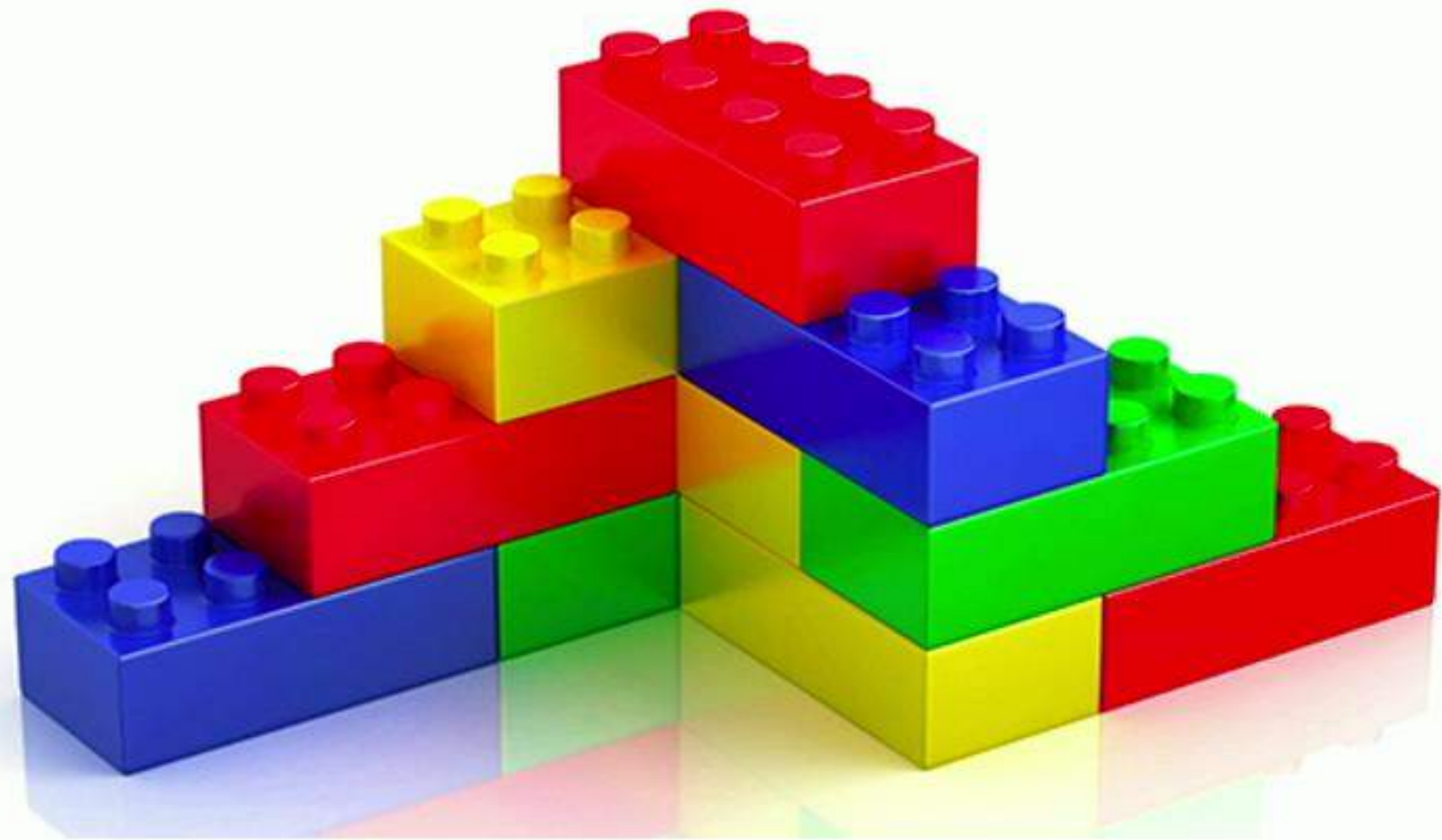


Playing with heights of functions to achieve variety,

Pinching down SE corner : view to nature, reduce solar gain

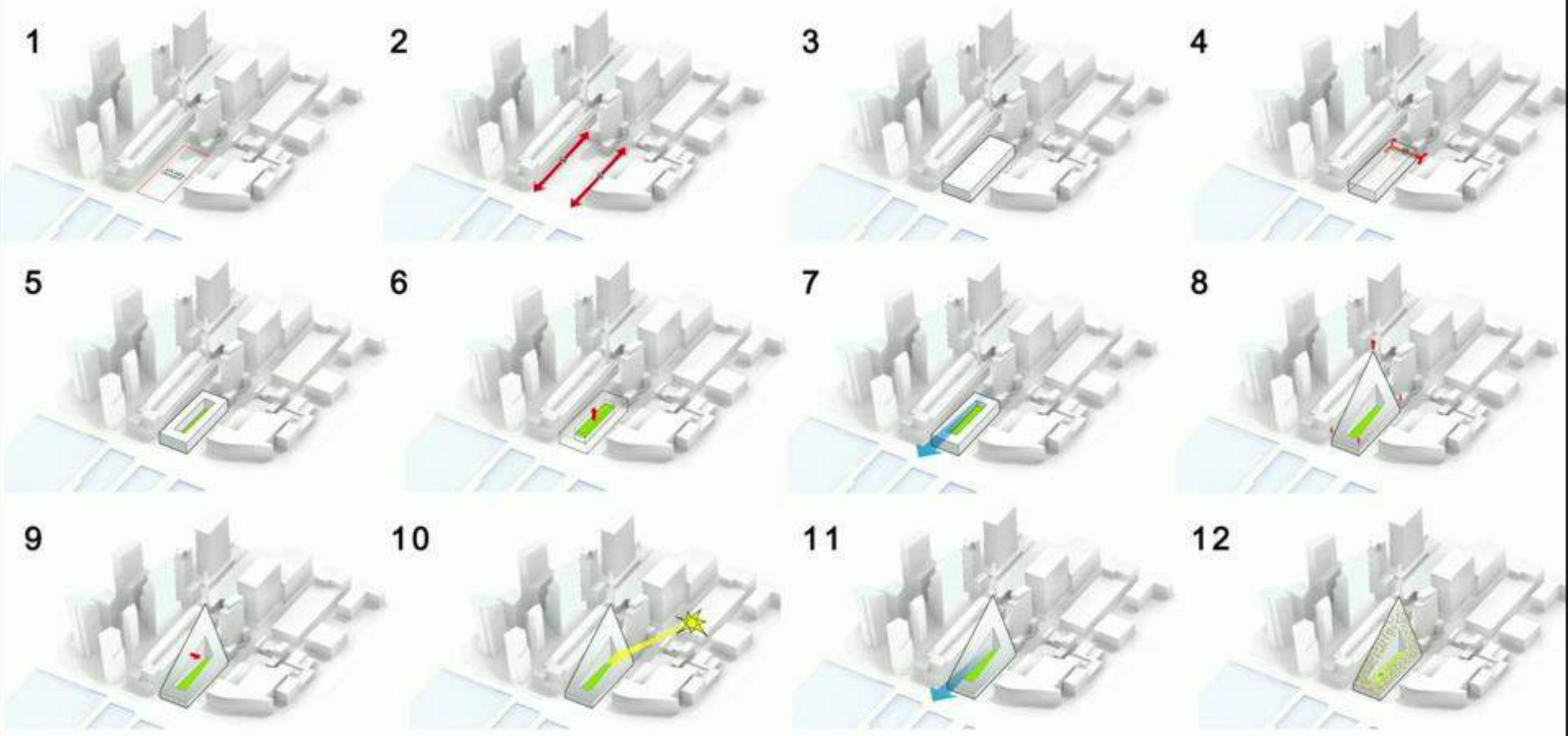


Pulling up NE corner offices: shade loving





Looking East thru courtyard at building collaboration space

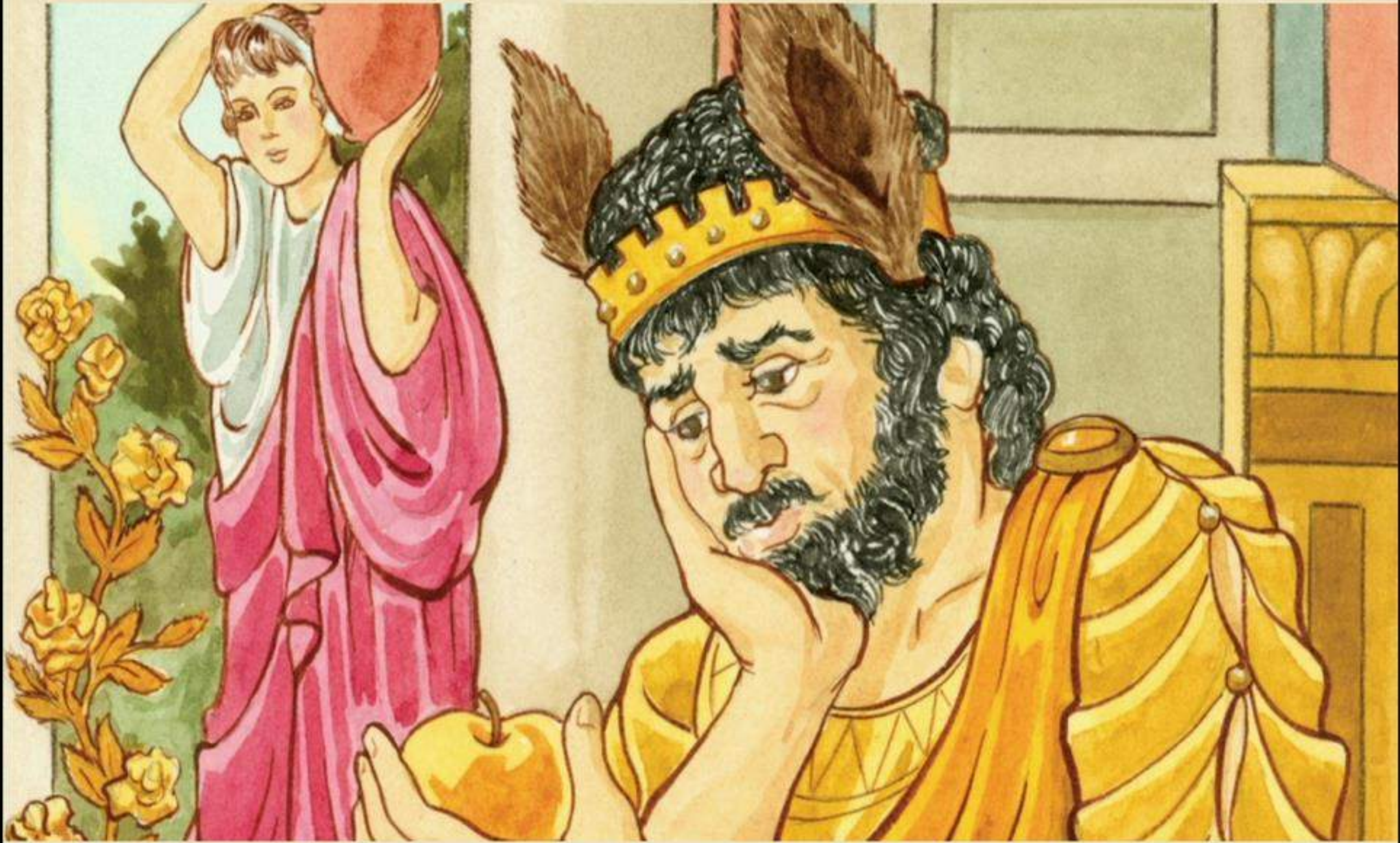


MAY

MAY
POSSIBILITIES
PREFERENCE
UTILITY
DESIRE
NEED
WANT

Tell me what you want
What you really really want





YOU HAVE THREE WISHES.
THE ONLY RULE IS YOU CAN'T
WISH FOR MORE WISHES.



I WISH THAT EACH WISH
BE CONSIDERED
SEPARATELY.

OKAY.



I WISH THAT WISHES
BE CALCULATED IN
ABSOLUTE VALUE.

I...
DON'T
SEE WHY
NOT...



I WISH FOR A THOUSAND
FEWER WISHES.





THIS IS
ONE REASON
WHY.

THIS IS WHY NO ONE LIKES
MATHEMATICIANS.

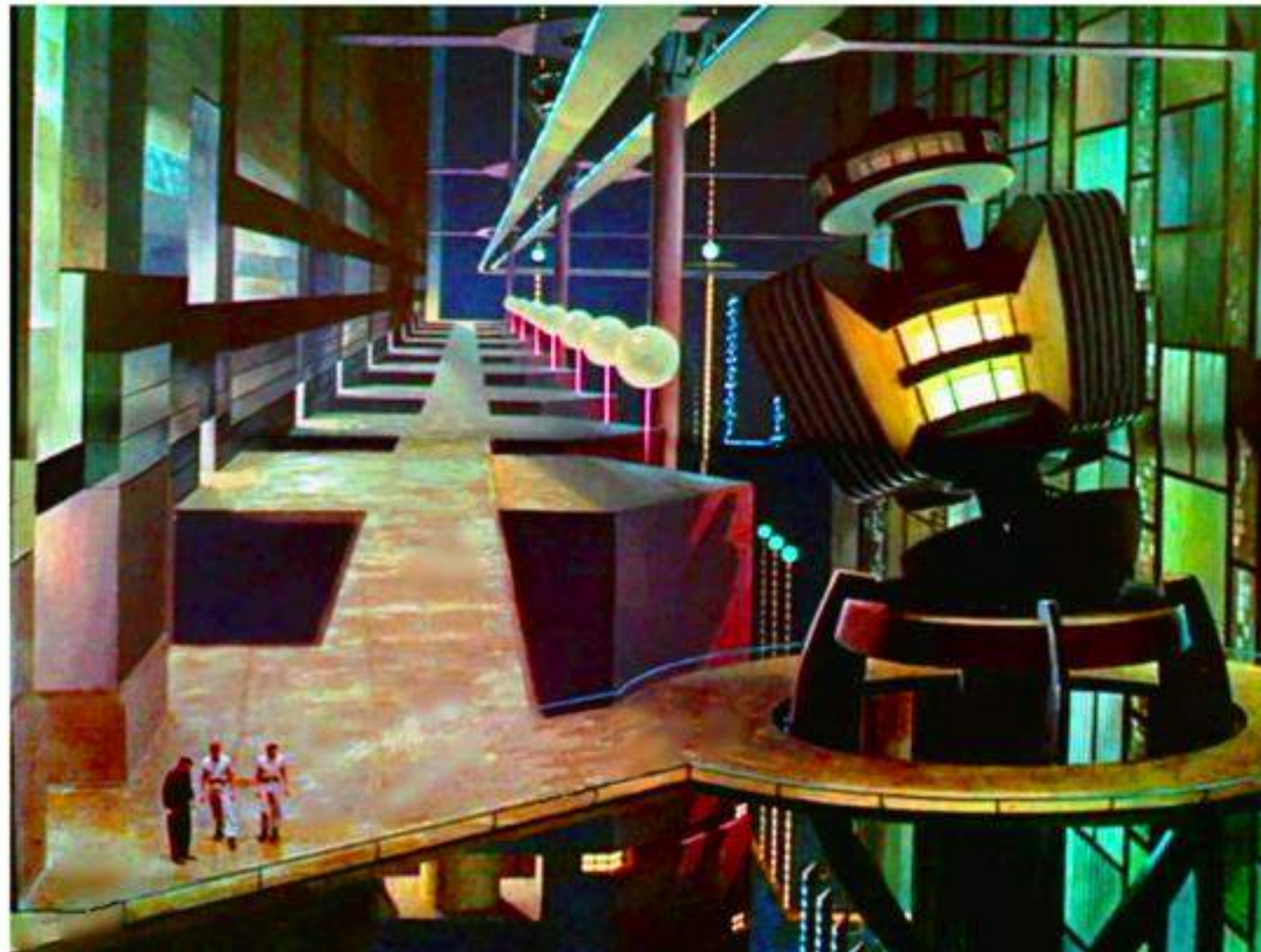
Last Tweets of the Krell



Peter Norvig [Follow](#)

Mar 31, 2017 · 5 min read

Many readers are no doubt familiar with *Forbidden Planet*, the documentary film about the *Krell* civilization, which came to an unfortunate end just at the launch of what could have been their biggest achievement. Ever since the film's release in 1956, xenoanthropologists have been stymied by a lack of source material on the Krell.



Bug Fixes for Midas / Genie / Krell

- Specify an “undo” function
- Do some simulations first
- Then do small-scale tests
- Do adversarial tests / red teams
- Monitor tests and deployments
- Have ability to shut down or roll back
- Specify a prompt for unsafe actions
- Continuous evolution and improvement
- Don't over-rely on language: case law

~~**MICROMANAGER**~~

RESEARCHER?

TEACHER?

LEADER?

PHILOSOPHER?

POET?

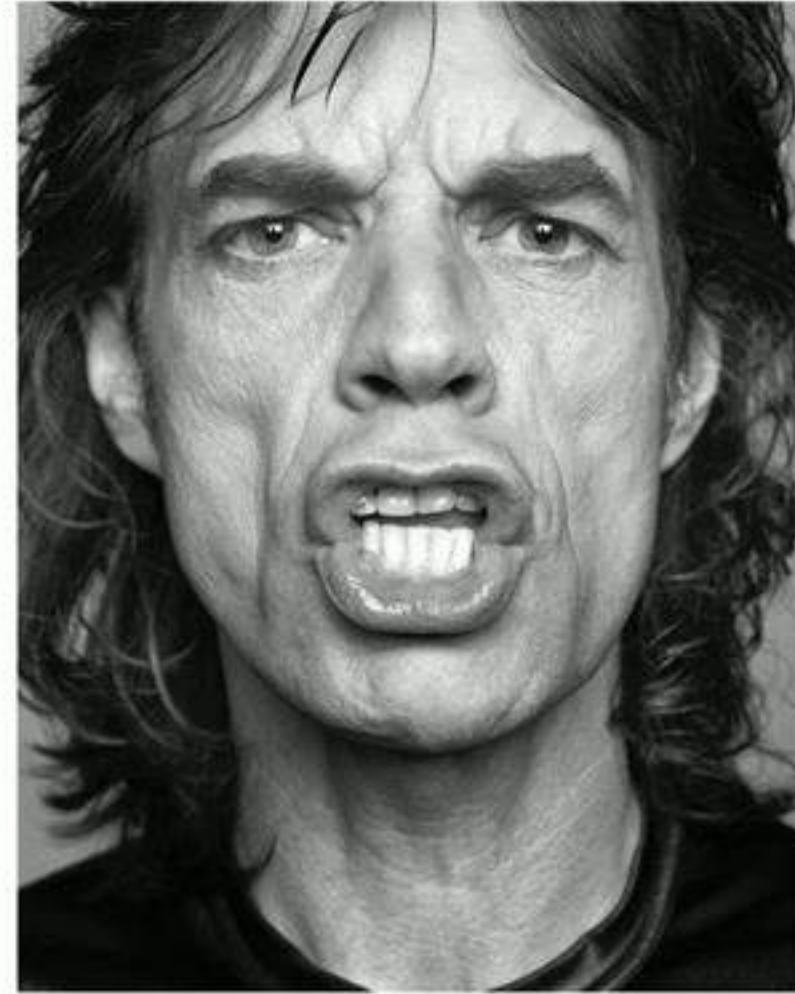
LEADER



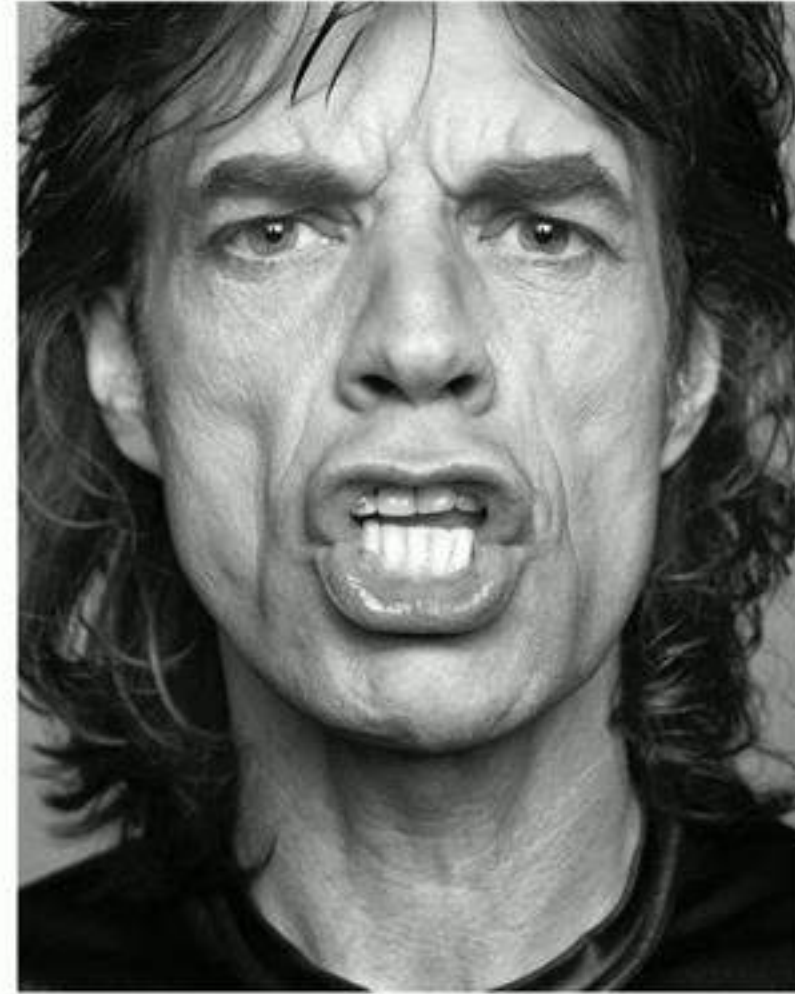
Don't tell people **how** to do things,
tell them **what** to do, and let them
surprise you with their results.

– Gen. George Patton

PHILOSOPHER / POET



PHILOSOPHER / POET

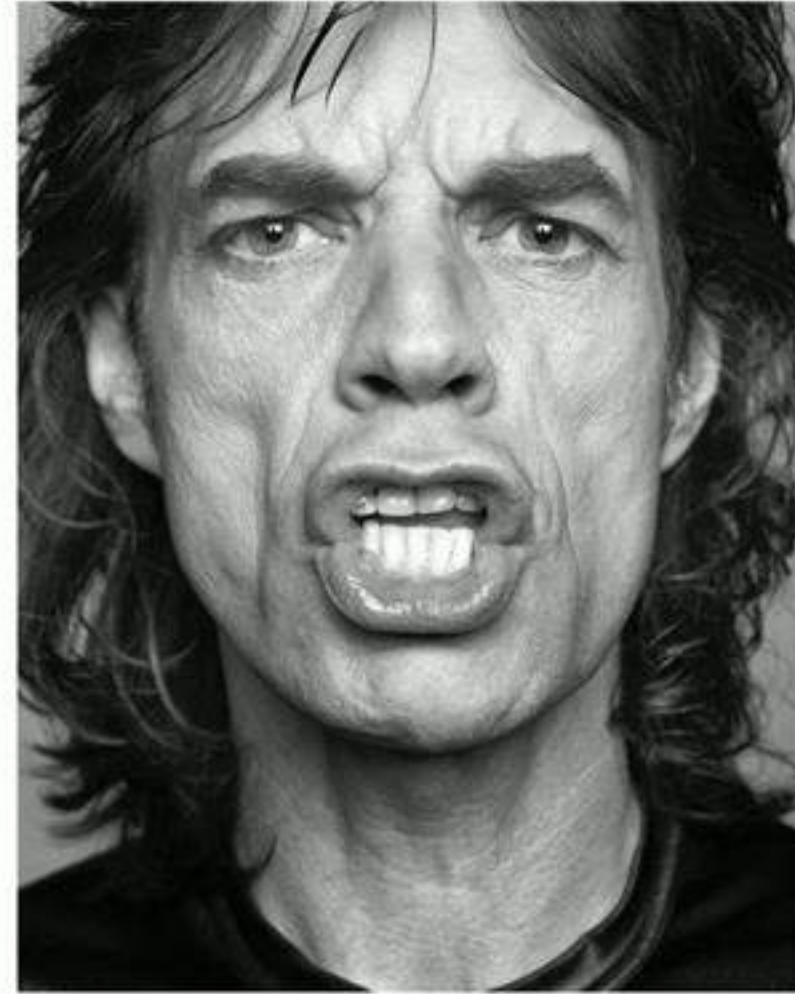


You can't always get what
you **want**, but ... you get
what you **need**.

PHILOSOPHER / POET



Your debutante just knows what you **need**, but I know what you **want**.



You can't always get what you **want**, but ... you get what you **need**.



NEED



NEED



WANT

MARKETPLACE



Commons are not Tragedies



Elinor Ostrom

- **Clear definition**
- **Adapted to local conditions**
- **Collective-choice**
- **Effective monitoring**
- **Sanctions**
- **Conflict resolution**
- **Self-determination**
- **Hierarchical control**

MARKETPLACE



