Visual graphics: Principles, vectorization and animation

1 author:

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Tongji University

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viz101

Visual Graphics
Principles, Vectorization and Animation

Guoyang Qin
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What is Graphic Design?

about
Art & Techniques
Taste & Rules
Beauty & Functionality
Me & Audience

A. Graphic Design Rules of thumb

Outlines

C.R.A.P.
#1 Contrast #2 Repetition #3 Alignment #4 Proximity

based on *The Non-designer's Design Book* by Robin Williams

#1 Contrast

✓ Contrast is one of the most effective ways to add visual interest to your page—a striking interest that makes a reader want to look at the page—and to create an organizational hierarchy among different elements.

✓ Contrast is created when two elements are different.

✓ If the two elements are sort of different, but not really, then you don't have contrast, you have conflict.

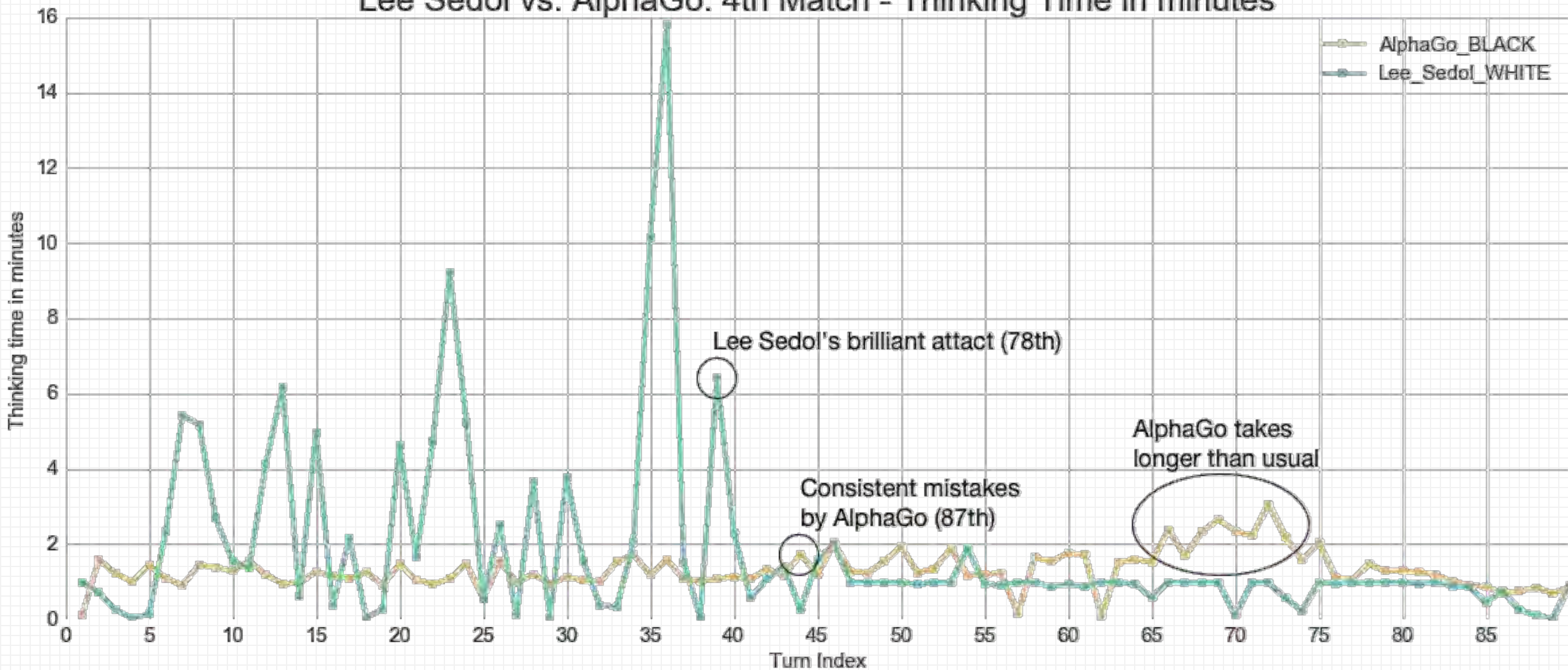✓ If two items are not exactly the same, then make them different. Really different.
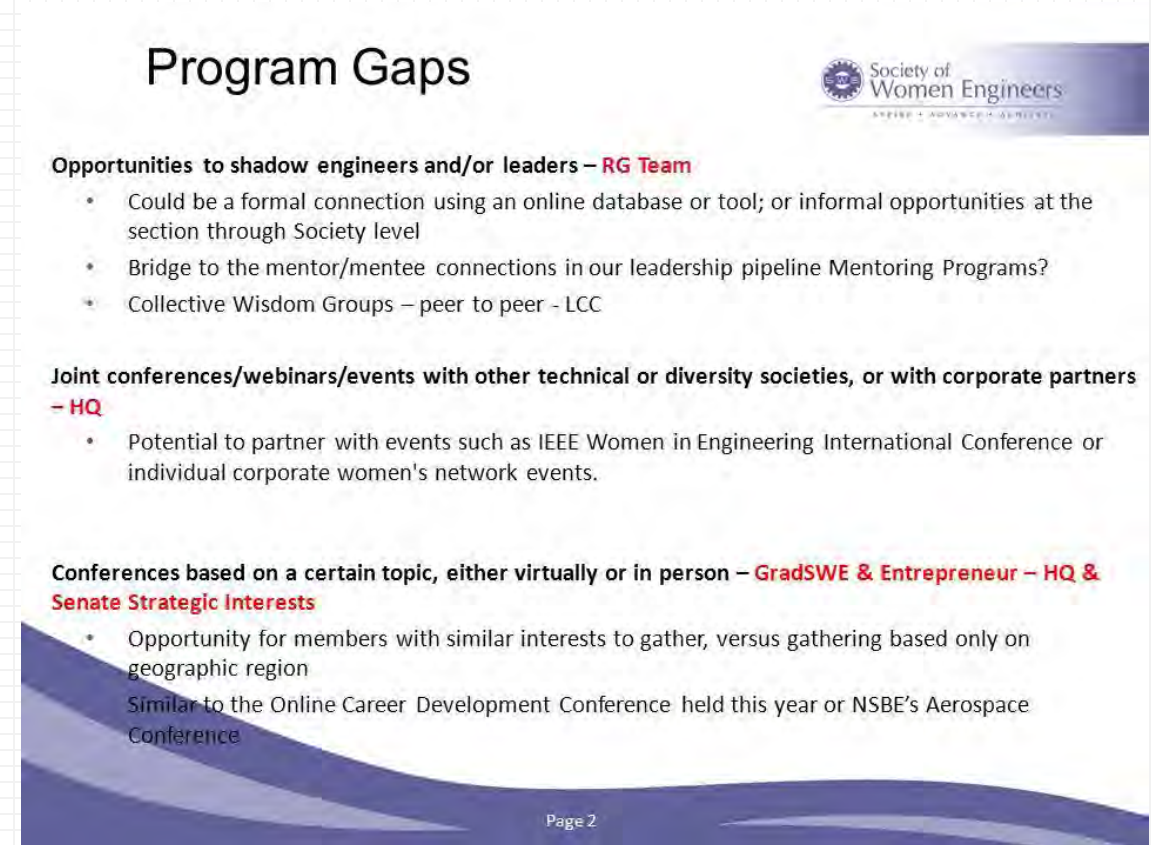
A Man Feeding Swans in the Snow ©Marcin Ryczek

A380 VS A318 @Annie55917614

Lee Sedol vs. AlphaGo: 4th Match – Thinking Time in minutes

#1 Contrast

How to create contrast?
a) Colors
b) Scale and Size
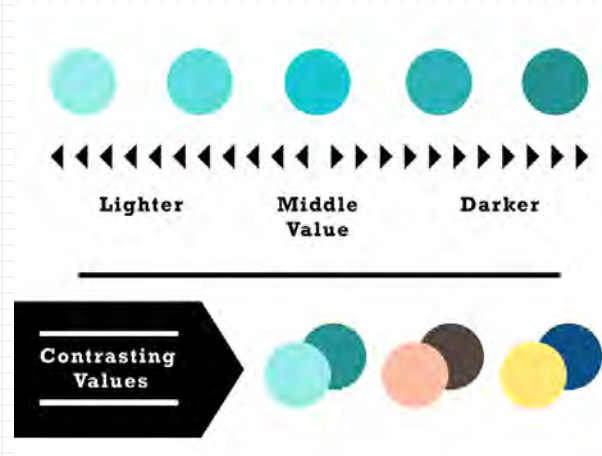c) Visual weight
d) Font combination
e) Textures
f) Spaces

Sample

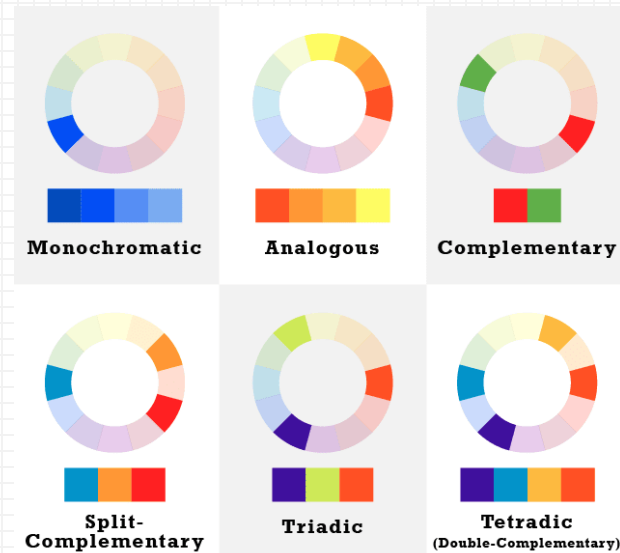## #1 Contrast

a) colors

Contrast with dark and light colors

Contrast with color hue

#1 Contrast

a) colors

Contrast with color temperature
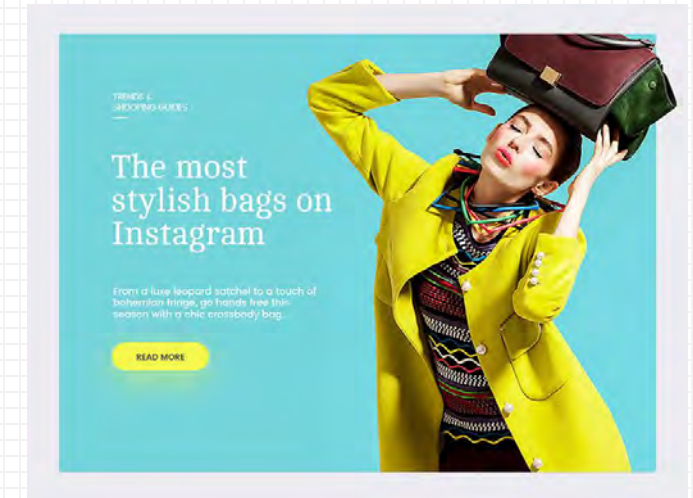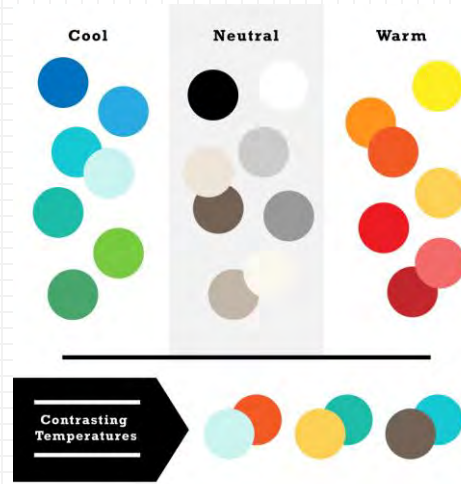
Contrast with color intensity
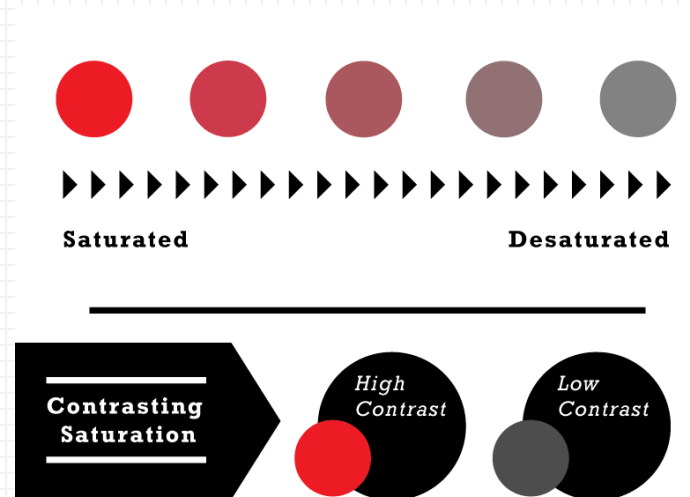
#1 Contrast

b) scale and size
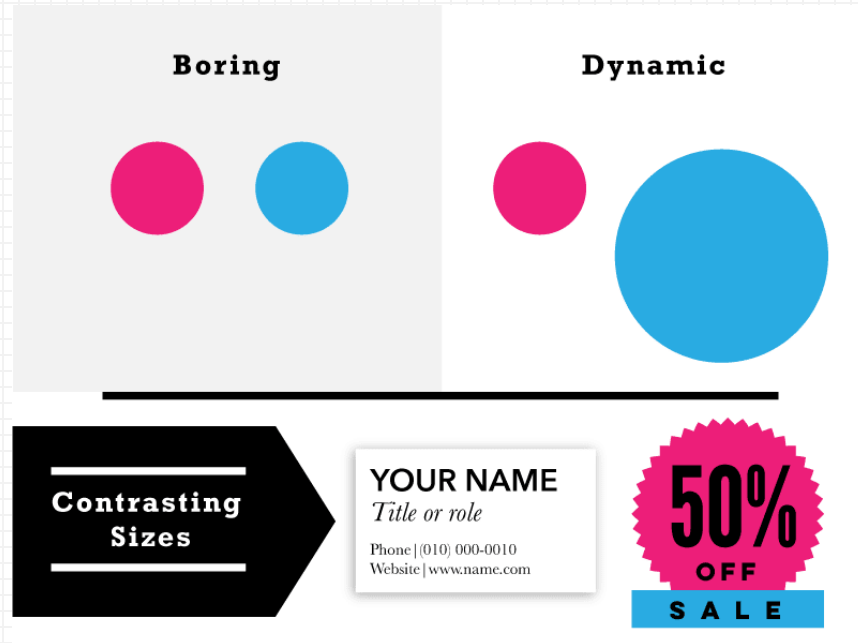
#1 Contrast

c) visual weight

#1 Contrast

d) font combination

Serif — **Times New Roman**

A serif is a small decorative flourish on the end of the strokes that make up letters and symbols.

Sans Serif — **Arial**

Sans Serif fonts do not have any flourishes at the end of strokes.

Monospaced — **Courier New**

Monospaced fonts, letters, and characters each occupy the same amount of horizontal space.

Three common families of typefaces

#1 Contrast

d) font combination

| B | I | U |
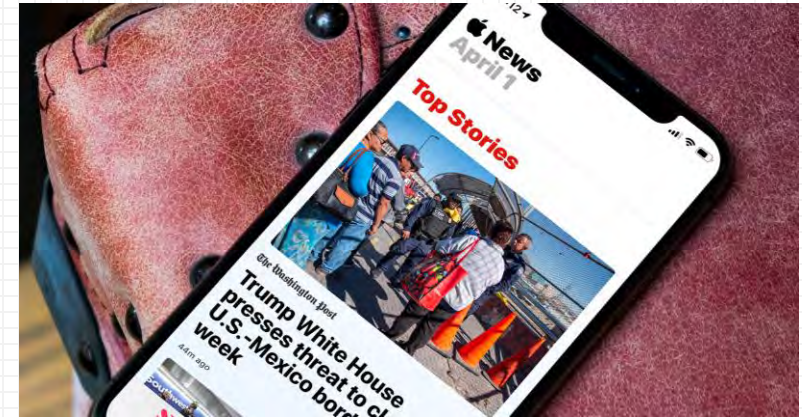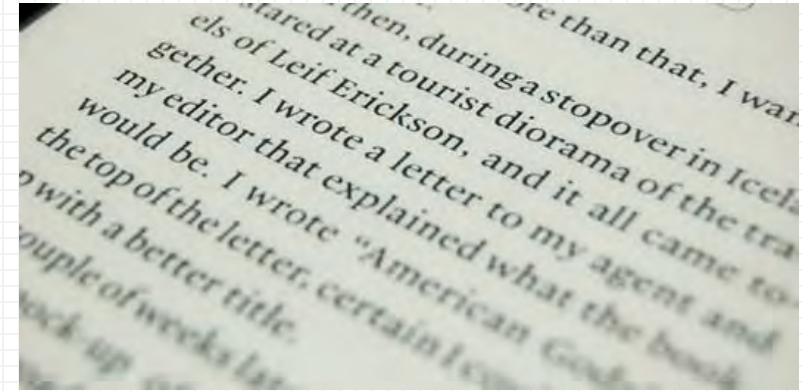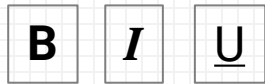
Font weights and styles

Minion Pro

afeunyi

Minion Pro Faux Italic

afeunyi

Minion Pro Italic

afeunyi

This is some regular text.
This is some **fake bold** text.
This is some **fake bolder** text.
This is some **fake boldest** text.

思源宋体 思源宋體 源ノ明朝 본명조
Source Han Serif

	简体中文 Simplifiled Chinese	繁體中文 Traditional Chinese	日本語 Japanese	한국어 Korean
Extra Light	赵钱孙李	金魏陶姜	鳥啼く声す	키스의고
Light	周吴郑王	戚謝鄒喻	夢覚ませ	유조건은
Regular	冯陈褚卫	柏水竇章	見よ明け渡る	입술끼리
Medium	蒋沈韩杨	雲蘇潘葛	東を	만나야하
Semi Bold	朱秦尤许	奚范彭郎	空色映えて	고특별한
Bold	何吕施张	魯韋昌馬	沖つ辺に	기술은필
Heavy	孔曹严华	苗鳳花方	帆船群れゐぬ	요치않다

Source Sans Pro

Regular	**Bold**	*Light Italic*
ExtraLight	**Black**	*Semibold Italic*
Light	*Italic*	**Bold Italic**
Semibold	*ExtraLight Italic*	**Black Italic**

#1 Contrast

d) font combination

#1 Contrast

e) textures

#1 Contrast

f) spaces

**Too Little
White Space**

BIG HEADLINE
Interesting subheadline

Author Name

Lorem ipsum dolor sit amet, ullum inermis ad mel, sumo appellantur sit an, et ullum ceteros hendrerit cum.

Clita feugiat omnesque an mei, debitis vocibus cu pri. Ius ornatus neglegentur ad, ei qui reque nominavi, no eius complectitur eam.

Postea vocent maiorum eu vim. Eius comprehensam nam ea, adipiscing mod-

**Good
Spacing & Margins**

BIG HEADLINE
Interesting subheadline

Author Name

Lorem ipsum dolor sit amet, ullum inermis ad mel, sumo appellantur sit an, et ullum ceteros hendrerit cum.

Clita feugiat omnesque an mei, debitis vocibus cu pri. Ius ornatus neglegentur ad, nominavi, no eius.

#1 Contrast

EXAMPLE 1

Lorem ipsum dolor sit amet, consectetur adipiscing elit.
- ✓ **Nam posuere malesuada turpis blandit scelerisque.**
  - • *Nunc gravida a velit eget ornare. Donec condimentum aliquet lorem eget consequat. Ut vel ipsum dolor. Morbi pretium ipsum at ipsum vulputate lacinia.*
- ✓ **Praesent congue est lacus.**
  - • *Nunc lectus arcu, congue sed varius quis, suscipit ut metus. Vivamus placerat odio vitae gravida varius.*
- ✓ **Nulla eu sem ligula. Morbi ac molestie enim.**
  - • *Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Suspendisse at dui quis massa laoreet euismod. Donec vitae mollis felis, sit amet bibendum turpis.*

Praesent ultricies fermentum finibus.
- ✓ **Integer elit ipsum, auctor in elit sit amet, ultricies interdum elit.**
  - • *Etiam libero lacus, sagittis et maximus eu, vulputate auctor dolor. Praesent porta, odio nec finibus imperdiet, neque mi porttitor augue, at malesuada tortor nisi ut elit.*
- ✓ **Sed porta est quis diam pellentesque dignissim.**
  - • *Aliquam erat volutpat. Fusce et sollicitudin leo, quis eleifend mi. Fusce vehicula, mi nec mattis vulputate, ligula sapien eleifend enim, eget blandit libero ex non sem.*

#1 Contrast

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

- ✓ Nam posuere malesuada turpis blandit scelerisque.
  Nunc gravida a velit eget ornare. Donec condimentum aliquet lorem eget consequat. Ut vel ipsum dolor. Morbi pretium ipsum at ipsum vulputate lacinia.

- ✓ Praesent congue est lacus.
  Nunc lectus arcu, congue sed varius quis, suscipit ut metus. Vivamus placerat odio vitae gravida varius.

- ✓ Nulla eu sem ligula. Morbi ac molestie enim.
  Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Suspendisse at dui quis massa laoreet euismod. Donec vitae mollis felis, sit amet bibendum turpis.

Praesent ultricies fermentum finibus.

- ✓ Integer elit ipsum, auctor in elit sit amet, ultricies interdum elit.
  Etiam libero lacus, sagittis et maximus eu, vulputate auctor dolor. Praesent porta, odio nec finibus imperdiet, neque mi porttitor augue, at malesuada tortor nisi ut elit.

- ✓ Sed porta est quis diam pellentesque dignissim.
  Aliquam erat volutpat. Fusce et sollicitudin leo, quis eleifend mi. Fusce vehicula, mi nec mattis vulputate, ligula sapien eleifend enim, eget blandit libero ex non sem.

#2 Repetition

✓ Repeat some aspect of the design through out the entire piece. The repetitive element may be a bold font, a thick rule (line), a certain bullet, color, design element, particular format, the spatial relationships, etc. It can be anything that a reader will visually recognize.

✓ Repetition can be thought of as "consistency."

✓ But repetition goes beyond just being naturally consistent—it is a conscious effort to unify all parts of a design.

Pattern Photography

Probability and Statistics for Programmers

Think Stats

O'REILLY®
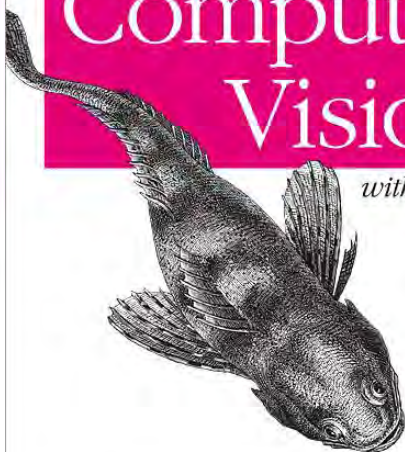
Allen B. Downey

Tools and Algorithms for Analyzing Images
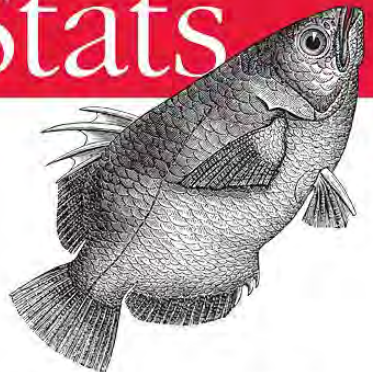
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Computer Vision

with Python

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Android

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Zigurd Mednieks, Laird Dornin,
G. Blake Meike & Masumi Nakamura

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6th Edition
covers ECMAScript 5

JavaScript

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David Flanagan

Perl, .NET, Java, and More

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Mastering

Regular Expressions

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Jeffrey E.F. Friedl

Solutions and Examples for Java Developers

Java Cookbook

O'REILLY®
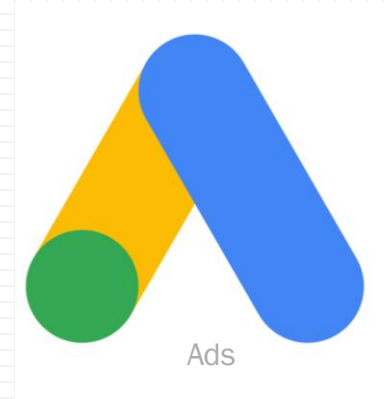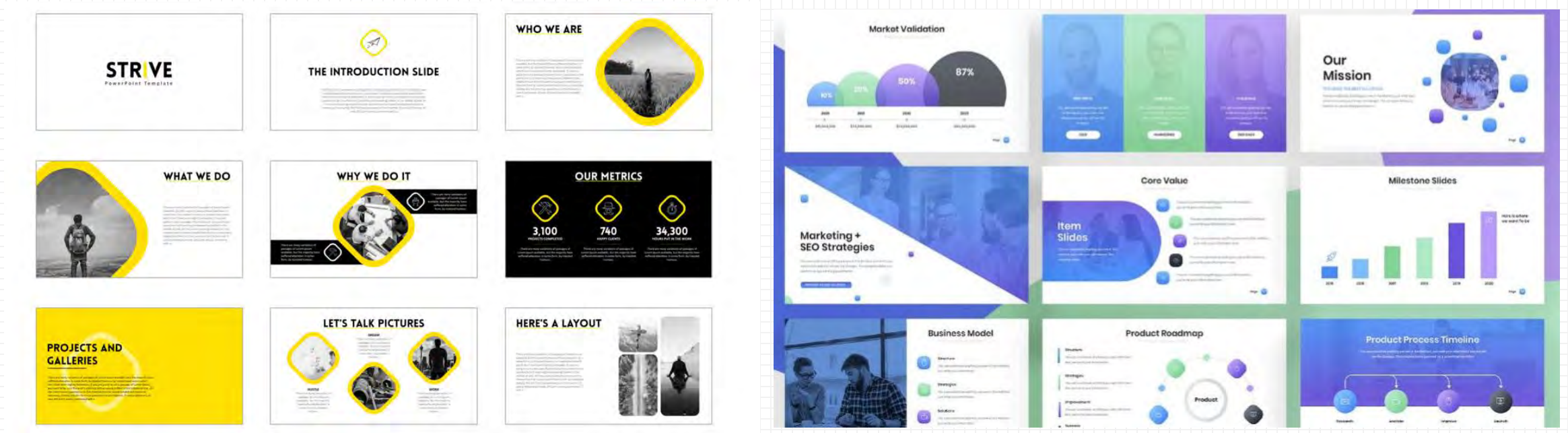
Ian F. Darwin

Cloud

News

Drive

Ads

Maps

#2 Repetition

Repeat color schemes, fonts, gradients, transparency, shadows…

Method   Method

#3 Alignment

✓ Nothing should be placed on the page arbitrarily. Every item should have a visual connection with some thing else on the page." The principle of alignment forces you to be conscious—no longer can you just throw things on the page and see where they stick.

✓ When items are aligned on the page, the result is a stronger cohesive unit. Even when aligned elements are physically separated from each other, there is an invisible line that connects them, both in your eye and in your mind.

A slide cover
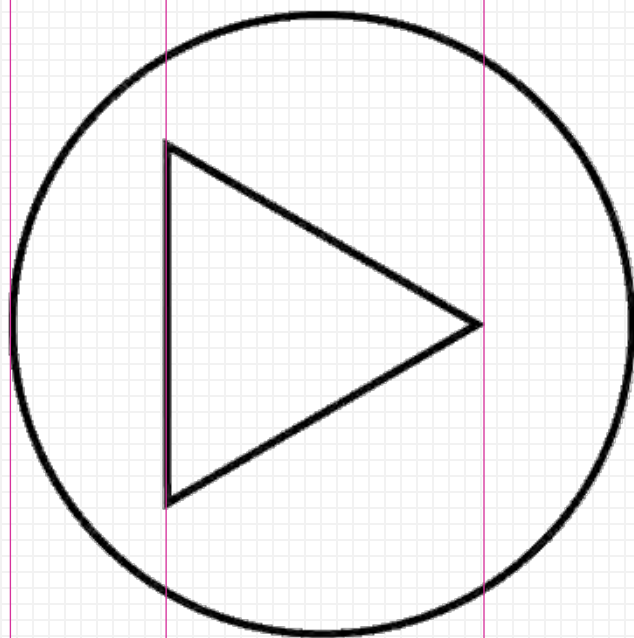
Mathematically

Optically

More about feeling than mathematics
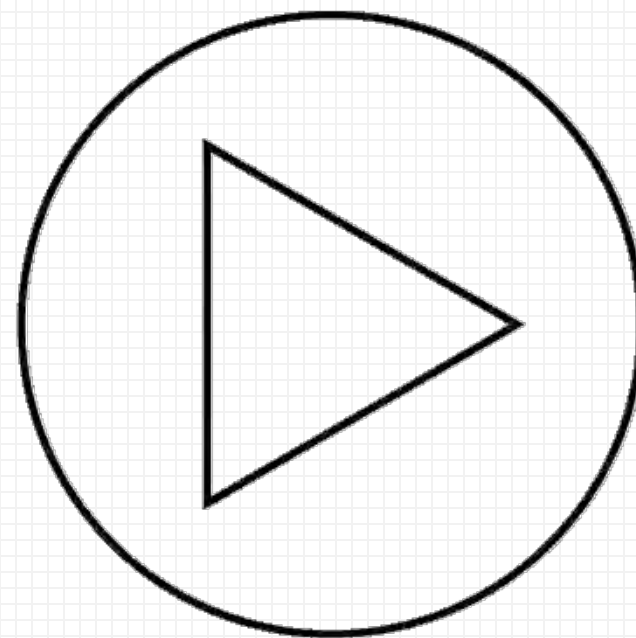
#3 Alignment

EXAMPLE 2

Use alignment tool instead

Book recommendations

More about feeling than mathematics
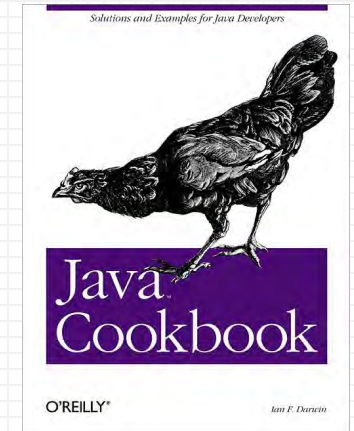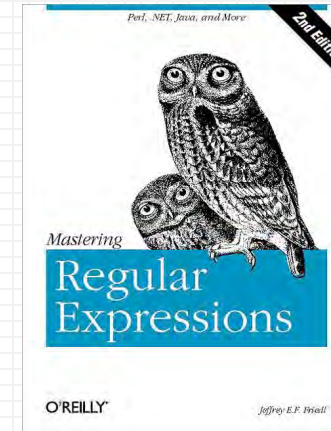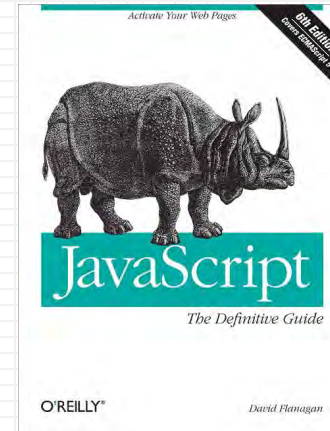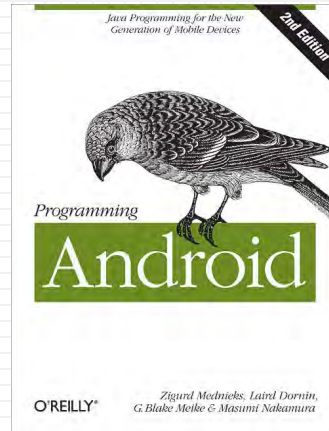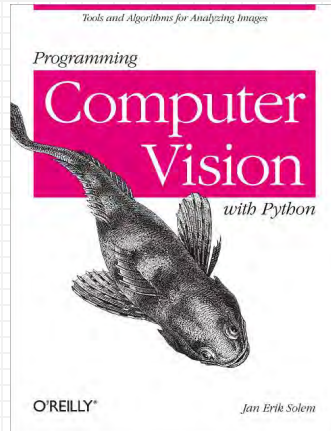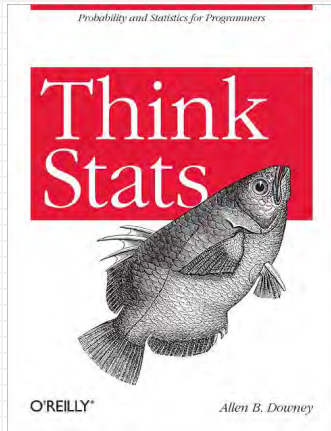
#4 Proximity

✓ Very often in the work of new designers, the words and phrases and graphics are strung out all over the place, filling corners and taking up lots of room so there won't be any empty space. There seems to be a fear of empty space.

✓ When pieces of a design are scattered all over, the page appears unorganized and the information may not be instantly accessible to the reader.

✓ Group related items together, move them physically close to each other so the related items are seen as one cohesive group rather than a bunch of unrelated bits.

| | MM | DD | YY | use the first date of operation in WA. (**Required.** If unknown, please estimate.) |

c. Is this location inside city limits? ☐ Yes ☐ No

*Primary Business Name/Trade Name

d.

*Business Mailing Address *(Street or PO Box, Suite No. do not use builiding name)*   *Business Street Address (if different than mailing) Do not use PO Box or PMB

City   State   Zip code   City   State   Zip code

e. ( )   ( )

Business Telephone Number   Fax Number   E-Mail Address

f. **List all owners & spouses:** *Sole proprietor, partners, officers, or LLC members.* *(Attach additional pages if needed.)*

First Name:

Last Name:

Email:
(Your email address will be your username)

Re-type Email:

Password:
(Min. 8 characters, 1 number, case-sensitive)

Re-type Password:

Address:

City:

State: Choose a state ▼

Zip Code: _____ Optional

Phone: _____ ❓ Mobile ▼
No spaces or dashes

Date of Birth: Month ▼ Day ▼ Year ▼ ❓

Gender: Choose a gender ▼ ❓

Security Question: Choose a security question ▼ ❓

Security Answer:
(Not case-sensitive)

Personal Information

First Name:

Last Name:

Date of Birth: Month ▼ Day ▼ Year ▼ ❓

Gender: Choose a gender ▼ ❓

Account Information

Email:
(Your email address will be your username)

Re-type Email:

Password:
(Min. 8 characters, 1 number, case-sensitive)

Re-type Password:

Security Question: Choose a security question ▼ ❓

Security Answer:
(Not case-sensitive)

Contact Information

Address:

City:

State: Choose a state ▼

Zip Code: _____ Optional

Phone: _____ ❓ Mobile ▼
No spaces or dashes

Grouping

GraphQL Schema Language Cheat Sheet

The definitive guide to express your GraphQL schema succinctly

Last updated: 28 January 2017
Prepared by: Hafiz Ismail / @sogko

What is GraphQL Schema Language?

It is a shorthand notation to succinctly express the basic shape of your GraphQL schema and its type system.

What does it look like?

Below is an example of a typical GraphQL schema expressed in shorthand.

```
# define Entity interface
interface Entity {
  id: ID!
  name: String
}

# define custom Url scalar
scalar Url

# User type implements Entity interface
type User implements Entity {
  id: ID!
  name: String
  age: Int
  balance: Float
  is_active: Boolean
  friends: [User]!
  homepage: Url
}

# root Query type
type Query {
  me: User
  friends(limit: Int = 10): [User]!
}

# custom complex input type
input ListUsersInput {
  limit: Int
  since_id: ID
}

# root mutation type
type Mutation {
  users(params: ListUsersInput): [User]!
}

# GraphQL root schema type
schema {
  query: Query
  mutation: Mutation
  subscription: ...
}
```

Schema

schema	GraphQL schema definition
query	A read-only fetch operation
mutation	A write followed by fetch operation
subscription	A subscription operation (experimental)

Built-in Scalar Types

Int	Int
Float	Float
String	String
Boolean	Boolean
ID	ID

Type Definitions

scalar	Scalar Type
type	Object Type
interface	Interface Type
union	Union Type
enum	Enum Type
input	Input Object Type

Type Modifiers

String	Nullable String
String!	Non-null String
[String]	List of nullable Strings
[String]!	Non-null list of nullable Strings
[String!]!	Non-null list of non-null Strings

Input Arguments

Basic Input

```
type Query {
  users(limit: Int): [User]
}
```

Input with default value

```
type Query {
  users(limit: Int = 10): [User]
}
```

Input with multiple arguments

```
type Query {
  users(limit: Int, sort: String): [User]
}
```

Input with multiple arguments and default values

```
type Query {
  users(limit: Int = 10, sort: String): [User]
}

type Query {
  users(limit: Int, sort: String = "asc"): [User]
}

type Query {
  users(limit: Int = 10, sort: String = "asc"): [User]
}
```

Input Types

```
input ListUsersInput {
  limit: Int
  since_id: ID
}

type Mutation {
  users(params: ListUsersInput): [User]!
}
```

Custom Scalars

```
scalar Url
type User {
  name: String
  homepage: Url
}
```

Interfaces

Object implementing one or more Interfaces

```
interface Foo {
  is_foo: Boolean
}

interface Goo {
  is_goo: Boolean
}

type Bar implements Foo {
  is_foo: Boolean
  is_bar: Boolean
}

type Baz implements Foo, Goo {
  is_foo: Boolean
  is_goo: Boolean
  is_baz: Boolean
}
```

Unions

Union of one or more Objects

```
type Foo {
  name: String
}

type Bar {
  is_bar: String
}

union SingleUnion = Foo
union MultipleUnion = Foo | Bar
type Root {
  single: SingleUnion
  multiple: MultipleUnion
}
```
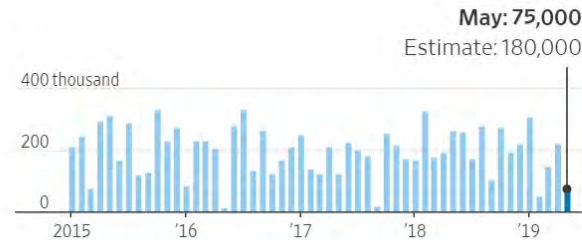
Enums

```
enum USER_STATE {
  NOT_FOUND
  ACTIVE
  INACTIVE
  SUSPENDED
}

type Root {
  stateForUser(userID: ID!): USER_STATE!
  users(state: USER_STATE, limit: Int = 10): [User]
}
```

THE WALL STREET JOURNAL.

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What's News →

Monthly change in nonfarm payrolls

May: 75,000
Estimate: 180,000

400 thousand

200

0

2015   '16   '17   '18   '19

Note: Seasonally adjusted
Source: Labor Department

U.S. Added 75,000 Jobs in May as Hiring Slowed

Employers tapped the brakes on hiring in May, signaling companies are taking a more cautious approach at a time of slowing global growth. The jobless rate held at 3.6%.

- Stocks Rally and Treasury Yields Fall
- Analysis: A Worrying Jobs Number With Trade Hit Looms

ANALYSIS

Softer Labor Market Could Strengthen Case for Rate Cut

May employment report adds to signs the U.S. economy was cooling even before the recent escalation in trade tensions—which could make it easier for Federal Reserve officials to justify an interest rate cut.

36 minutes ago

- Heard on the Street: Investors, Buy the Dips

U.S.-Mexico Border Negotiations Continue Amid Signs of Progress

Frackers Scrounge for Cash as Wall Street Closes Doors

The companies behind the U.S. fracking boom are turning to asset sales, drilling partnerships and other alternative financing to supplement their cash flow. 💬 16

- Frackers Chase Fast Oil Output

States Add to Scrutiny on Google, Facebook, Other Big Tech

State attorneys general are preparing for their own investigations into big tech platforms including Google and Facebook, based on concerns that largely mirror those driving federal probes. 💬 2   37 minutes ago

- Facebook Bolsters Antitrust Defenses

Trump Brings Rare Dose of Stability to a Continent in Flux

At a time of political upheaval across the European Union, it was President Trump who was the relative picture of stability—both diplomatically and politically—as he skipped back and forth across the English Channel this week. 💬 162

Hackers Won't Let Up in Their Attack on U.S. Cities

THE INTELLIGENT INVESTOR

The Deal Hidden in Your 401(k)

California Homelessness Grows Despite Government Spending

GE's Nemesis: An Eerily Prescient Bear

Markets →

	US	EUROPE	ASIA	FX	RATES	FUTURES

1D
5D
3M
6M
1Y

DJIA	26003.54	282.88	1.10%
S&P 500	2877.81	34.32	1.21%
Nasdaq	7747.05	131.49	1.73%
Russell 2000	1515.64	12.10	0.81%
DJ Total Mkt	29559.37	328.06	1.12%

Jun 7 '19, 11:24 AM EDT   MARKETS →

Opinion →

Joe Biden's Green Free Lunch

By The Editorial Board | Review & Outlook

Overthrow the Prince of Facebook

By Peggy Noonan | Declarations

Nationalism and D-Day

By The Editorial Board | Review & Outlook

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Got a tip for us?

Here's how to submit it.

Summary

✓ Contrast - If two items are not exactly the same, then make them different. Really different

✓ Repetition - Repeat some aspect of the design through out the entire piece

✓ Alignment - Nothing should be placed on the page arbitrarily. Every item should have a visual connection with some thing else on the page.

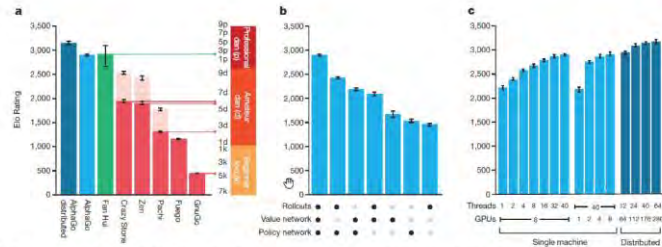✓ Proximity - Group related items together

B. Vectorization

Vectorization

Vector graphics
Infinitely scalable

Raster graphics
Subject to resolutions

High-quality, professional, easy-to-reuse	PROS	Compatible, printing-friendly
Rendered slowly if complicated	CONS	Pixelated, less professional, hard-to-reuse

Scalable

Vector graphics are computer graphics images that are defined in terms of 2D points, which are connected by lines and curves to form polygons and other shapes. WIKIPEDIA



```
      5.147058486938477,
      -0.000009056165538368077,
      253.23532859192255)"></path>
  <path class="st1" d=
  "M262,54.5l7.6,5c-2.4,3.6-8.3,9.8-
  18.5,9.8c-12.6,0-22-9.7-22-
  22.2C229.1,34,238.6,25,250,25
      c11.5,0,17.1,9.2,19,14.1l1,2.5l-
  29.6,12.3c2.3,4.5,5.8,6.7,10.8,6.7C2
  6.1,60.6,259.5,58.2,262,54.5L262,54.
  z M238.7,46.5
      l19.8-8.2c-1.1-2.8-4.4-4.7-8.2-
  4.7C245.4,33.6,238.5,37.9,238.7,46.5
  " style="fill: rgb(234, 67, 53);"
  transform="matrix(5.147058486938477,
  0, 0, 5.147058486938477,
  -6.969866938037228,
  256.02326419766996)"></path> == $0
```

Matrix manipulations
Affine transformations

www.vecteezy.com/editor

However, raster images are just a matrix of colored pixels, cannot be recomputed when scaled.
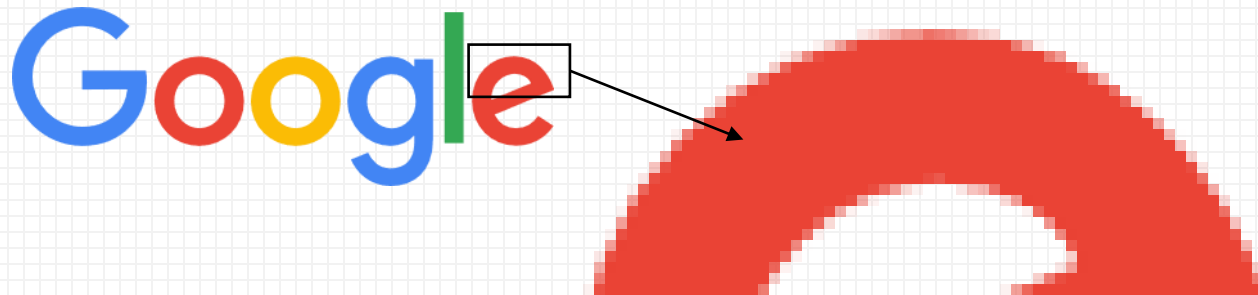
Programmable and Interactive

Not just a static image any longer, it is a group of objects you can manipulate to tell great stories.
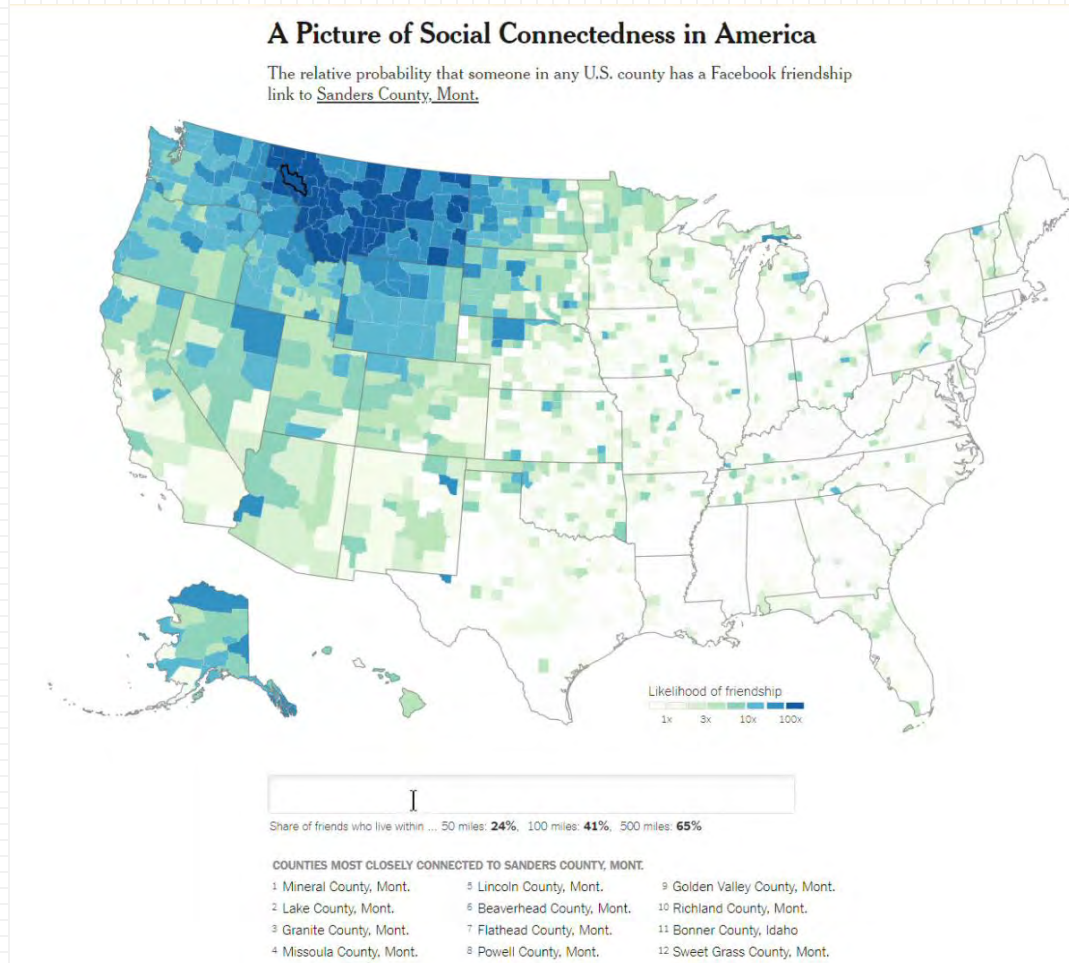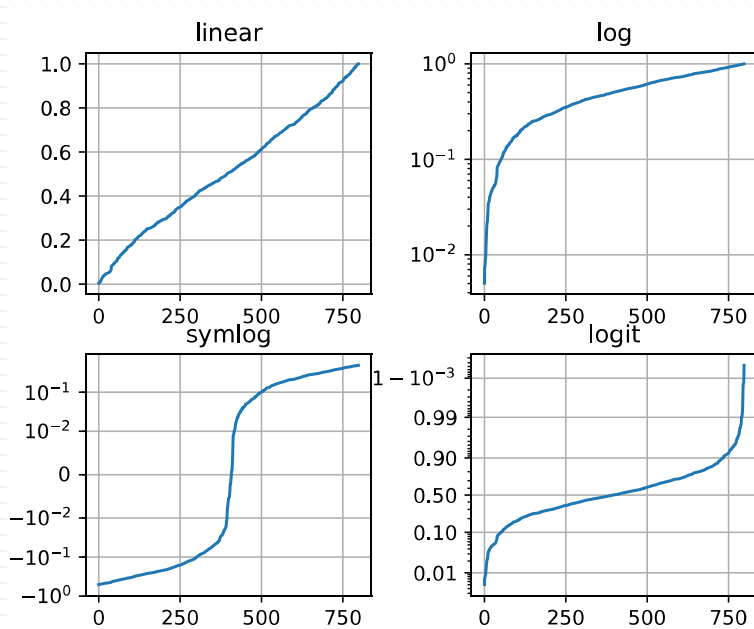

New York Times
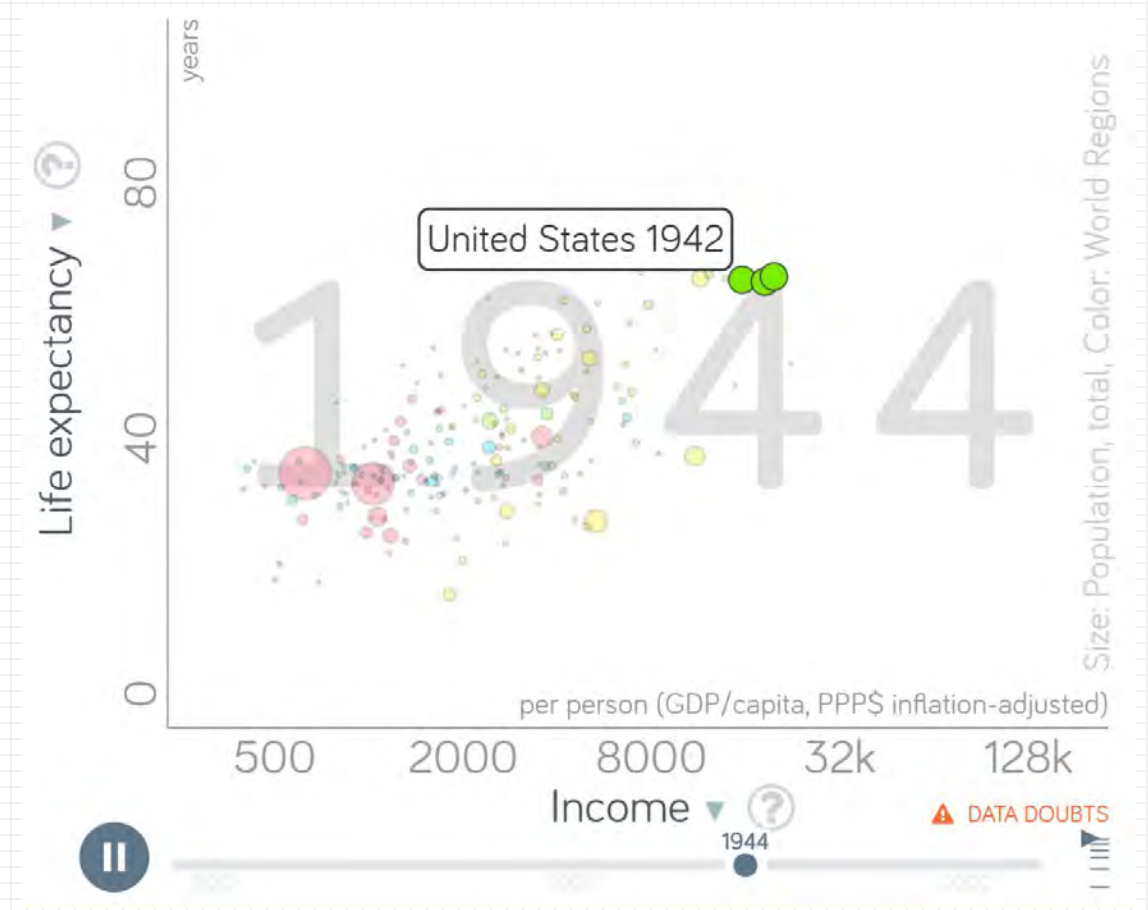
Gapminder.org

Where to get vector graphics?

#1 By coding

STEP 1   Plot any figure as you always do with your favorite programming language

STEP 2   Save figures as `.pdf`, `.svg`, or `.eps`.

Common formats for vector graphics.
- Python: `fig.savefig("name.svg")`
- Julia: `savefig("name.svg")`
- Matlab: File -> Export Setup -> Export and chooses type `.svg`.
- Office: export to `.pdf`

STEP 3   Insert the files into your slides or text editors.

- Word, PowerPoint 2019 support .svg
- LaTeX supports .pdf and .svg.

Advanced   Animate it!

Where to get vector graphics?

#1 By coding

EXAMPLE 3
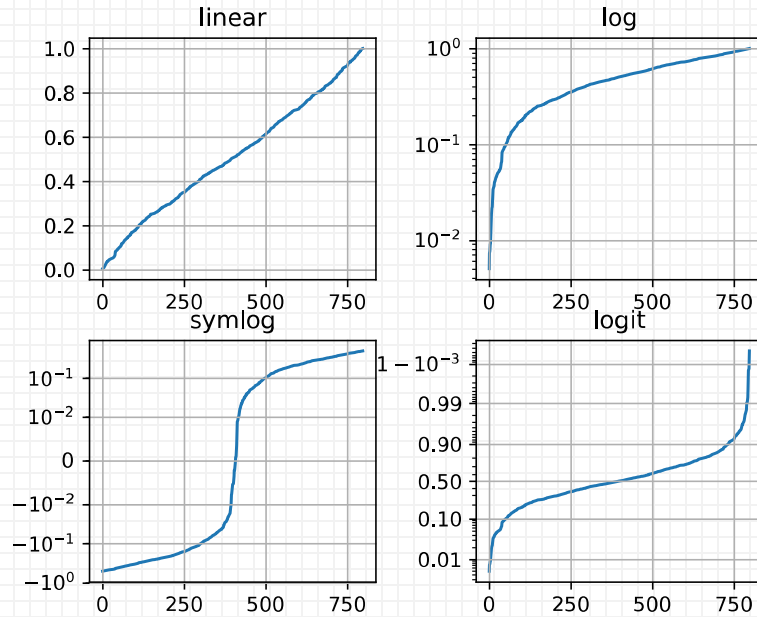
Advanced   Animate it!

1. Convert to shape
2. Ungroup
3. Animation

Where to get vector graphics?
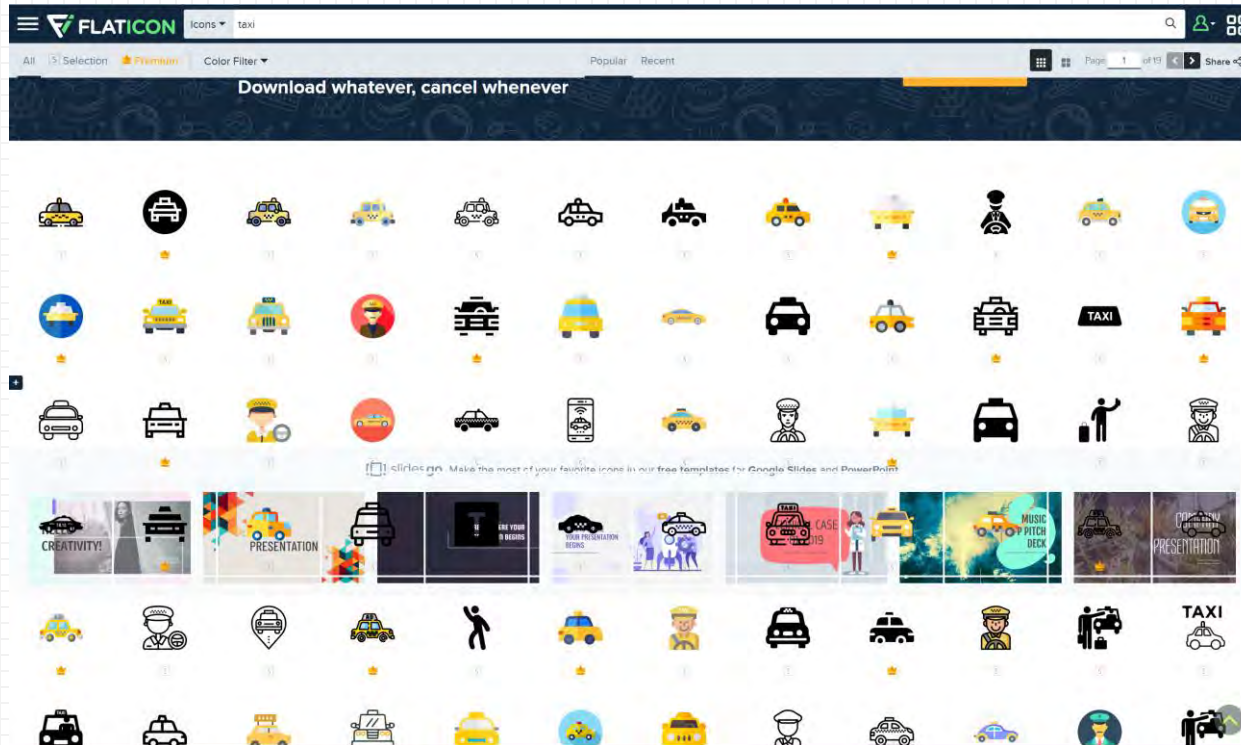
#1 By coding

REPRODUCE
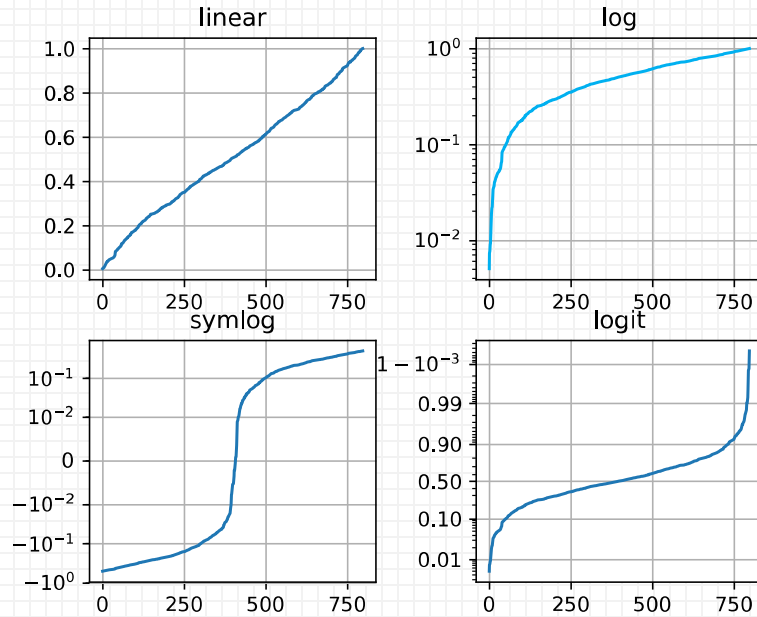
Advanced   Animate it!

1. Convert to shape
2. Ungroup
3. Animation

Where to get vector graphics?

#2 By downloading
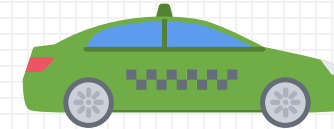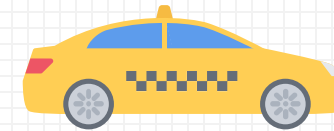
Source:
flaticon.com
freepik.com
vecteezy.com
and many…

Where to get vector graphics?

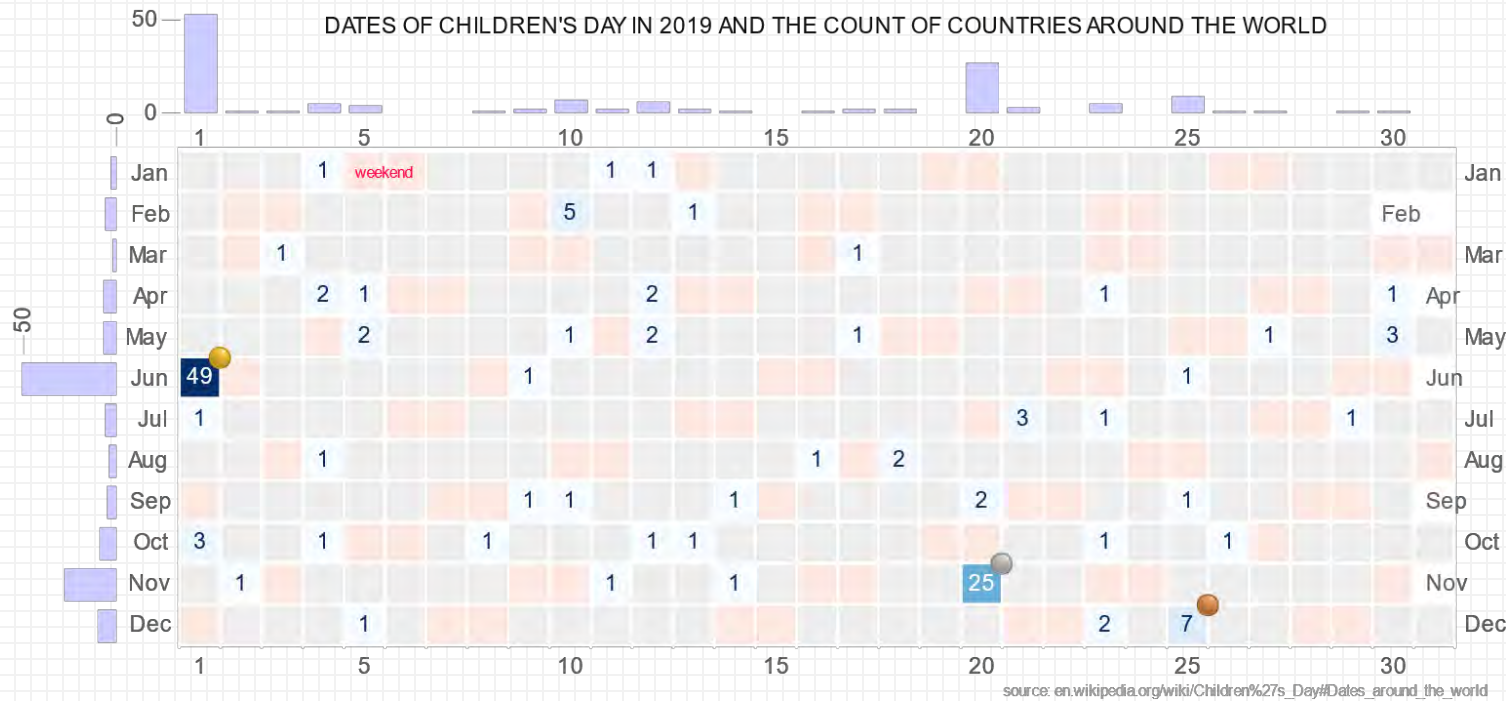#2.5 By coding + downloading

EXAMPLE 4

[Modify you exported figures]

Vector graphic editors

DATES OF CHILDREN'S DAY IN 2019 AND THE COUNT OF COUNTRIES AROUND THE WORLD

Adobe Illustrator

Inkscape

Online editors: Vectr, Boxy SVG Editor

Where to get vector graphics?

By drawing
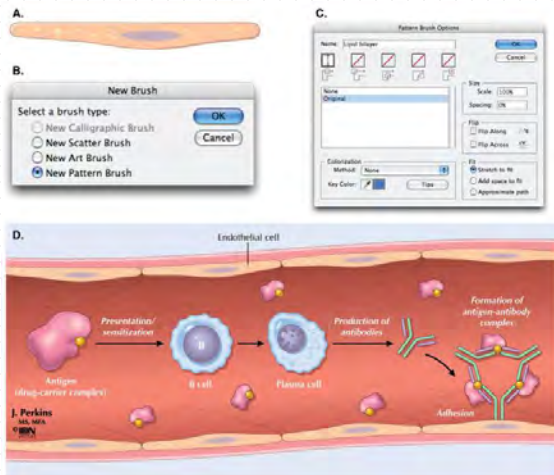
Diagrams, infographics
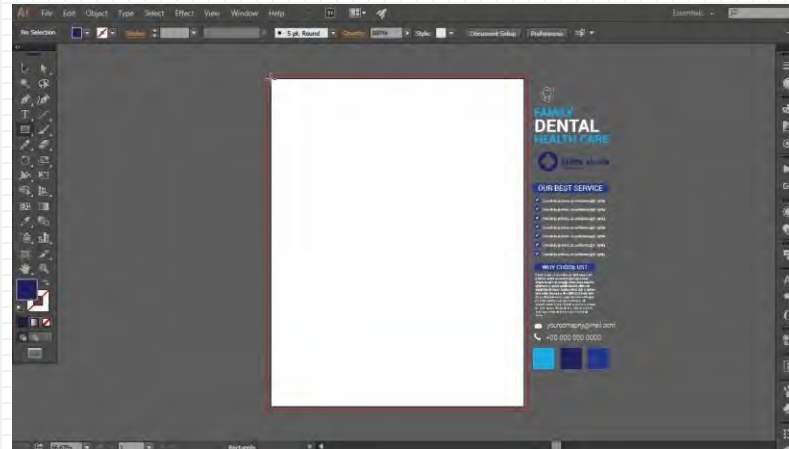
Design logos, posters, brochures etc.

Advanced

C. Animation

Animate

2013-05-06 08:00:00

Veh. status
■ searching
■ deadheading
■ delivering
Pass. status
○ requested
✕ assigned
├────┤ 1 mile

w/ PowerPoint

w/ animation programs
such as Adobe Animate

w/ programming languages

Easy-to-use

Flexible

Data-driven

Frames and layers: key concepts in animations
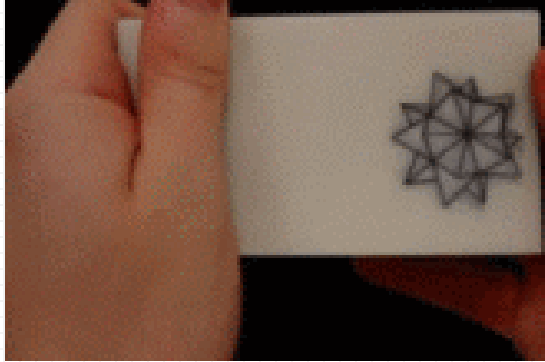
Frames in flip books
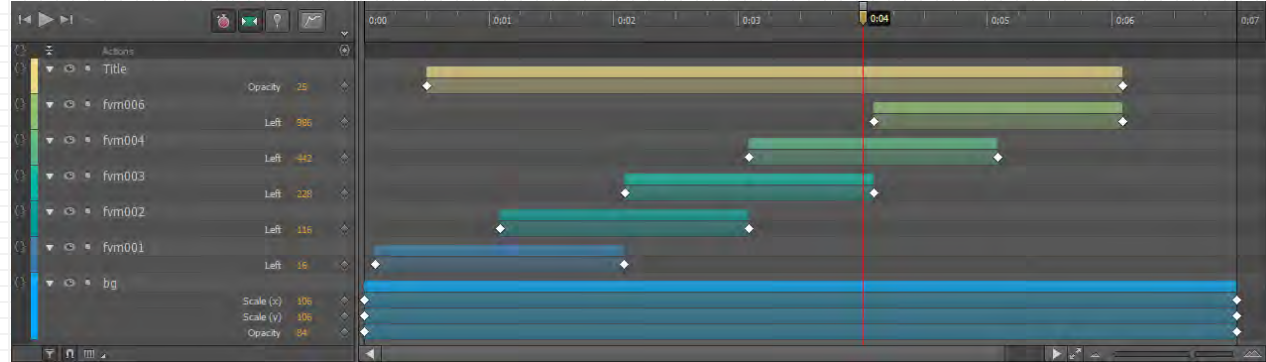
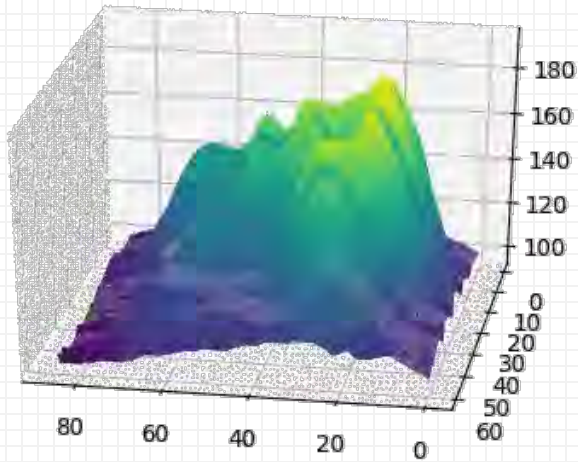Timeline in animation programs
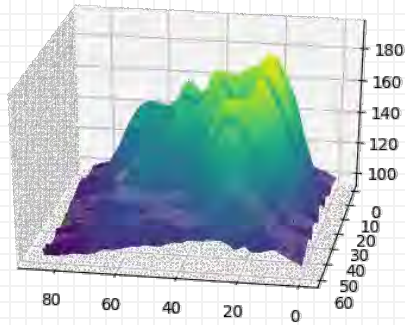
<u>Program it</u>

```
ax.plot_trisurf(df['Y'], df['X'], df['Z'])          Create objects

for angle in range(70,210,2):                       Iterate over frames
    ax.view_init(30,angle)                          Update object status
```

Animate with coding

EXAMPLE 5


```python
fig = plt.figure()
ax = fig.gca(projection='3d')
ax.plot_trisurf(df['Y'], df['X'], df['Z'],
cmap=plt.cm.viridis, linewidth=0.2)

for angle in range(70, 210, 2):
    # Make the plot

    ax.view_init(30, angle)

    fig.canvas.draw()
    fig.canvas.flush_events()
```
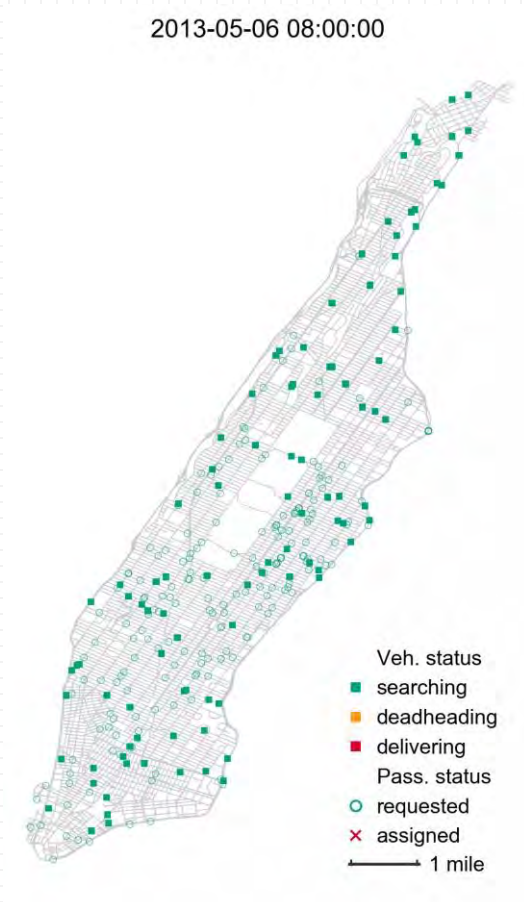
Animate with coding

EXAMPLE 6

2013-05-06 08:00:00

Veh. status
- ■ searching
- ■ deadheading
- ■ delivering

Pass. status
- ○ requested
- ✕ assigned

⊢————⊣ 1 mile

Objects	Status	Action	Relationship
Passengers	Requested Assigned	Appear/dis appear	Connecting if assigned pairs
Drivers	Searching Deadheading Delivering	Moving	
Maps	static	static	

Key: if you want to control them, get their handles/axes first

```
passengers_requested =
    ax.scatter([], [], 10,...)
    plt.scatter([], [], 10,...)
```

Visual Graphics
Principles, Vectorization and Animation

thank you · 谢谢 · متشكرم · merci

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