

Modern Data Science Methods for Educational Research

Creating Effective Data Visualization with R

Fine Tune the Plots and Design Principle

ผศ.ดร.สิริวัฒน์ ครีสุทธิยการ

ภาควิชาวิจัยและจิตวิทยาการศึกษา
คณะครุศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

February 19, 2023

Theme สำเร็จรูปของ ggplot2

ggplot2 มี theme สำเร็จรูปให้เลือกหลายตัว

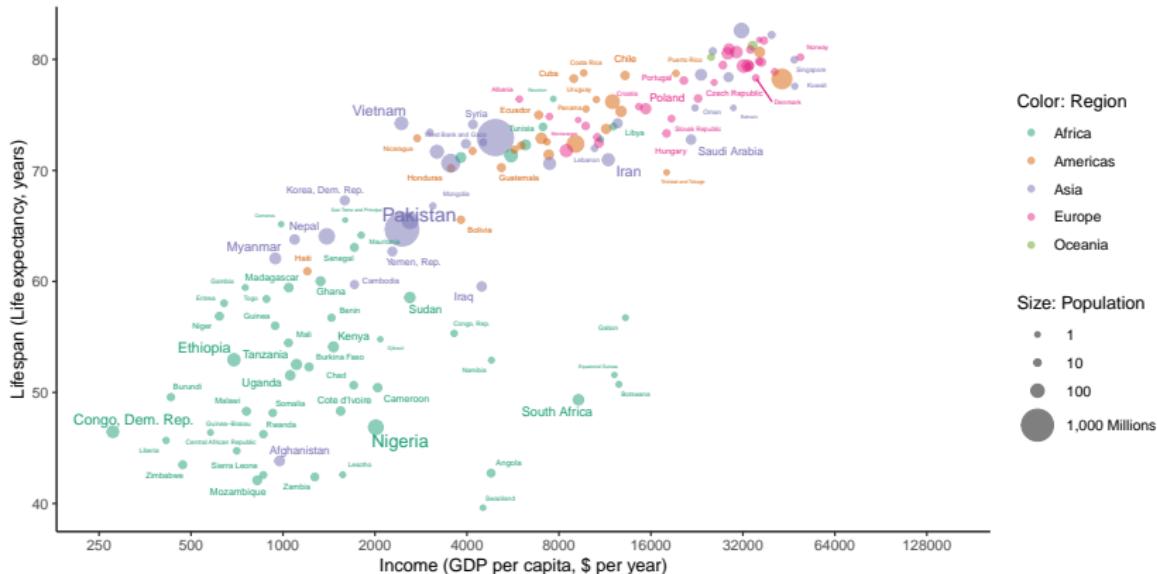
```

1 p <- gapminder %>%
2   filter(year == "2007") %>%
3   ggplot(aes(x = gdpPercap,
4           y= lifeExp,
5           col=continent))+ 
6   geom_point(aes(size = pop),alpha=0.5)+ 
7   geom_text_repel(aes(label=country, size = pop),
8                   show.legend = F,
9                   max.overlaps = 12)+ 
10  scale_x_log10(limits=c(250,150000),
11                  breaks=c(250, 500, 1000,2000,4000,8000,1600))
12  scale_size(breaks=c(10^6, 10^7, 10^8, 10^9),
13              labels = c("1","10","100","1,000 Millions",
# max.size=30

```

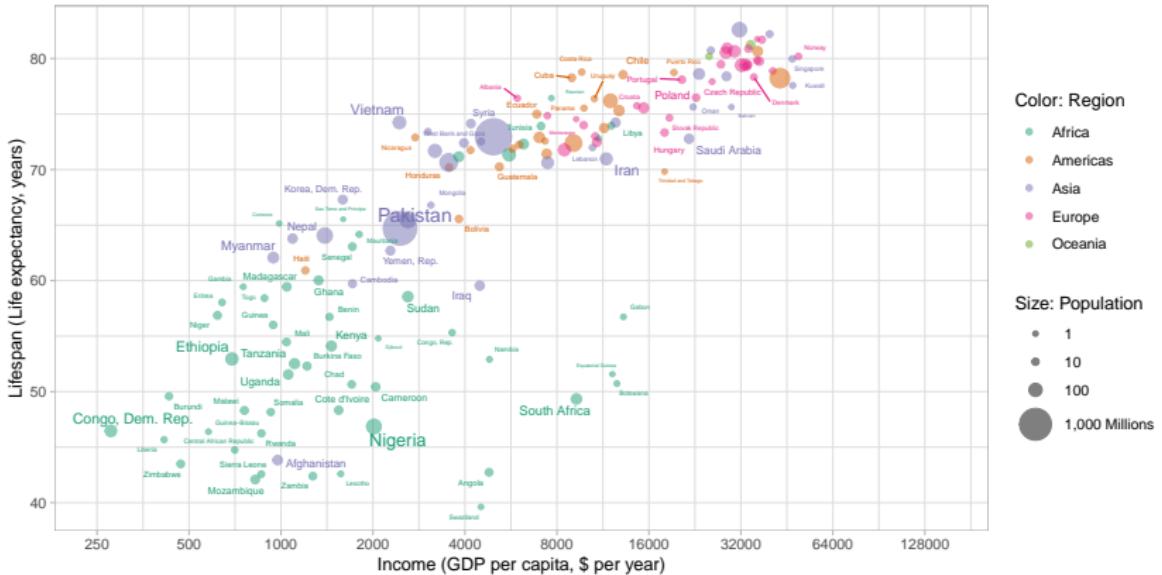

Classic Theme

1 p + theme_classic()



Light Theme

1 p + theme_light()



Element of a theme

ggplot2 theme elements reference

Set `minimal` as the baseline theme:

```
theme_minimal() +  
  theme(element_type = element_type())
```

Use `element_blank()` to remove an element

Axis titles, text, ticks, and lines can be specified per axis using theme inheritance by putting `.x/.y` at the end of the theme element.

```
axis.line.y = element_line()
```

```
axis.title.y = element_text()
```

```
panel.grid.major = element_line()
```

```
panel.grid.minor = element_line()
```

```
axis.text = element_text()
```

`text = element_text()` ← modifications will be applied to all text elements

`plot.title.position = "plot"
plot.caption.position = "plot"`

`plot.title = element_text()
plot.subtitle = element_text()`

`plot.margin = margin(25, 25, 25, 25)`

Miles per Gallon & Horsepower
of 32 Automobiles (1973-74 models)

Number of cylinders

● 4
● 6
● 8

`legend.title = element_text()`

`legend.background = element_rect()
legend.text = element_text()`

`legend.position = c(.85,.85) / "none"/
"left"/"right"/
"bottom"/"top"`

`plot.background = element_rect()`

`plot.caption = element_text()`

isabella-h

Full list of elements at ggplot2.tidyverse.org/reference/theme.html

Example

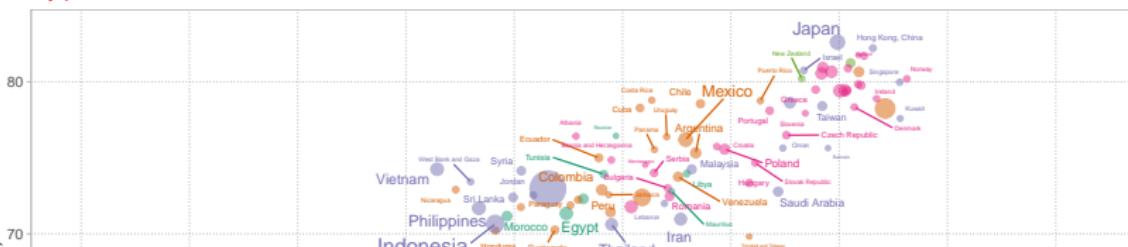
```

1 p + ggtitle("my plot") +
2   labs(caption = "Data Source: gapminder")+
3   theme_light()+
4   theme(plot.title = element_text(color = "red"),
5         legend.position = c(0.9,0.4))+  

6   theme(plot.caption = element_text(color = "grey"))+
7   theme(axis.text.x = element_blank())+
8   theme(panel.grid.minor = element_blank())+
9   theme(panel.grid.major = element_line(linetype = 3, color=)

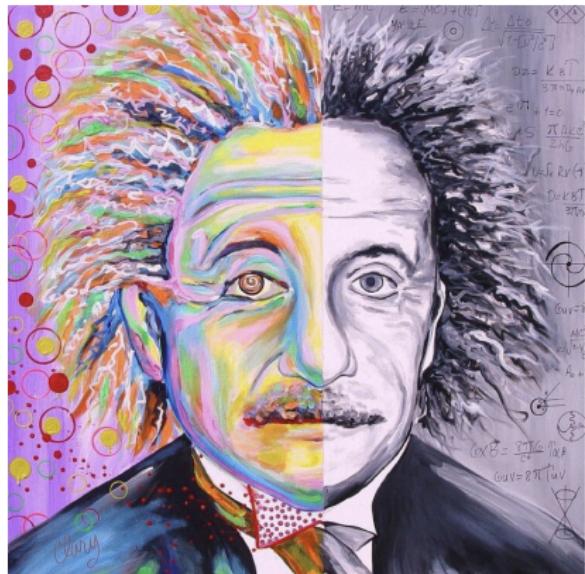
```

my plot



Design Principle

Design Principle



Design Principle



Good Design is **innovative**.

Good Design makes a product **useful**.

Good Design is **aesthetic**.

Good Design makes a product **understandable**.

Good Design is **unobtrusive**.

Good Design is **honest**.

Good Design is **long-lasting**.

Good Design is **thorough** down to the last detail.

Good Design is **environmentally friendly**.

Good Design is as **little design** as possible.

<https://bellroy.com/journal/heroes-of-design-dieter-rams>

Design Principle



Good Design is innovative.

Good Design makes a product useful.

Good Design is aesthetic.

Good Design makes a product understandable.

Good Design is unobtrusive.

Good Design is honest.

Good Design is long-lasting.

Good Design is thorough down to the last detail.

Good Design is environmentally friendly.

Good Design is as little design as possible.

<https://bellroy.com/journal/heroes-of-design-dieter-rams>

Design Principle

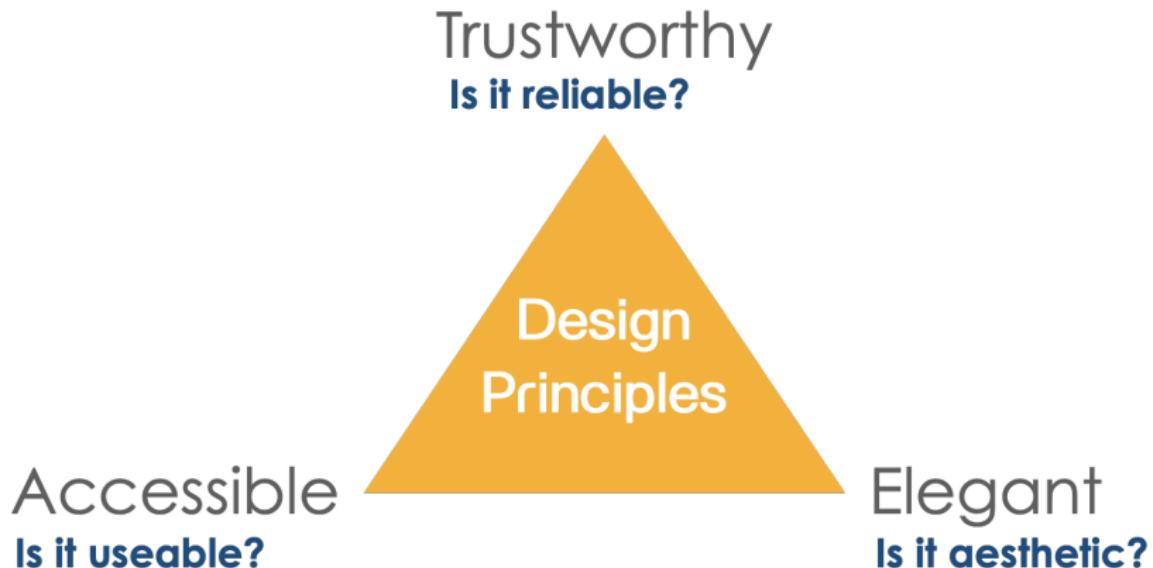
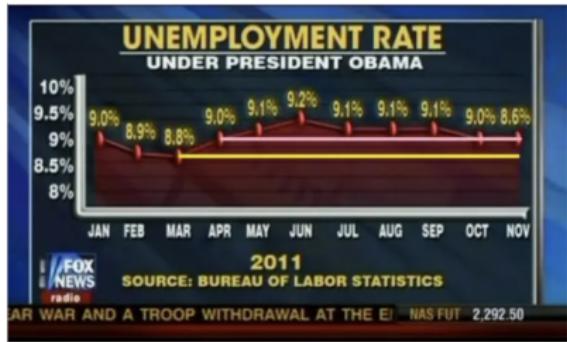
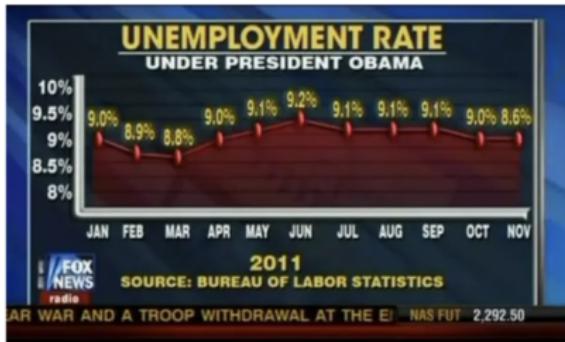


Figure 1: ที่มา : Kirk (2019)

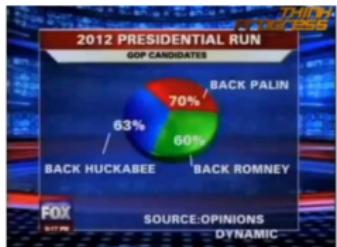
Trustworthy

- ▶ Data
- ▶ Design

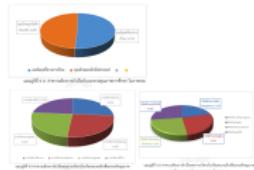
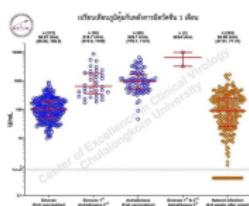
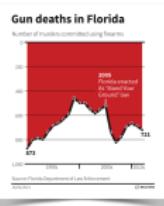
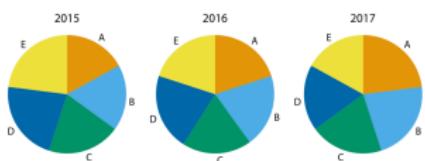
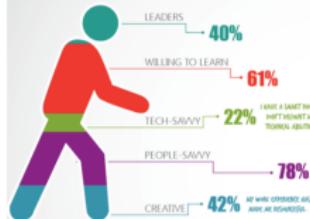
Trustworthy Design



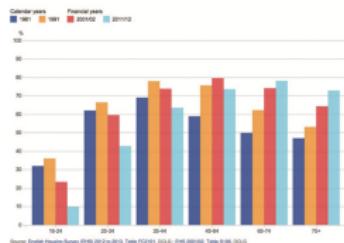
Trustworthy Design



How baby boomers describe themselves



Trustworthy Design

Percentage of each age group that are home owners², England, 1981 to 2012

Source: English Housing Survey (EHS), 1981-2012; Table HC2101, HS04, 2nd edition; Table HS010, HS02

Accessible Design

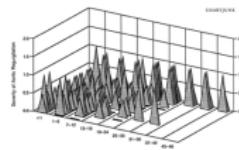
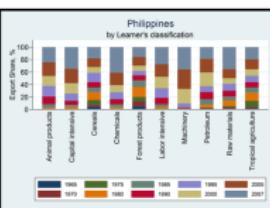
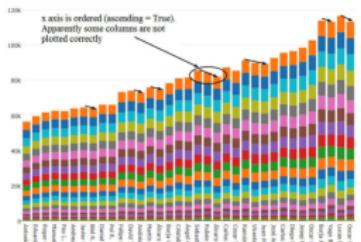
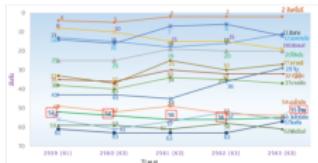


Figure 1: Waste Management Performance Index for the Philippines. *Sustainable Angelika et al. (2013)*.
The original graph was adapted according to *Figure 5, page 21, Table 1.2 & 1.3, 440-453*.

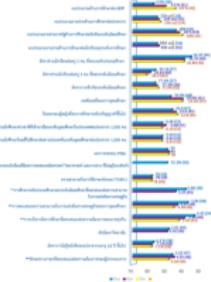


แผนภาพ 43 อันดับความสามารถในการแข่งขันด้านการค้าโลก ปี 2559 – 2563
ในภูมิภาคเอเชียตะวันออกเฉียงใต้



ที่มา : *IMD World Competitiveness Yearbook 2016 - 2020*
หมายเหตุ : ลําดับในแต่ละ 5 ปี จํานวนประเทศที่เข้าร่วมการคิดอันดับ ปี ปัจจุบัน

แผนภาพ 45 ผู้นำด้านการค้าโลก IMD ปี 2561 - 2563



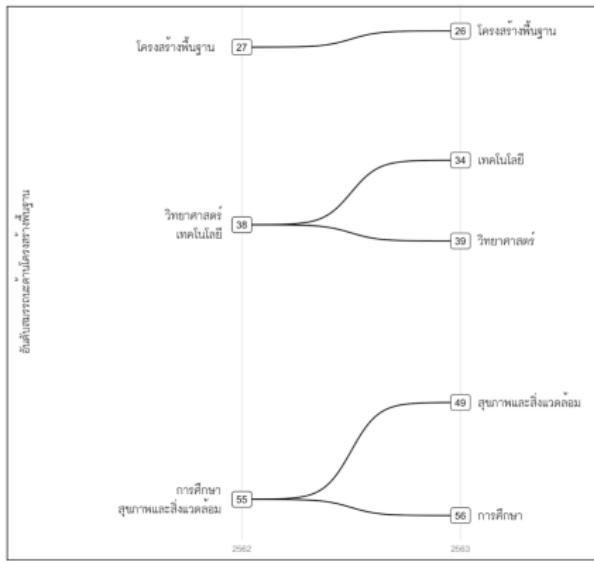
ที่มา : *IMD World Competitiveness Yearbook 2018-2020*
หมายเหตุ : ผู้นำด้านการค้าโลกในปี 2563
+ ประเทศที่เข้าร่วมการคิดอันดับ

Accessible Design

แผนภาพ 14 สมรรถนะด้านโครงสร้างพื้นฐานของประเทศไทย ปี 2563
เปรียบเทียบ 5 กลุ่มปัจจัยอ้อย

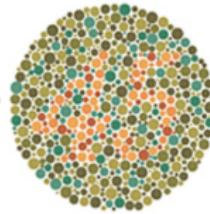
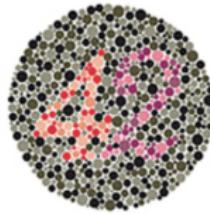
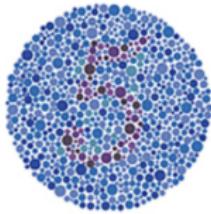
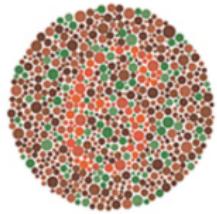
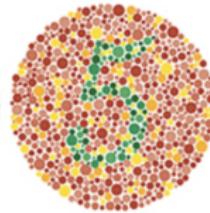
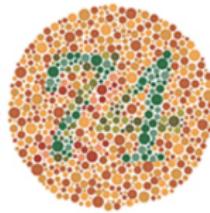
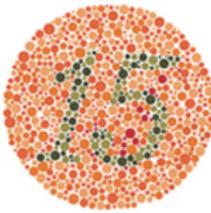
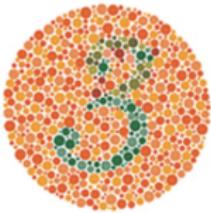
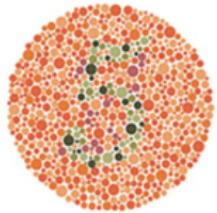
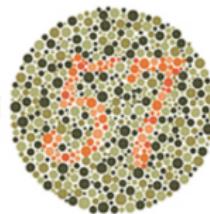
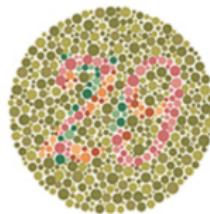
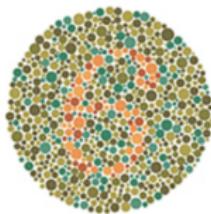
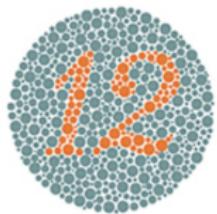


ที่มา : IMD. World Competitiveness Yearbook 2020
ดาวน์โหลดในวันที่ 28 กันยายน ปี 2562



สิริวิชิต ศรีสุทธิยากร (2565)

Accessible Design



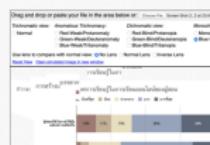
Accessible Design

Coblis – Color Blindness Simulator

If you are not suffering from a color vision deficiency it's very hard to imagine how it feels like to be colorblind. The Color Blindness Simulator can close this gap for you. Just play around with it and get a feeling of how it is to be a color vision handicap.

As all the simulations are made on your local machine, no images are uploaded to the servers. There are also no cookies or other tracking mechanisms used. So make sure there are no privacy issues for the "Save" function or for data and themes. Features: 40 others should be implemented in the future.

To go ahead, choose an image through the subject functionality or just drag and drop your image in the center of our Color Blindness Simulator. It is also possible to zoom and move your image which means using your mouse - > it will, I hope you will see.



<https://www.color-blindness.com/coblis-color-blindness-simulator/>

Accessible palettes

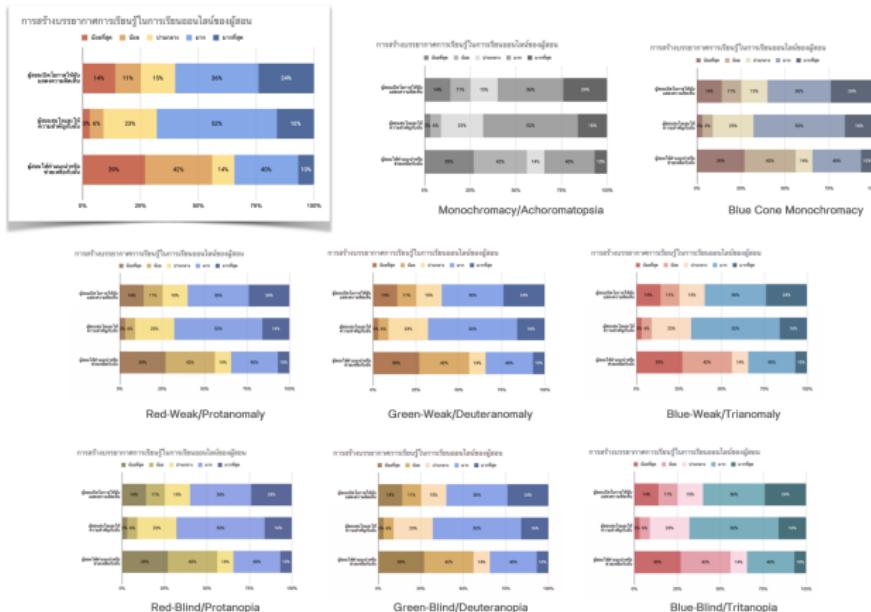
So what colors *should* you use? The colorpicker tool above is intended to give the freedom to choose your own colors while making sure that your color palette is accessible. But to get you started, here are some ideas. Here are 8 pairs of contrasting colors which maintain their contrast for people who are colorblind. Click on any of them to load it into the color palette selection tool above.

	HEX #FFC20A R 255 G 194 B 10		HEX #994F00 R 153 G 79 B 0		HEX #E1BE6A R 225 G 190 B 106		HEX #E66100 R 230 G 97 B 0
	HEX #0C7BDC R 12 G 123 B 220		HEX #006CD1 R 0 G 108 B 209		HEX #40B0A6 R 64 G 176 B 166		HEX #5D3A9B R 93 G 58 B 155
	HEX #1AFF1A R 26 G 255 B 26		HEX #FEFE62 R 254 G 254 B 98		HEX #005AB5 R 0 G 90 B 181		HEX #1A85FF R 26 G 133 B 255
	HEX #4B0092 R 75 G 0 B 146		HEX #D35FB7 R 211 G 95 B 183		HEX #DC3220 R 220 G 50 B 32		HEX #D41159 R 212 G 17 B 89

<https://davidmathlogic.com/colorblind/#%23FFC20A-%230C7BDC>

ภาควิชาวิจัยและจัดการศึกษา คณะครุศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

Accessible Design

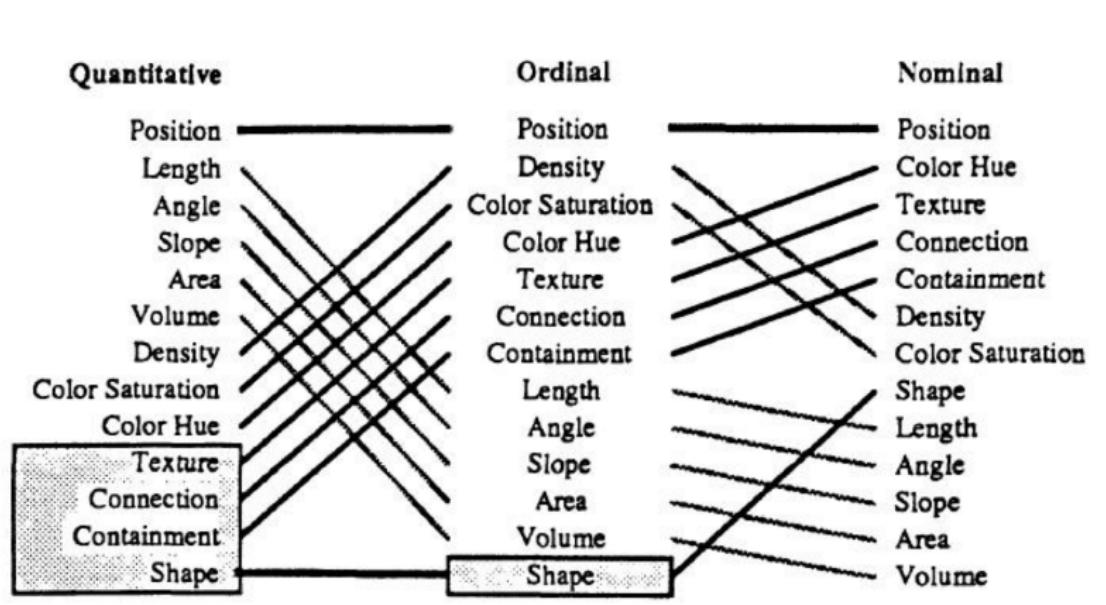


<https://www.color-blindness.com/coblis-color-blindness-simulator/>

Two Principles by Jacques Bertin (1967)

- ▶ The Principle of expressiveness — “Say everything you want to say – no more, no less — and don’t mislead”
- ▶ The Principle of effectiveness — “Use the best method available for showing data”

Mackinlay



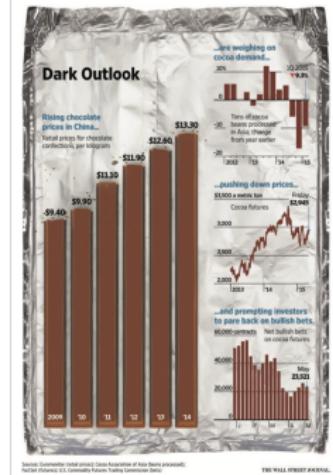
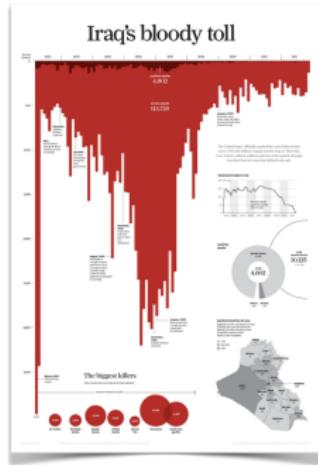
https://infovis-wiki.net/wiki/File:Mackinlay_PerceptualTask.jpg

Elegant Design

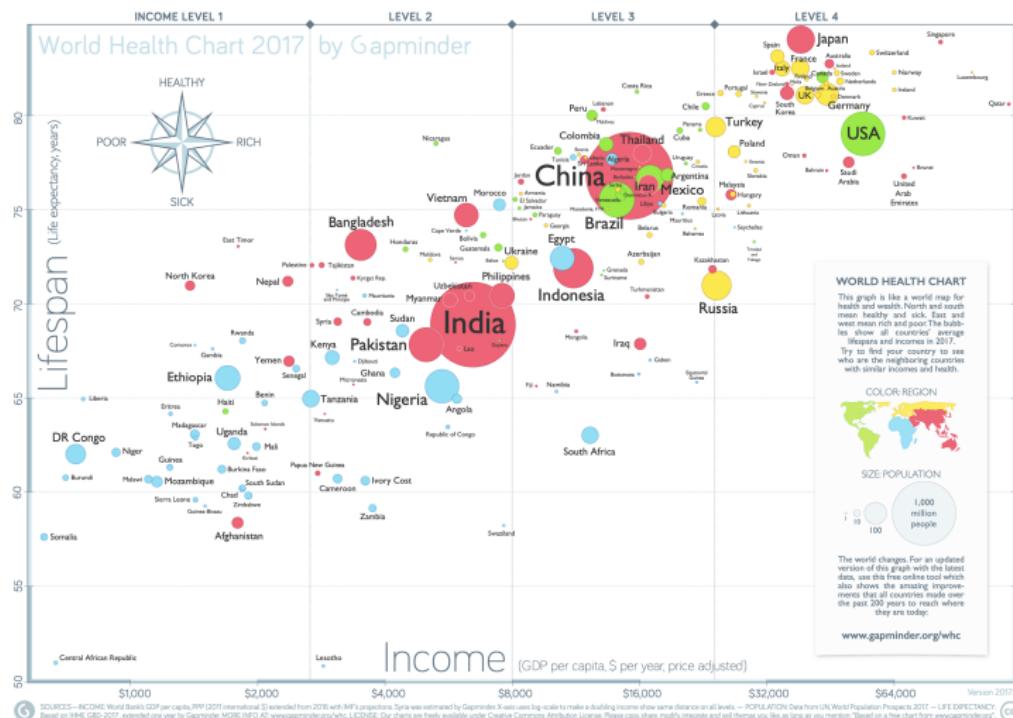


“Do not make something unless it is both necessary and useful; but if it is both, do not hesitate to make it beautiful.”

Elegant Design



Elegant Design



Note!!

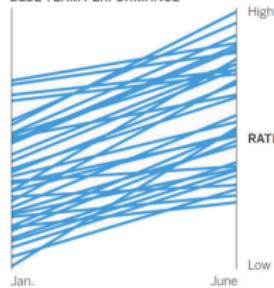


- วิเคราะห์/ศึกษาบริบทก่อนเสมอ
- อย่าสร้างทั้งหมดข้อมูลที่ทำให้เกิดความคลาดเคลื่อนหรือเข้าใจผิด
 - เลือก Chart และเครื่องมือการสร้างที่เหมาะสมกับข้อมูล
 - จะใช้อะไรแกน Y (และ/หรือ แกน X) ด้วยว่าเป็นแกนของตัวแปรหรือข้อมูลอะไร
 - การนำเสนอดATA หรือปริมาณของตัวแปรควรเริ่มแกน Y จากค่า 0 เสมอ
- นำเสนอแต่เพียงตัวอย่างที่สำคัญที่สุดเท่านั้น ระวัง “Chartjunk”
- อย่าทำแผนภาพ 3D หากไม่จำเป็น
- ใช้สีใหม่ประลิอภิภาพสูงสุด
- เน้นลิงค์สำคัญ
- ใช้สี/คำอธิบายแผนภาพเสมอ
- อย่าใช้ Default !!

เน้นสิ่งสำคัญ...

TEAM PERFORMANCE

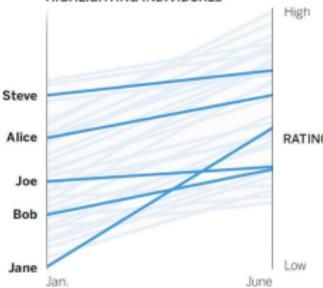
BLUE TEAM PERFORMANCE



SOURCE: COMPANY RESEARCH

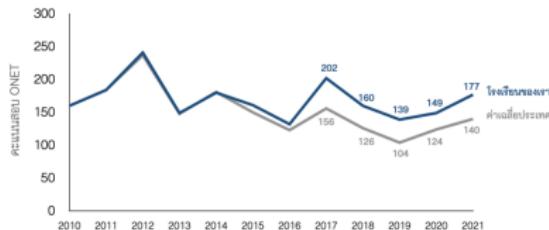
TEAM PERFORMANCE

HIGHLIGHTING INDIVIDUALS



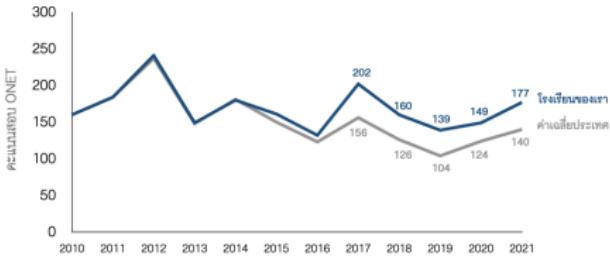
SOURCE: COMPANY RESEARCH

Berinato (2016)

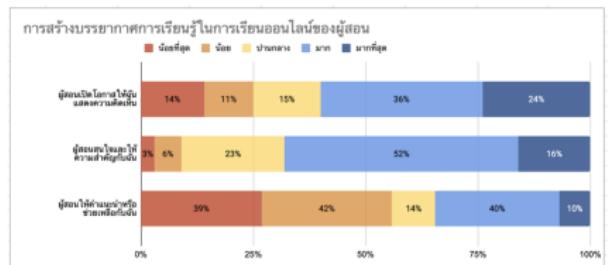
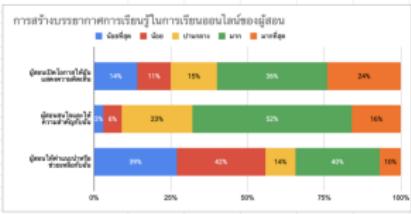


ดูป 1 คะแนน O-NET ใจเรียนของชาเบรีซ์เปที่ยกบัคค่าเฉลี่ยของประเทศไทยในช่วงปี 2010-2021

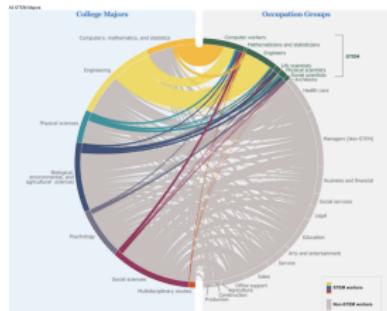
อย่าใช้ Default ...



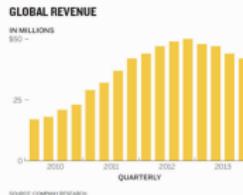
รูป 1 คะแนน O-NET โรงเรียนของภาฯเปรียบเทียบกับค่าเฉลี่ยของประเทศไทยในช่วงปี 2010 ถึง 2021



ความหมายสม/ประสิทธิภาพของแผนภาพไม่ใช่ค่าเบี้ยงสัมบูรณ์



<https://www.census.gov/dataviz/visualizations/stem/stem-html/>



GLOBAL REVENUE

IN MILLIONS

\$25 -

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

Q1 Q2 Q3 Q4

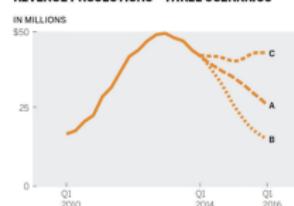
0 -
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Q1 Q2 Q3 Q4

REGIONAL REVENUE TRENDS, Q1 '10-Q4 '13

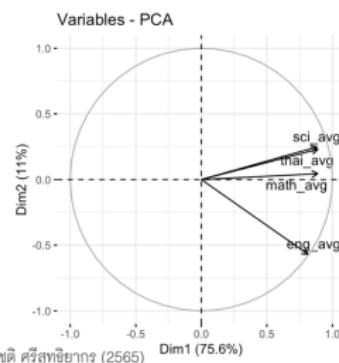


SOURCE: COMPANY RESEARCH

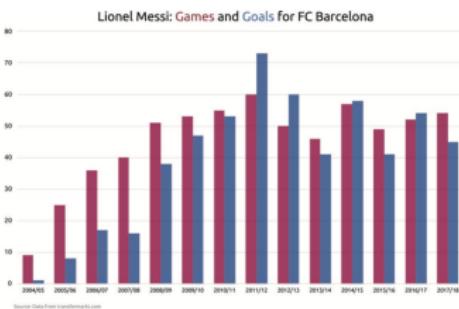
REVENUE PROJECTIONS—THREE SCENARIOS



Berinato (2016)



ສຶກສາໃຫຍ້ ດີວິຈານ ຂອງລາວ (2565)



Source: Data from lionscores.com

Kirk (2019)

LIVE PRESENTATION WRITTEN DOC OR EMAIL

