The Impact of Package Design Changes on Sales

Name: Youngjun Kim

Package Design

- ***We can find product package every where.***

Motivation

Package Design

"Package Design" → ***"Consumption"***

= "Advertising" *= "Consumers Decision"*

Why Important

- **Biggest medium** of communication (Behaeghel, 1991; Peters, 1994).
- Significant in customer's **decision making.**
- **Differentiate** the product from competitors.
- Reinforces a **brand and product positioning**.

Previous Literature

- Previous literature focused on individual elements in package design, mainly through experiments.
- Most research lack a holistic view in package design.

Literature Review (1)

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Package Design

- **Single elements were examined.**
- **Position** (Barbosa et al, 2012), **Color** (Huang, L., & Lu, J., 2015), **Health Claims** (Andre, Chandon, & Haws, 2019; Quentin, Chandon, & Haws, 2019), **Nutrition Label** (Lim et al, 2020), **Nutrition Information** (Creyer, & Burton, 2003) **Health Warnings** (McNeill, A. et al, 2017) **Package Size** (Yan, Sengupta & Wyer Jr, 2014), **Character** (Hebden, King, Kelly, Chapman, & Innes-Hughes, 2011; Chacon, Letona, & Barnoya, 2013) **Ingredient Pictures** (Thomas & Capelli, 2018)

- **Holistic Package** (Orth, U. R., & Malkewitz, K., 2008) :
  - Data made with 9 professional designers.
  - Images were taken in a professional photo studio.

Literature Review (2)

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Features

- ***Size*** of elements is essential to draw **attention** from consumers (Pieters & Wedel, 2004).
  - **Larger product pictures** created **more favorable attitudes** toward advertised brands (Percy & Rossiter, 1983).
- ***Location*** of the package elements affects **consumer perception** (Deng & Kahn, 2009).
  - The location of product image influences flavor perception and healthy eating decisions (Togawa, Park, Ishii, & Deng, 2019).
  - Consumers prefer more powerful brands with logos higher on packages (Sundar & Noseworthy, 2014).

- ***Text-Image Congruence*** helps the impression formation process and increases attention (Van Rompay, De Vries, & Van Venrooij, 2010; Powell, Boomgaarden, De Swert, & de Vreese, 2015; Houts, Doak, Doak, & Loscalzo, 2006).

- ***Colors*** of the package deliver the information about product's sensory properties such as taste and abstract brand attributes (Garber Jr, Hyatt, & Starr Jr, 2000; Spence & Velasco, 2018).

Package Elements

Category	Elements	Features	Literature
Text	▪ Product Name ▪ Brand ▪ Size Mention ▪ Claims (Health / Taste) ▪ Other Texts ▪ Flavor	▪ Texts ▪ Size ▪ Location	Sundar, A., & Noseworthy, T. J. (2014), Klink, R. R. (2003). Laforet, S. (2011) Krishna, A., Cian, L., & Aydınoğlu, N. Z. (2017). Andre, Chandon, and Haws (2019), Chandon, P., & Wansink, B. (2012). Elder, R. S., & Krishna, A. (2010), Cian, L., Krishna, A., & Schwarz, N. (2015) Garber Jr, L. L., Hyatt, E. M., & Starr Jr, R. G. (2000).
Image	▪ Colors ▪ Logo ▪ Product Picture ▪ Character ▪ Ingredient Picture ▪ Certification Labels	▪ RGB & HSL ▪ Size ▪ Location	Spence, C., & Velasco, C. (2018), Garber, L. L., Burke, R. R., & Jones, J. M. (2000). , Gorn, G. J.,Chattopadhyay, A., Yi, T., & Dahl, D. W. (1997), Mead, J. A., & Richerson, R. (2018) Klink, R. R. (2003). Sundar, A; Noseworthy, TJ (2014), Barbosa, A. A. L., de Moura, J. A., & de Medeiros, D. D. (2021). Underwood, R. L., & Klein, N. M. (2002), Deng, X., & Kahn, B. E. (2009)., Barbosa, A. A. L., de Moura, J. A., & de Medeiros, D. D. (2021), Togawa, T., Park, J., Ishii, H., & Deng, X. (2019)., Underwood, R. L., & Klein, N. M. (2002) Hebden, L., King, L., Kelly, B., Chapman, K., & Innes-Hughes, C. (2011), Chacon, V., Letona, P., & Barnoya, J. (2013) Thomas, F., & Capelli, S. (2018), Capelli, S., & Thomas, F. (2021) Piqueras-Fiszman, B., & Spence, C. (2015), Lim et al (2020), Ikonen, I., Sotgiu, F., Aydinli, A., & Verlegh, P. W. (2020), Buttriss, J. L. (2018)

Package Design

Number	Topic	Current Status
#1.	A Systematic analysis of products' front package design elements using machine learning	▪ A small number of package design data. ▪ **Data Augmentation** for better model performance.
#2.	Optimize promotion messages by selecting the right words and colors. - The Interaction between Health Claims and Size Claims	▪ Found some interesting patterns. ▪ Reviewing papers for **surveys.**
#3.	The Impact of Package Design Changes on Sales	▪ **Preprocessing** ▪ Acquiring Images for Analysis.

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Topic #3.

- Data : Sales Data from Franchised Mart (110 stores) (in 000 KRW)
- Category : Beer
- Dates : 2021.01.01 ~ 2022.04.30 (Monthly)
- 196 different kinds of beers have sales data every month.

- Can : 138, Bottle : 32, …

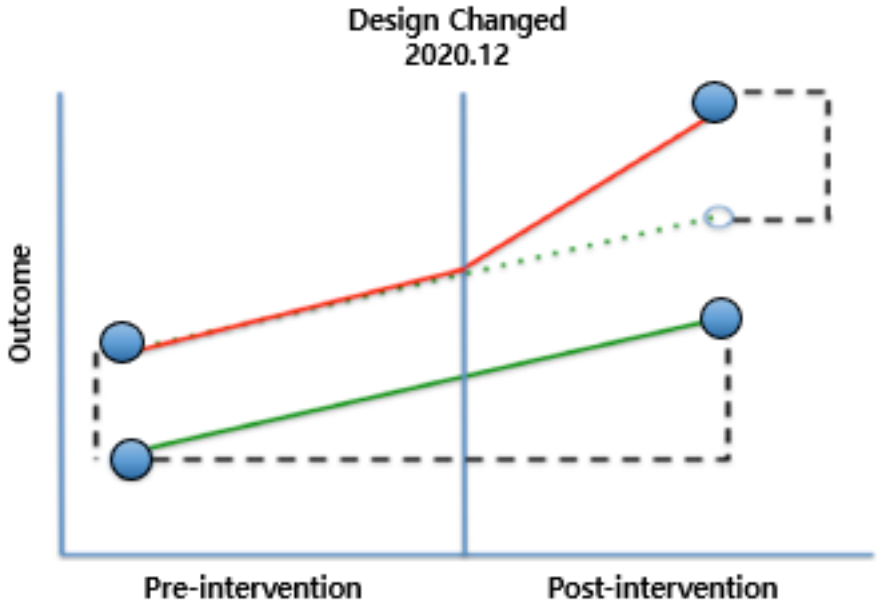
Topic #3.

Package Design Elements

- Product Name
- Logo
- Character
- Image
- Health Claim
- Texts
- Product Picture

Feature Extraction

- Size
- Location
- Color
  - Major Color
  - Color Contrast



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Package Elements

Elements

- ☐ Product Name
- Logo
- Flavor
- Brands
- Manufacturers
- Product Pictures
- Ingredient Pictures
- ☐ Images
- Certification Labels
- Health Claim
- Size Mention
- Colors
- Sizes of the elements
- Locations of the elements

Texts & Images

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Color Extraction

RGB →

24.8% 23.9% 23.9% 19.7% 7.6%

→ [navy, teal, white, teal, gray]

RGB →

32.0% 28.3% 15.2% 12.6% 11.9%

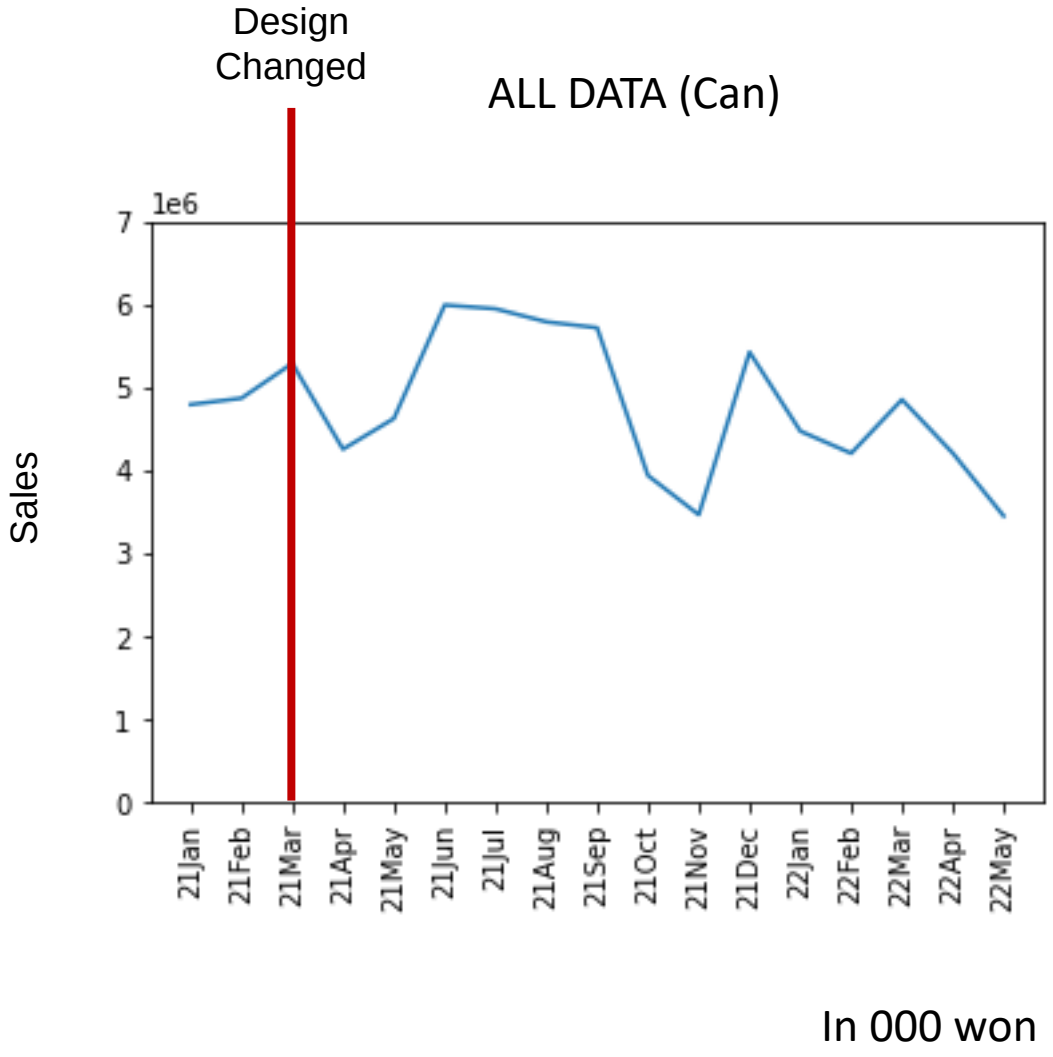
→ [teal, navy, white, gray, aqua]

Perimetric Complexity

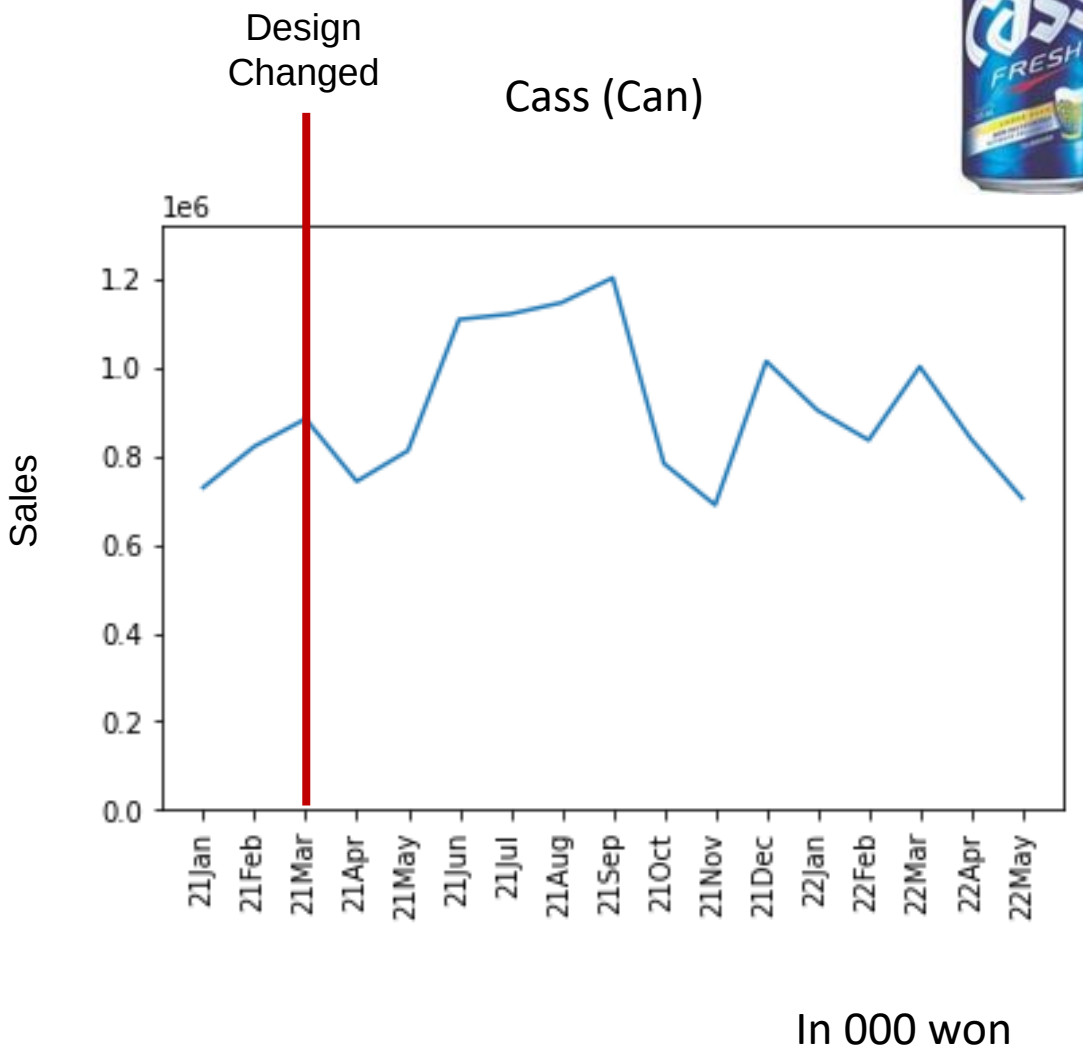
Perimetric Complexity
60.37

Perimetric Complexity
52.31

Topic #3.



In 000 won



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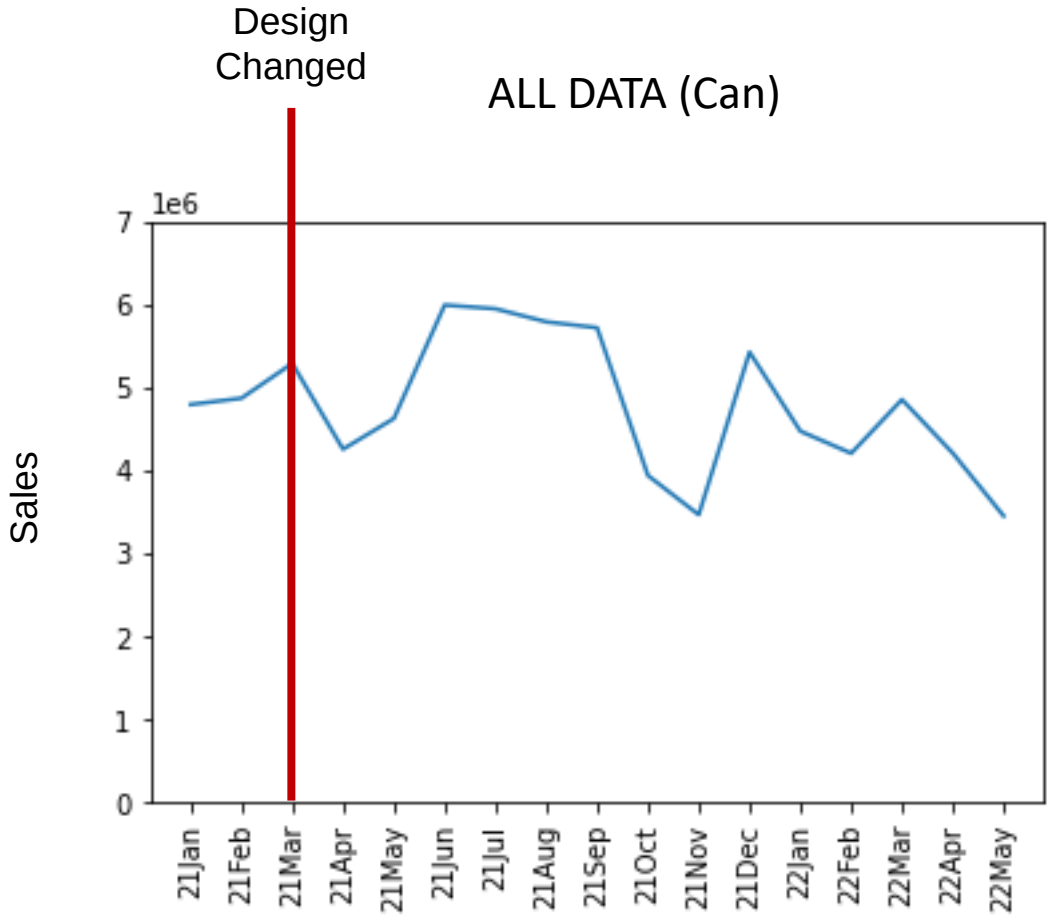
Topic #3.



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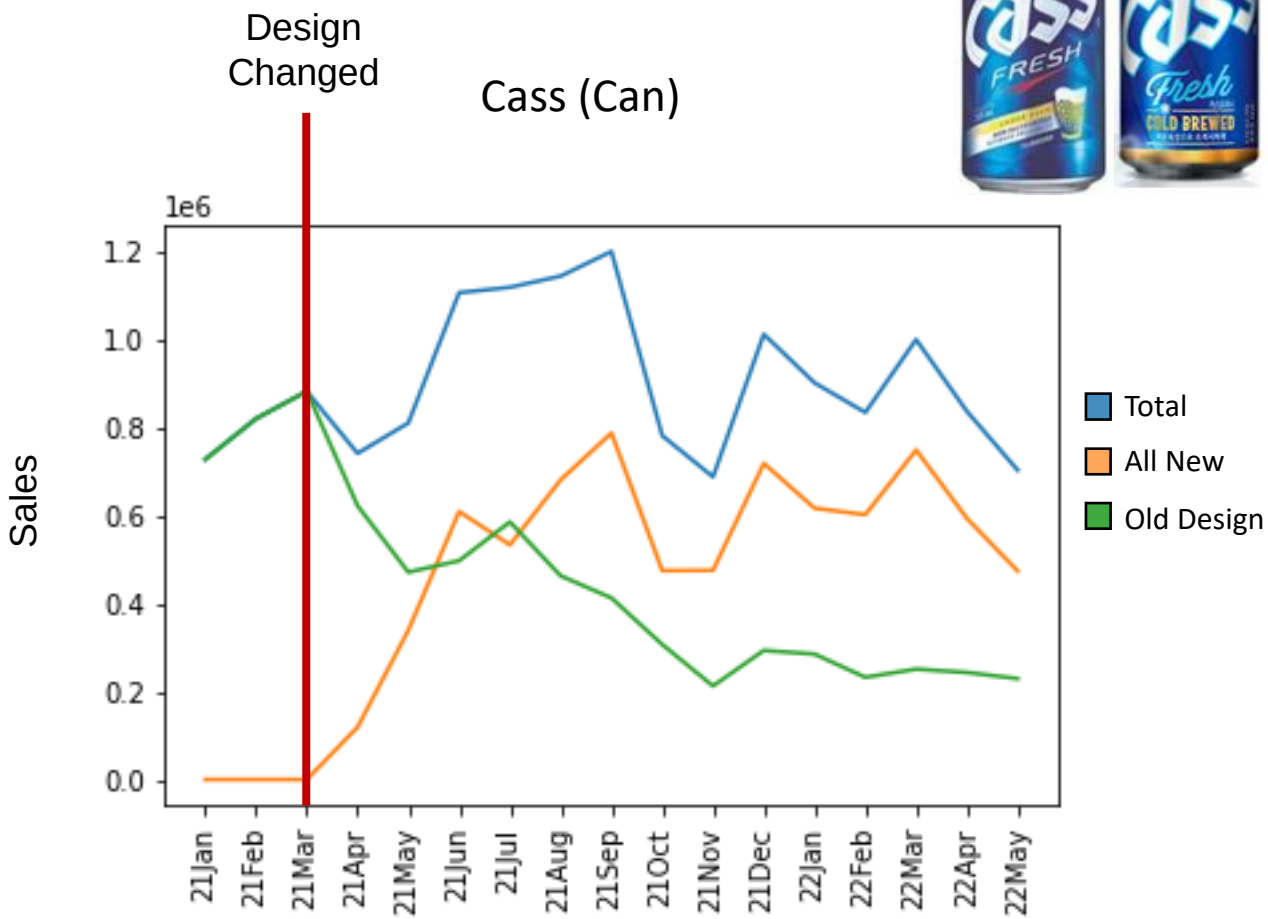

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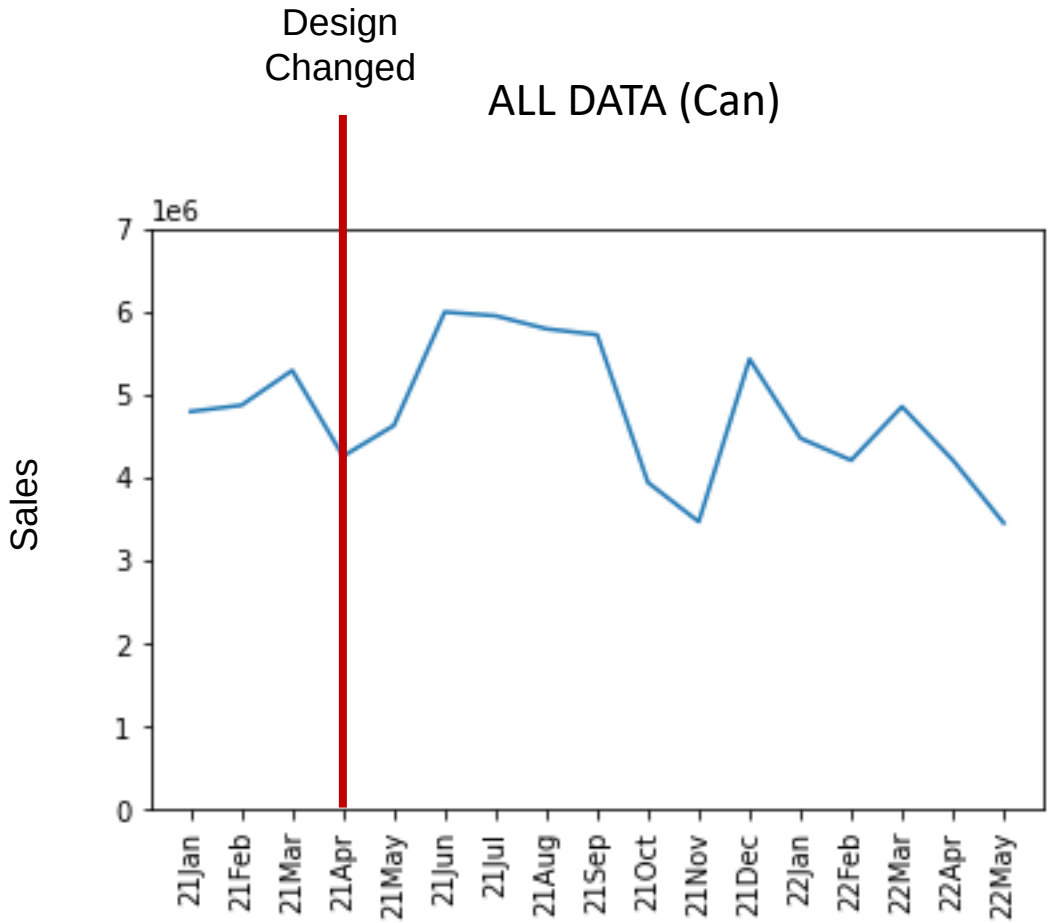
Topic #3.



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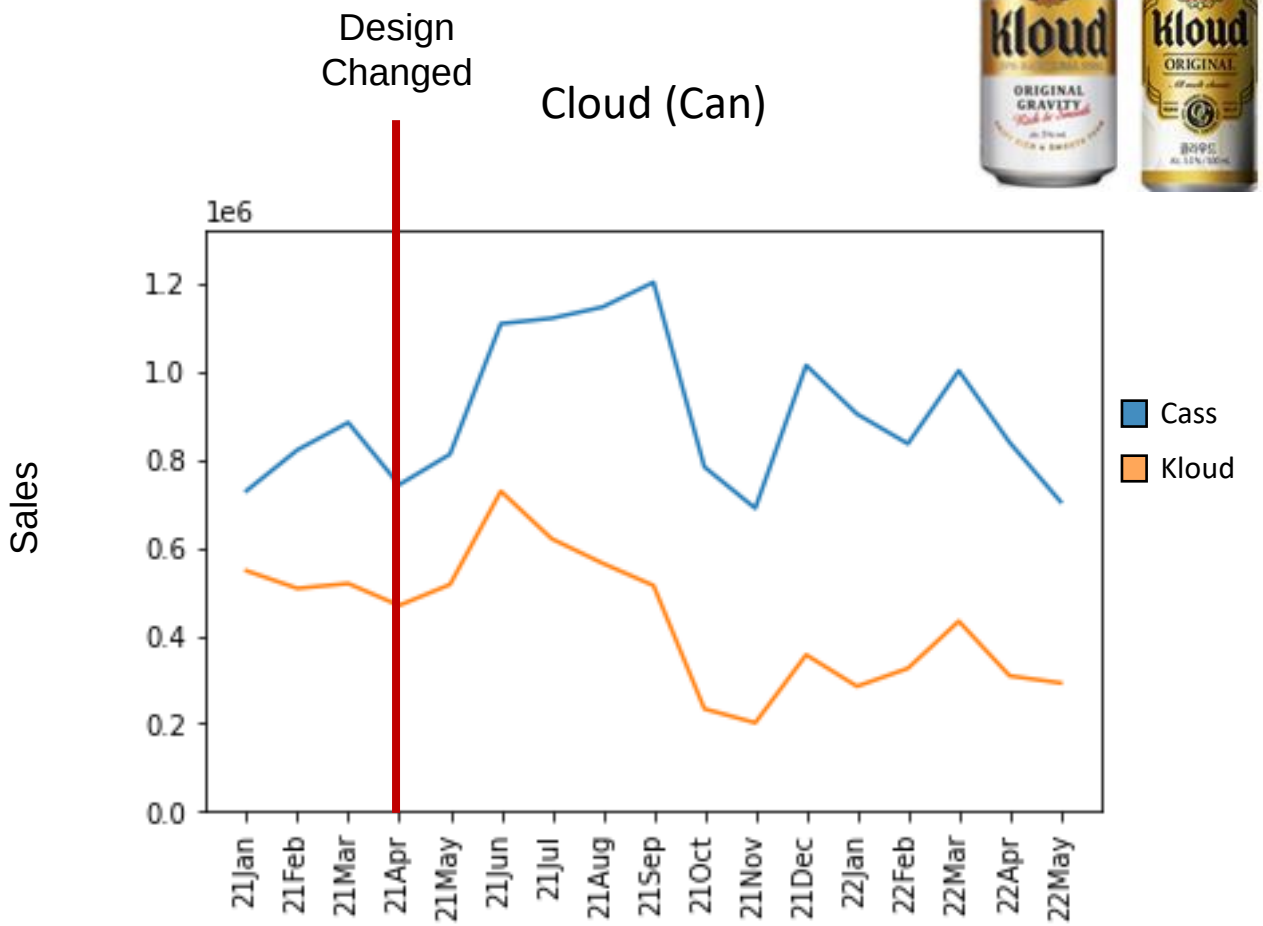

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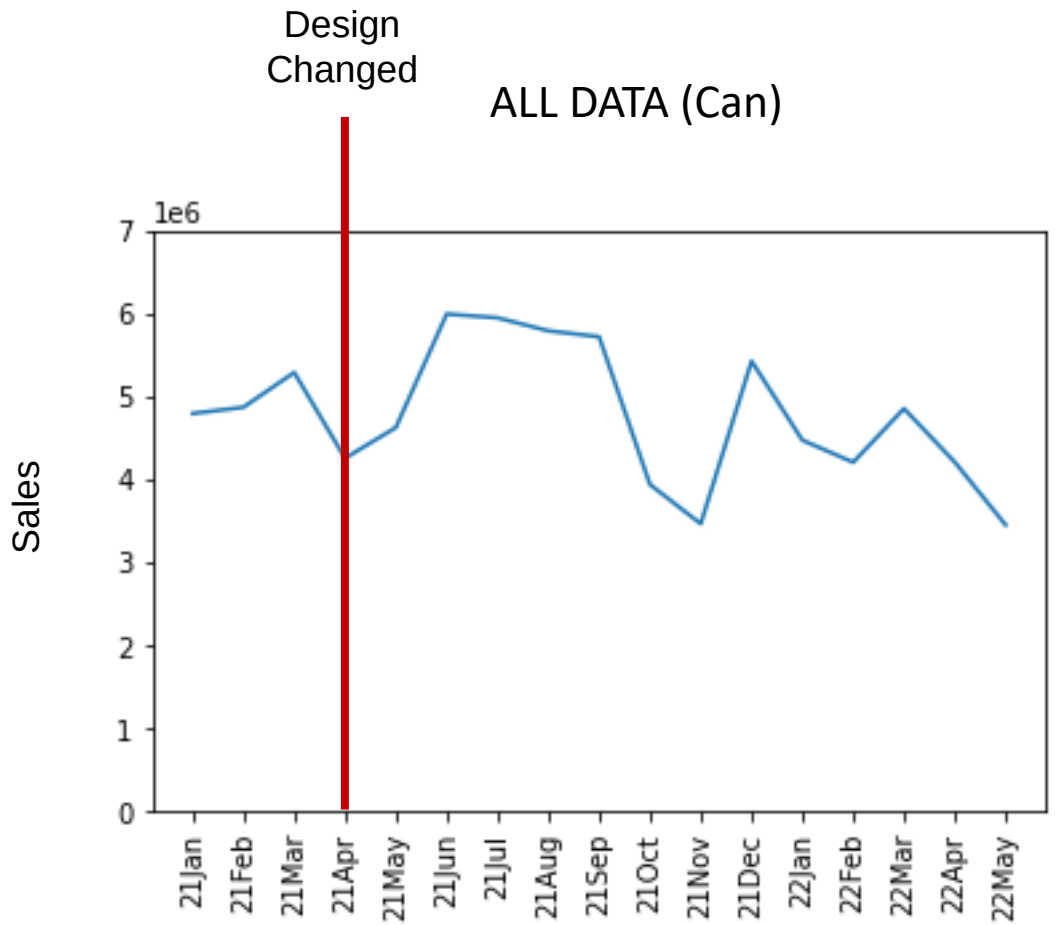
Topic #3.



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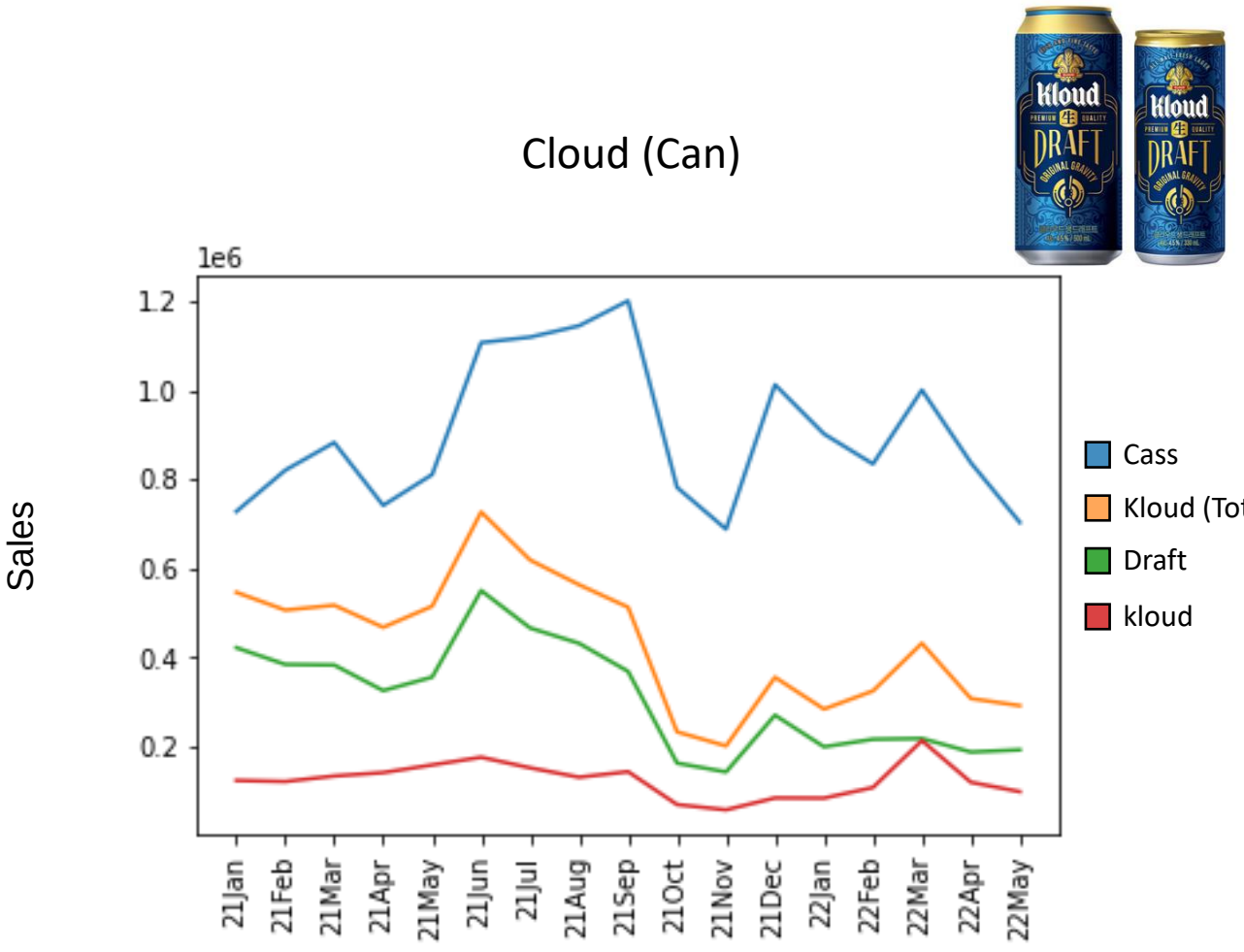
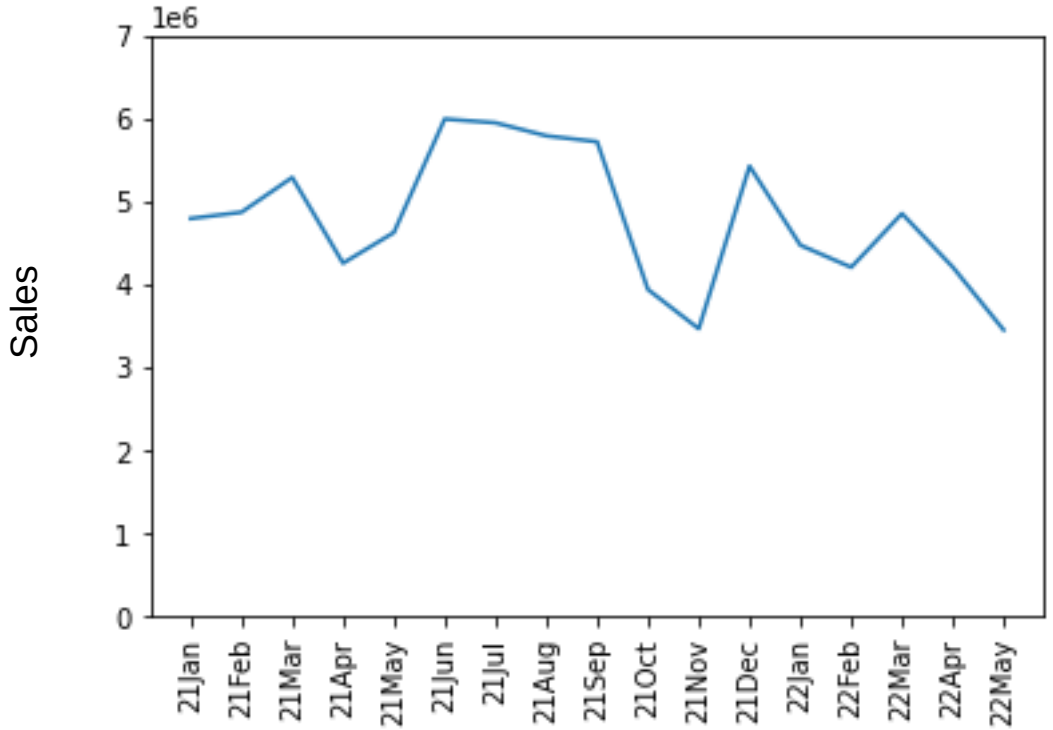


In 000 won

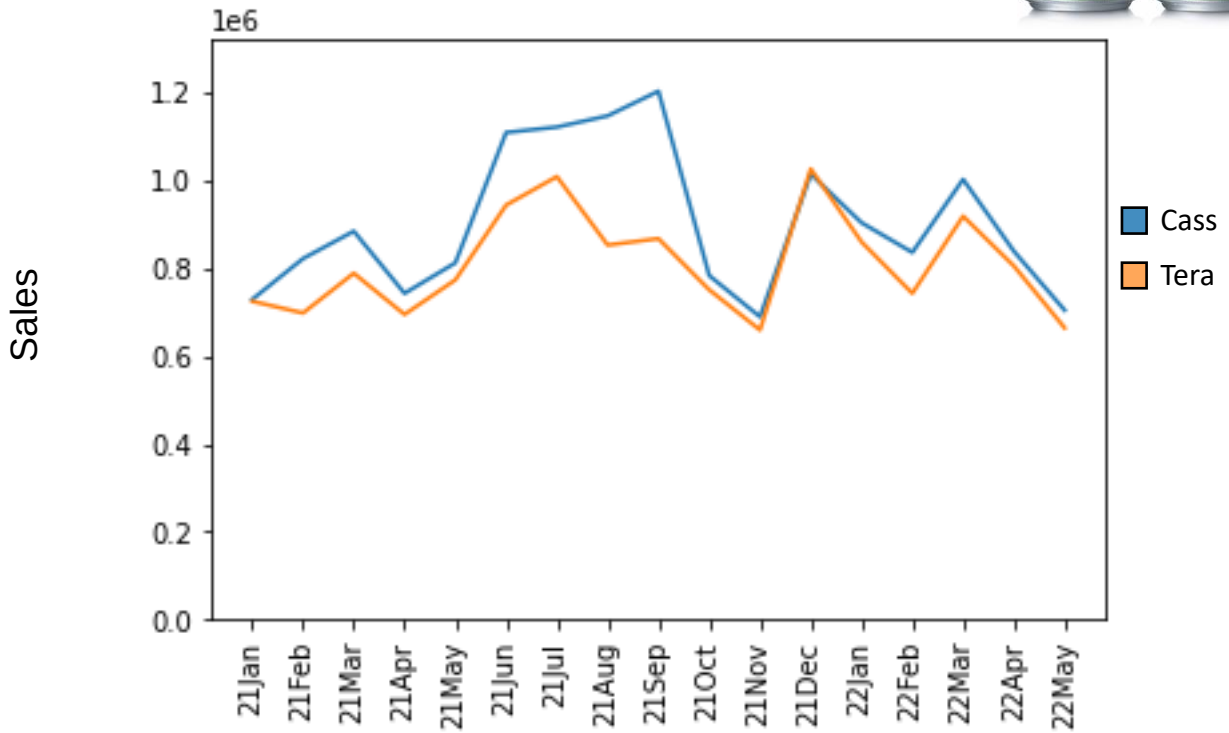
Topic #3.

ALL DATA (Can)



In 000 won

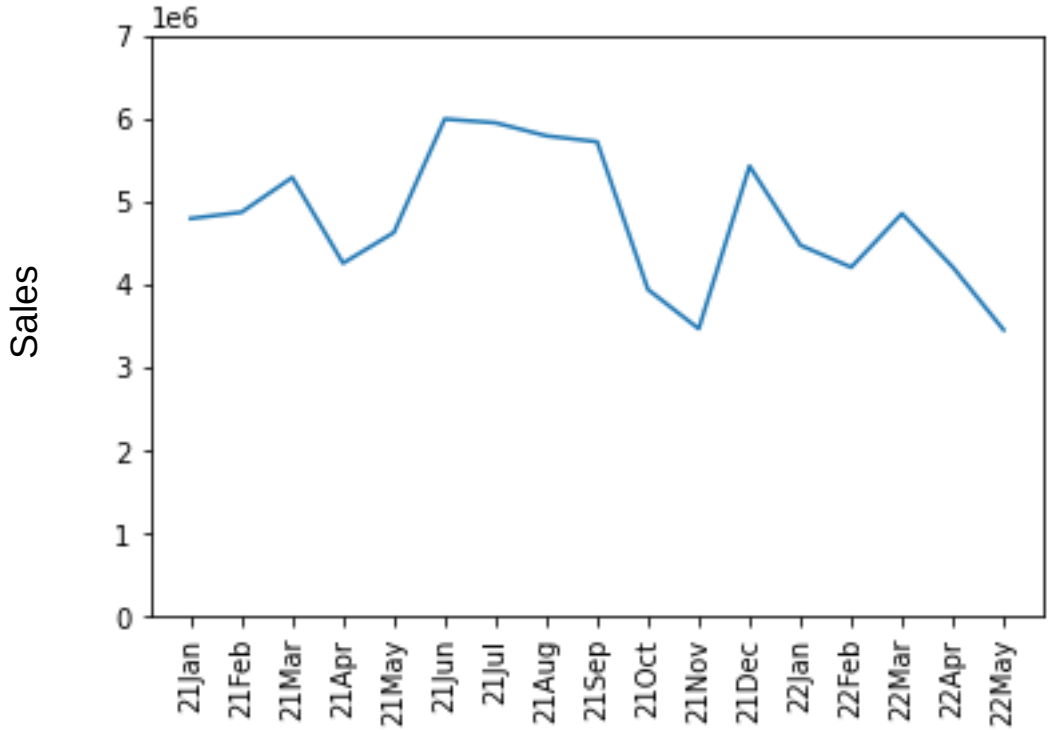
Tera (Can)



In 000 won

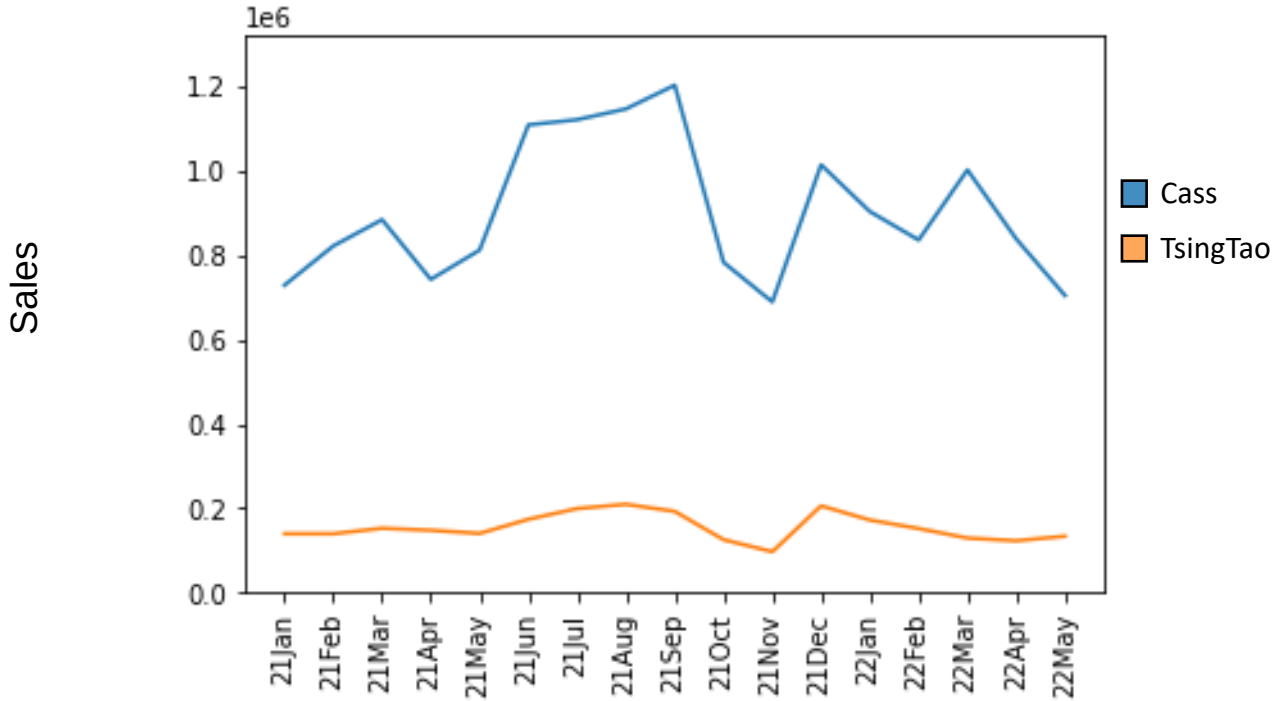
Topic #3.

ALL DATA (Can)



In 000 won

TsingTao (Can)



In 000 won

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Top 30 of 113 Stores

지점	Total_Sum
중계점	1,546,179.8740
김포한강점	1,437,108.5740
첨단점	1,398,225.8470
의왕점	1,374,898.5800
월드컵점	1,337,970.9330
시흥배곧점	1,289,359.6710
잠실점	1,286,557.4810
울산점	1,246,751.1200
롯데몰수지점	1,185,787.2440
남악점	1,165,060.5520
삼산점	1,131,979.0740
서울역점(위탁경영점)	1,130,976.0690
대덕점	1,101,621.7590
장유점	1,098,002.1640
청량리점	1,095,295.4320

지점	Total_Sum
은평점	1,063,701.2880
사상점	1,054,702.2780
군산점	1,042,296.5610
김포공항점	1,041,554.1960
여수점	1,040,409.5780
송파점	1,039,550.7720
구미점	1,007,845.4910
서초점	993,066.9770
양덕점	982,231.2880
서청주점	976,494.2500
인천터미널점(위탁영영점)	953,709.1690
수완점	921,475.0960
시흥점	912,081.4310
부평점	896,279.6440
화명점	892,477.2240

In 000 won

Conclusion

Implication

▪ Theoretical Implication

- There is very **few research** examining package design elements holistically, and even these research are based on **human judgement** and lack **systematic analysis** of the elements.
- Using image analysis tools, we analyze how different package elements can affect the sales.

▪ Managerial Implication

- Provide insight on how different kinds of package elements affect positively/negatively.
- Suggest how managers should utilize the package elements.

▪ Limitation

- Product Category (beer)
- Only 16 months
- Few numbers of design changed products in the data.

Thank You!

Frosted Chocolate Flakes
CORN FLAKES
Oat Flakes
Muffin Mix
Tiramisu
Penne
Olive OIL
Rice
Bread Mix
CHICKEN Soup
Tagliatelle
SUGAR
STEVIA
MILK LIGHT
SunFlower
Vegetables
NOODLE
COFFEE
Drinking Chocolate
Rice
Finest Quality
Nuts
Spring
Chocolate
Peanut
HairColor
Body Wash
YRUP
TAM
MARMALA
YOGURT
Spaghetti
PIZZA
Cheese Pie
Keep Frozen
TEA

Package Design

Number	Topic	Current Status
#1.	A Systematic analysis of products' front package design elements using machine learning	▪ A small number of package design data. ▪ **Data Augmentation** for better model performance.
#2.	How packaging design influences consumers? - The Interaction between Health Claims and Size Claims	▪ Found some interesting patterns. ▪ Reviewing papers for **surveys.**
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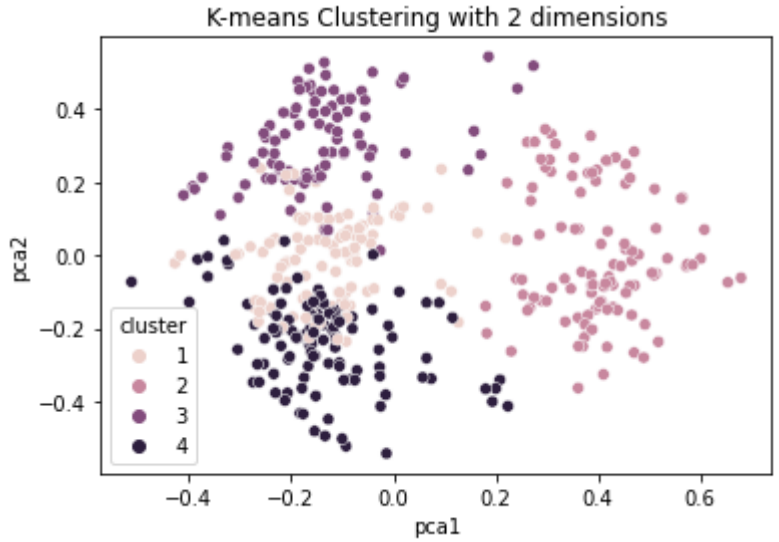
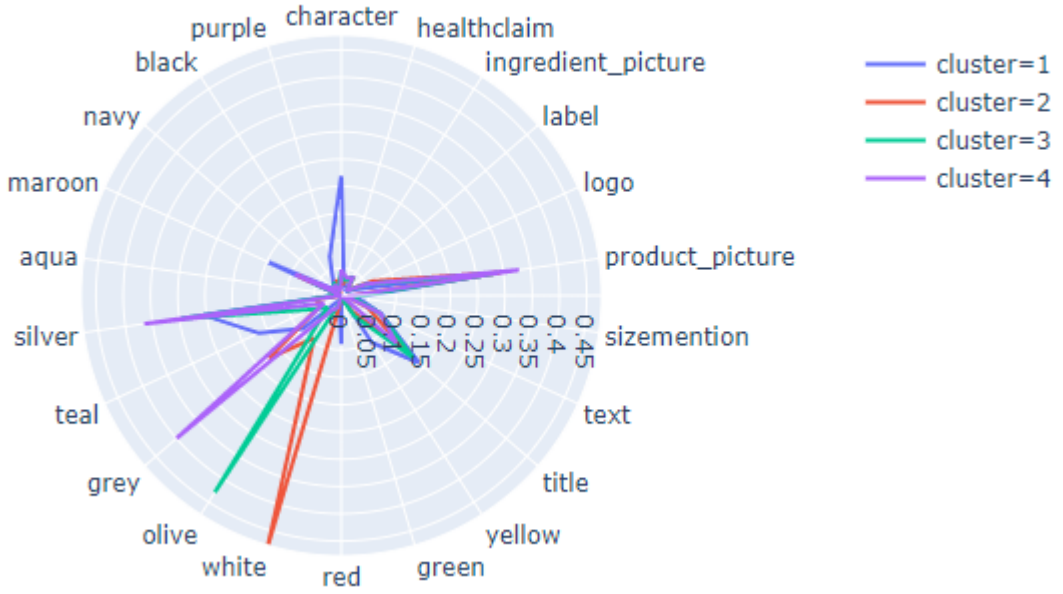
K-means Clustering





Topic #1. Summary of Results

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Cluster 1 (N=105)

"Kids Appeal"

Characteristics

Brands:
Cheerios, Cap'n Crunch, Lucky Charms, Funko, Oreo o's, Froot Loops, Monsters, Pebbles, Cocoa Puffs …

Colors:
Maroon, Navy, Purple, Red, Teal, Yellow

Major Features:
Character, Size Mention, Texts, Product Name

Cluster 2 (N=107)

"Healthy"

Characteristics

Brands:
Kashi, Special k, Cascadian Farm Organic, Cinnamon Toast Crunch, Great Value, Nature's Path, Life Cereal …

Colors:
White

Major Features:
Certification Labels, Logo

Cluster 3 (N=91)

"Classics"

Characteristics

Brands:
Reese's Puffs, Chex, Nature's Path, Cheerios, Frosted Mini-Wheats, Honey Bunches Of Oats, EnviroKidz…

Colors:
Aqua, Black, Green, Olive

Major Features:
Ingredient Picture

Cluster 4 (N=115)

"Niche"

Characteristics

Brands:
Nature's Path, Barbara's, Cheerios, Ezekiel, Great Value, Chex, Special k, BariatricPal, Arrowhead Mills …

Colors:
Grey, Silver

Major Features:
Health Claim, Product Picture

Package Design

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Topic #2.

Health Claim

What is Health Claim?

- *A statement on a food or drink product, or in its advertising, that says that it is good for health.*
- ***Types:*** ***Not Adding Negatives :*** 'artificial flavor', 'additive', 'ingredients'
  Removing Negatives : 'trans fat', 'salt', 'gluten'
  Not Removing Positives : 'organic', 'all natural', 'pure'
  Adding Positives : 'fiber', 'antioxidants', 'omega'

(André, Q., Chandon, P., & Haws, K, 2019)

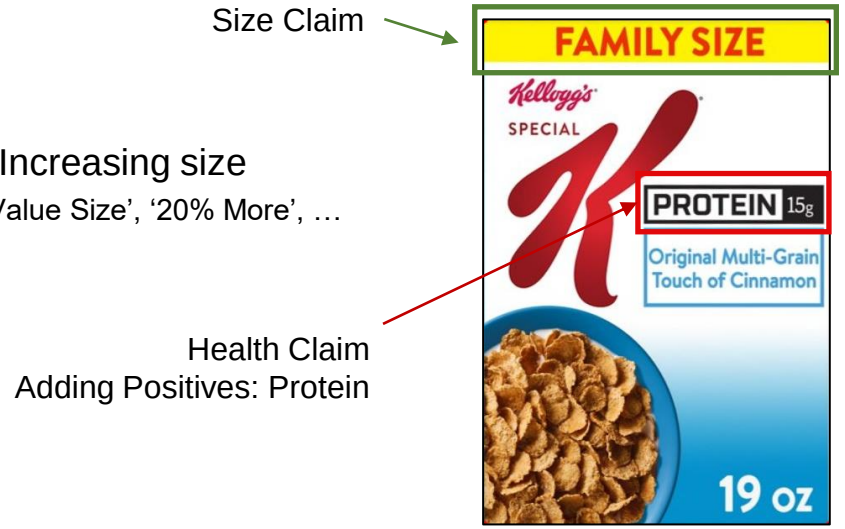
Why is it important?

"In 2016, the global health and wellness food market was valued at 707.12 billion U.S. dollars and is projected to increase to 811.82 billion U.S. dollars by 2021."

(Health and wellness food market value worldwide 2016-2021 by Nils-Gerrit Wunsch)

Size Claim

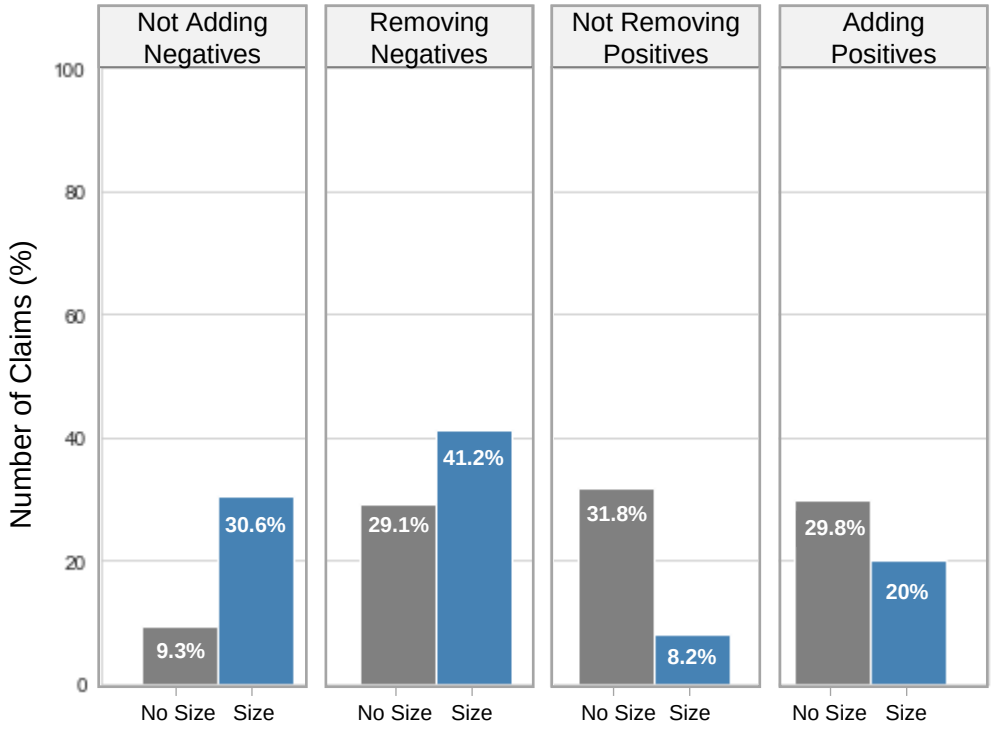
- A statement related to Increasing size
- Examples : 'Family Size', 'Value Size', '20% More', …



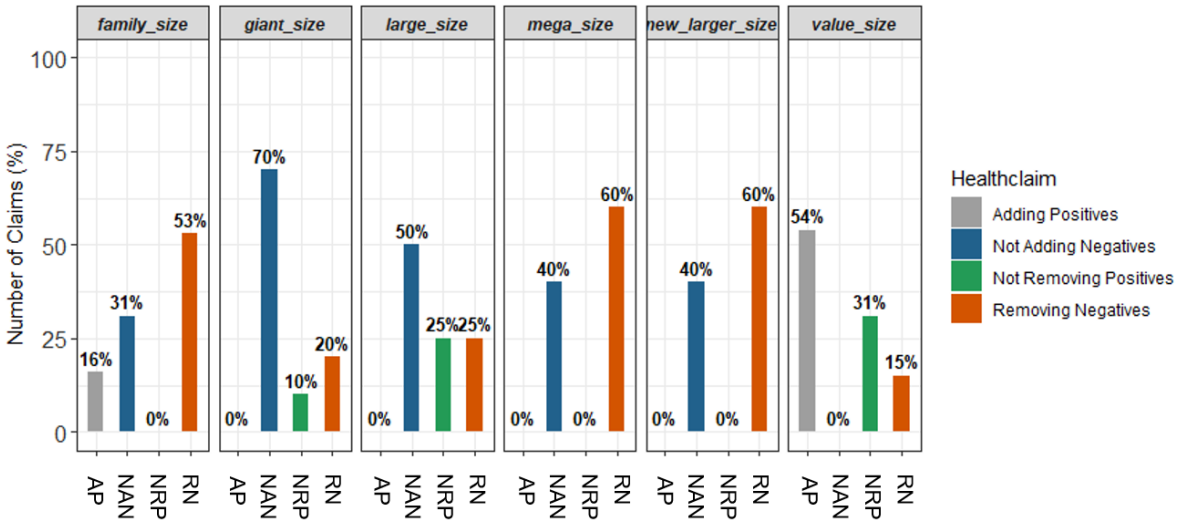
From our Data:

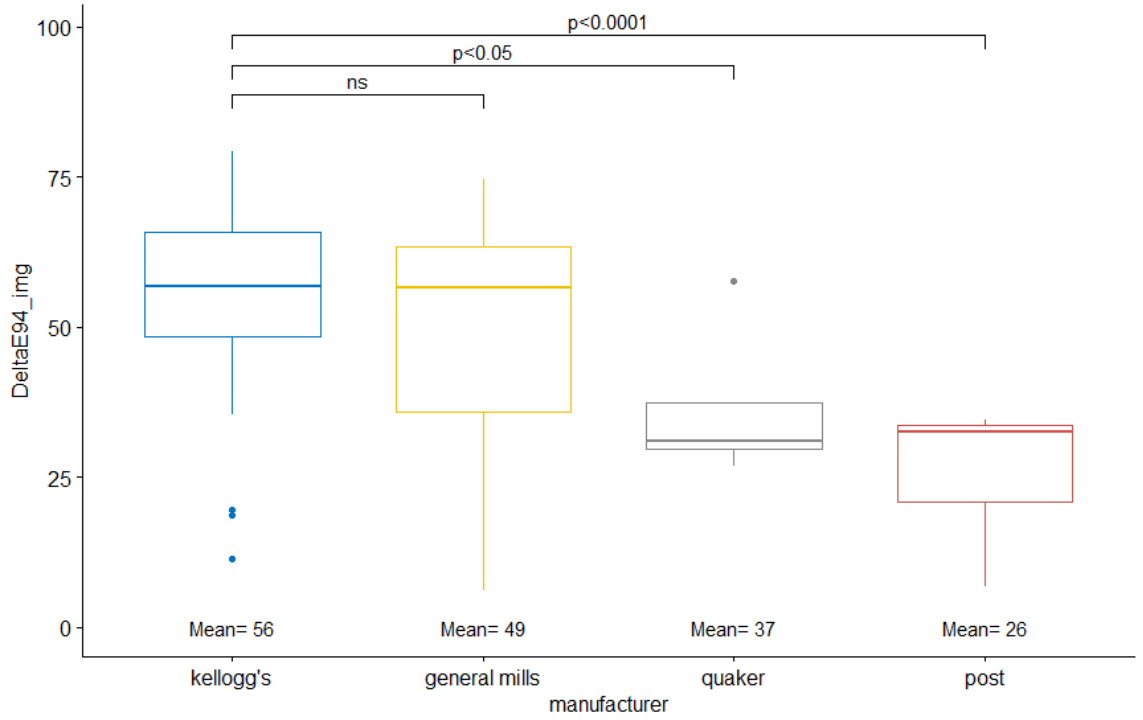
- It was confirmed that the proportion with and without size claim varies by Health Claim type.

→ Research Objective :
Examining the interaction between Health Claim and Size Claim as the main effect.



Topic #2.


family_size
giant_size
large_size
mega_size
new_larger_size
value_size
Number of Claims (%)
100
75
50
25
0
16%
31%
0%
53%
0%
70%
10%
20%
0%
50%
25%
25%
0%
40%
0%
60%
0%
40%
0%
60%
54%
0%
31%
15%
AP
NAN
NRP
RN
Healthclaim
Adding Positives
Not Adding Negatives
Not Removing Positives
Removing Negatives


p<0.0001
p<0.05
ns
DeltaE94_img
100
75
50
25
0
Mean= 56
Mean= 49
Mean= 37
Mean= 26
kellogg's
general mills
quaker
post
manufacturer

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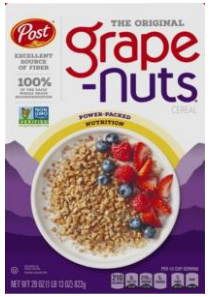
Color Extraction
K-means Clustering



RGB → → ['white', 'purple', 'grey']

Proportion: [0.408, 0.356, 0.236]

RGB → → ['maroon', 'grey', 'silver']

Proportion: [0.568, 0.230, 0.203]

RGB → → ['white', 'maroon', 'olive']

Proportion: [0.446, 0.294, 0.261]

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Text Detection

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Text Recognition

2020.12

2019.05

2021.02

2020.06

2021.04

2021.03

2019.05

2017.04

2021.01

BRAND	Total_Sales
카스 후레쉬	1.532151e+07
테 라	1.376127e+07
클라우드	7.412072e+06
칭타오	2.640624e+06
하이네켄	2.546429e+06
버드와이저	1.738069e+06
호가든	1.728172e+06
크로넨버그 1664	1.670166e+06
곰표	1.570061e+06
스텔라 아르투아	1.247487e+06
한맥	1.235331e+06
아사히	1.073563e+06
제주	9.289673e+05
카스 라이트	9.114476e+05
코젤	9.031837e+05
기네스	7.713972e+05
볼파스 엔젤맨	5.942541e+05
필스너 우르켈	5.756500e+05
에델바이스	5.409703e+05
하이트	5.373096e+05