The Impact of Package Design Changes on Sales

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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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- **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, …

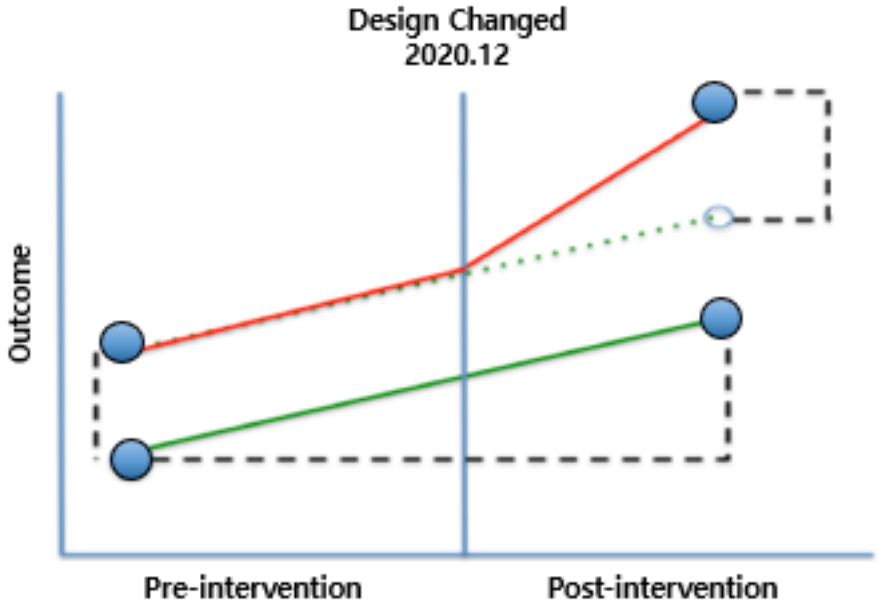
Topic #3.

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

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%

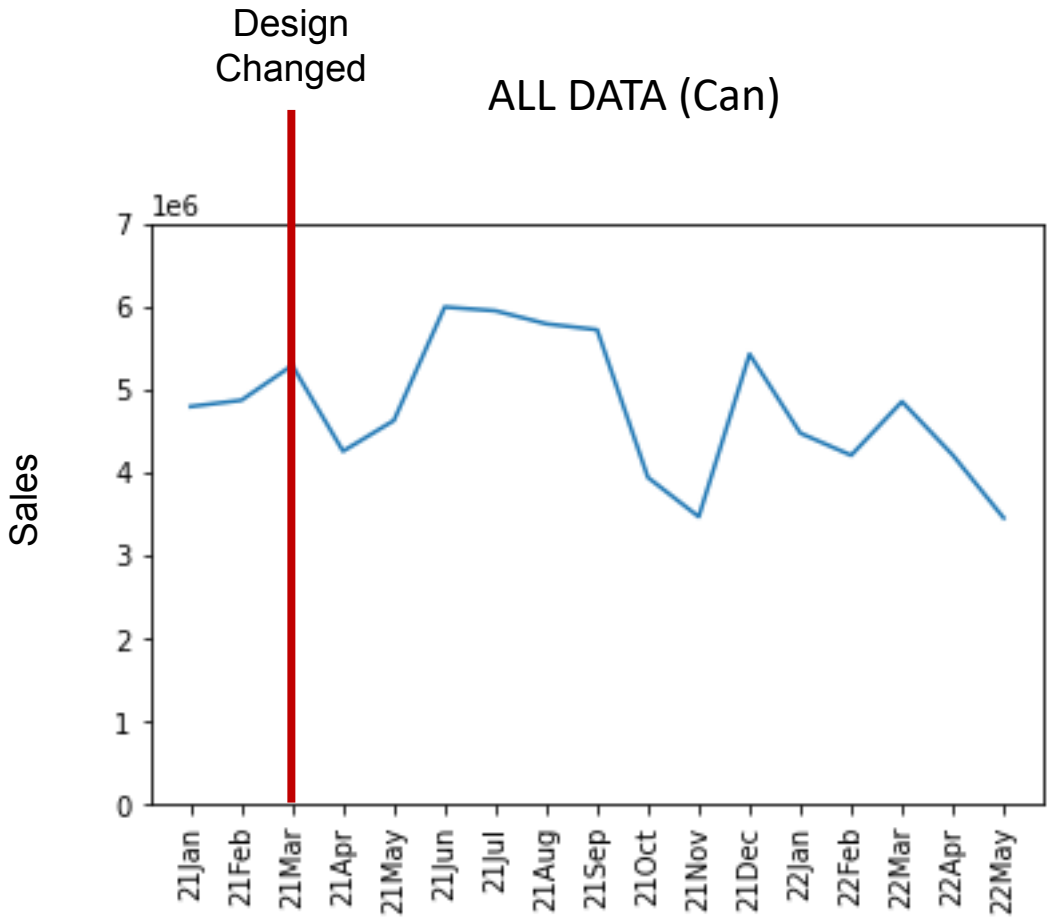
→ [teal, navy, white, gray, aqua]

Perimetric Complexity

Perimetric Complexity
60.37

Perimetric Complexity
52.31

Topic #3.



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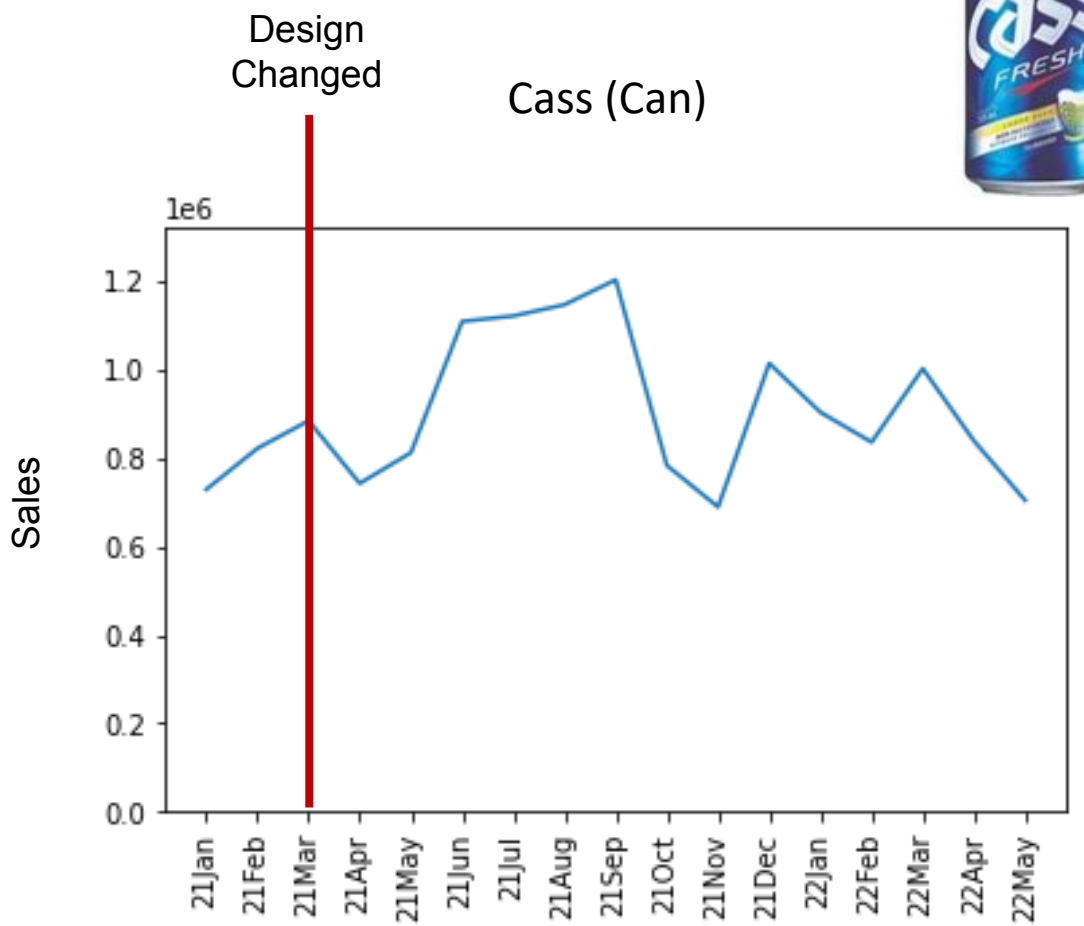

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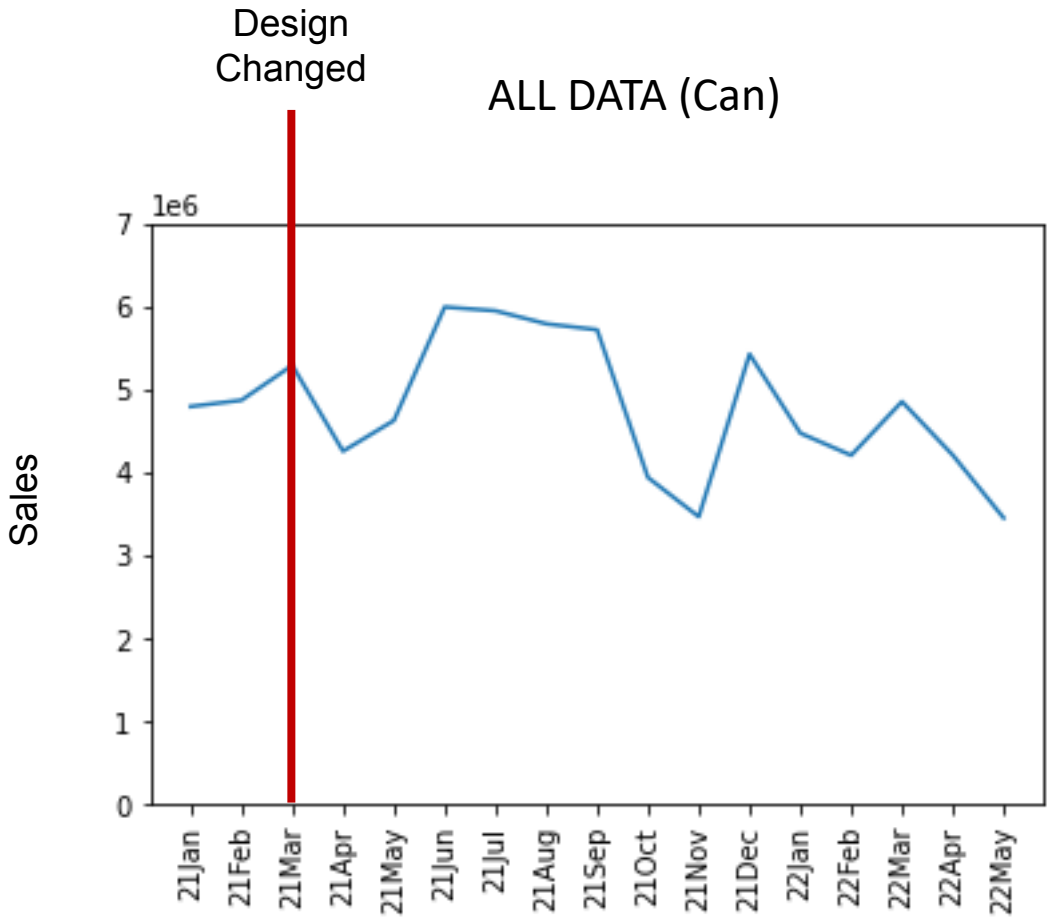

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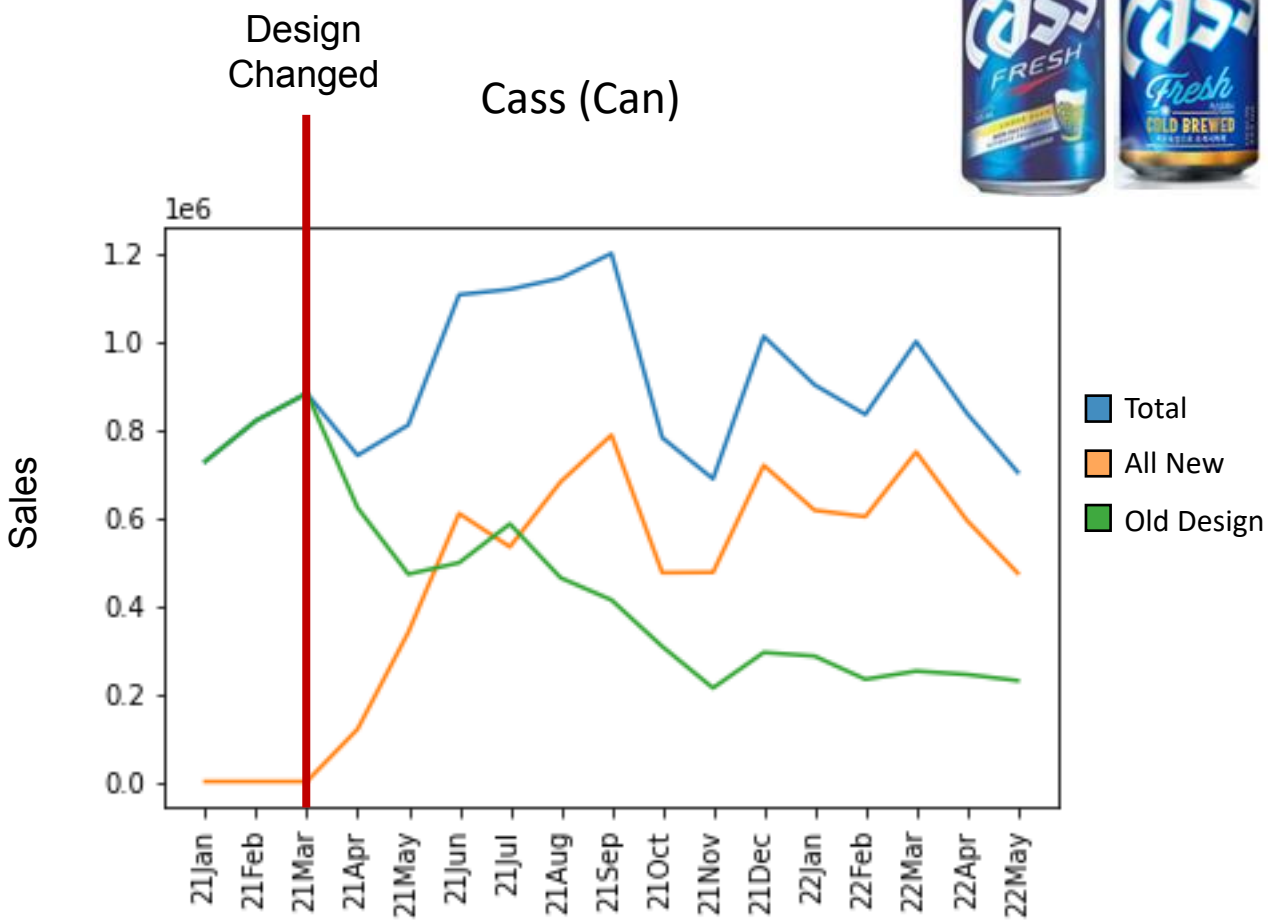

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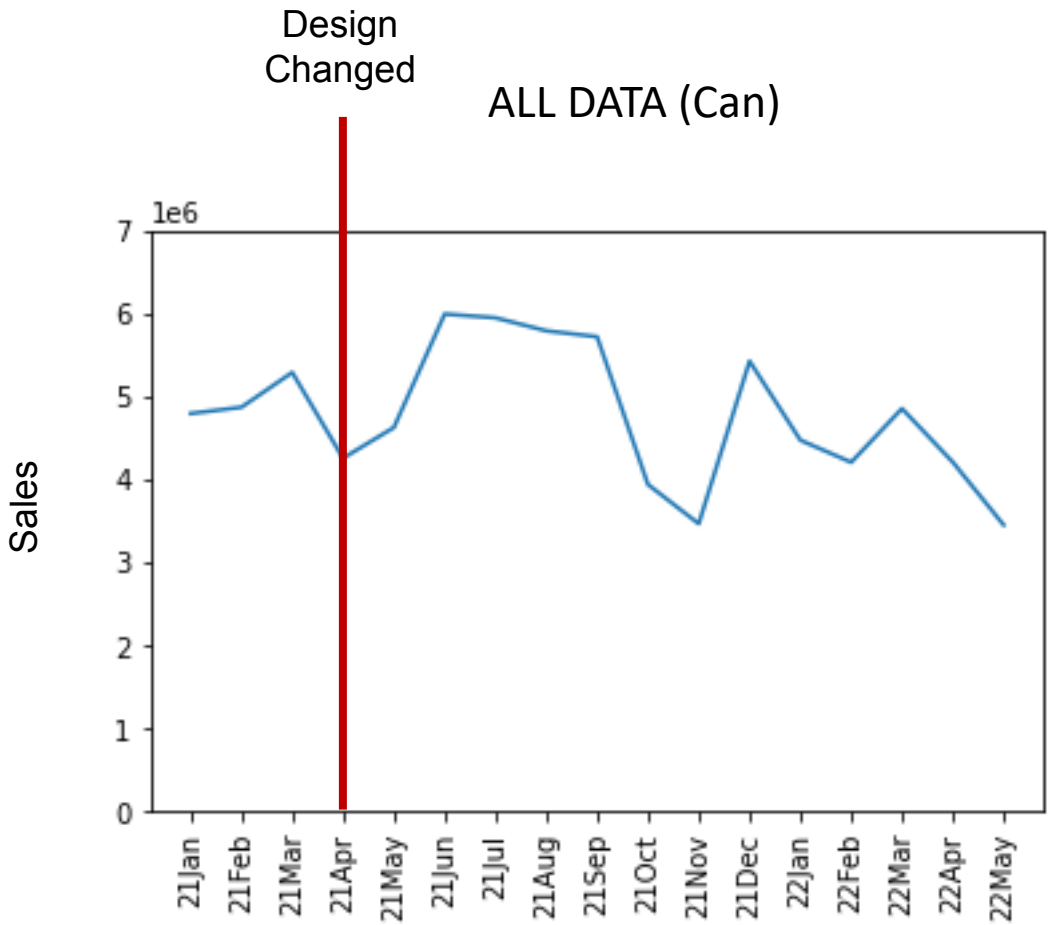

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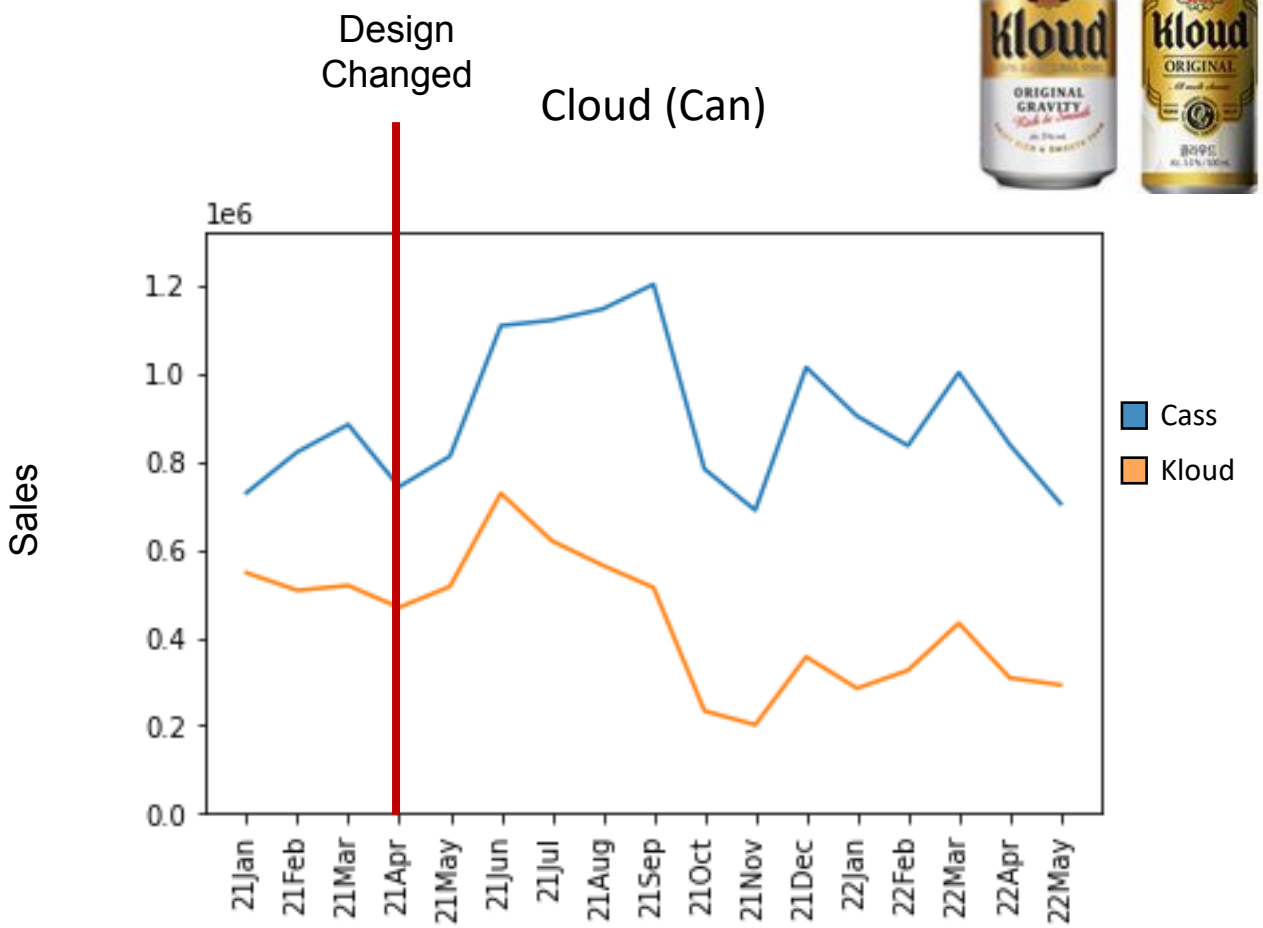

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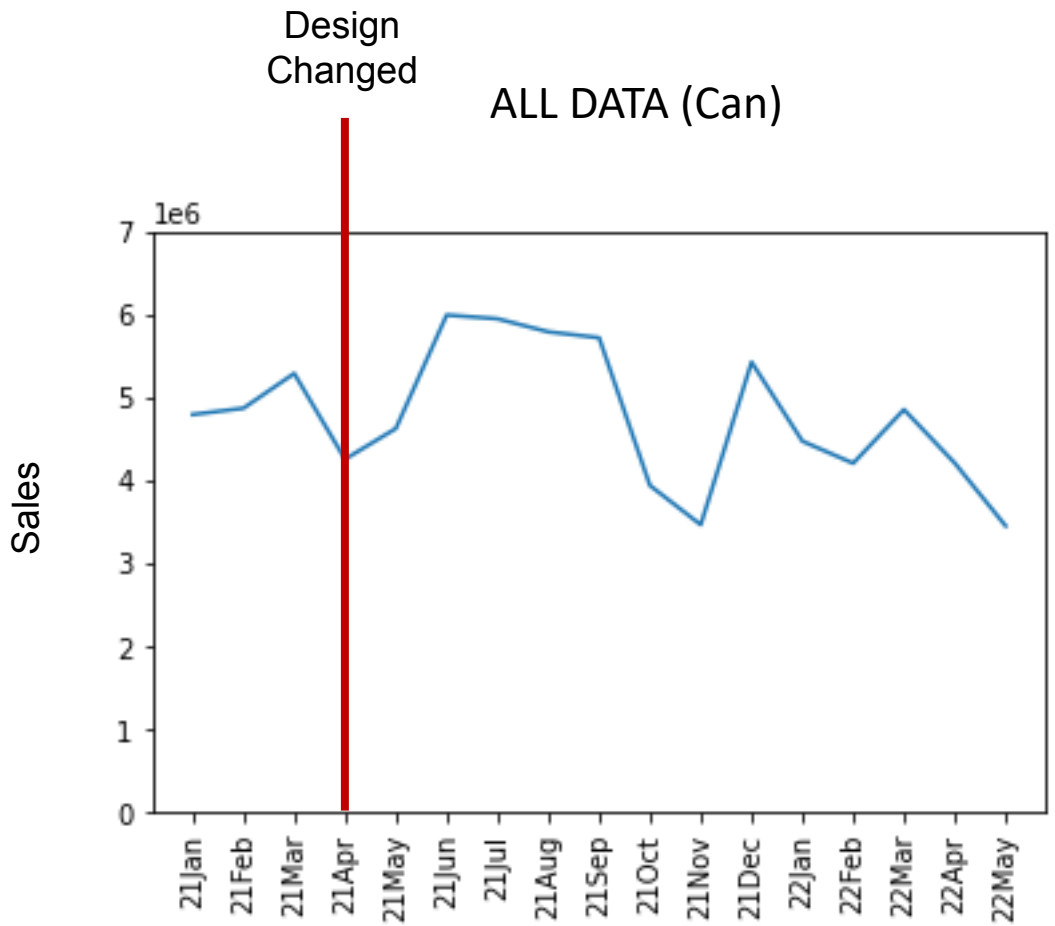

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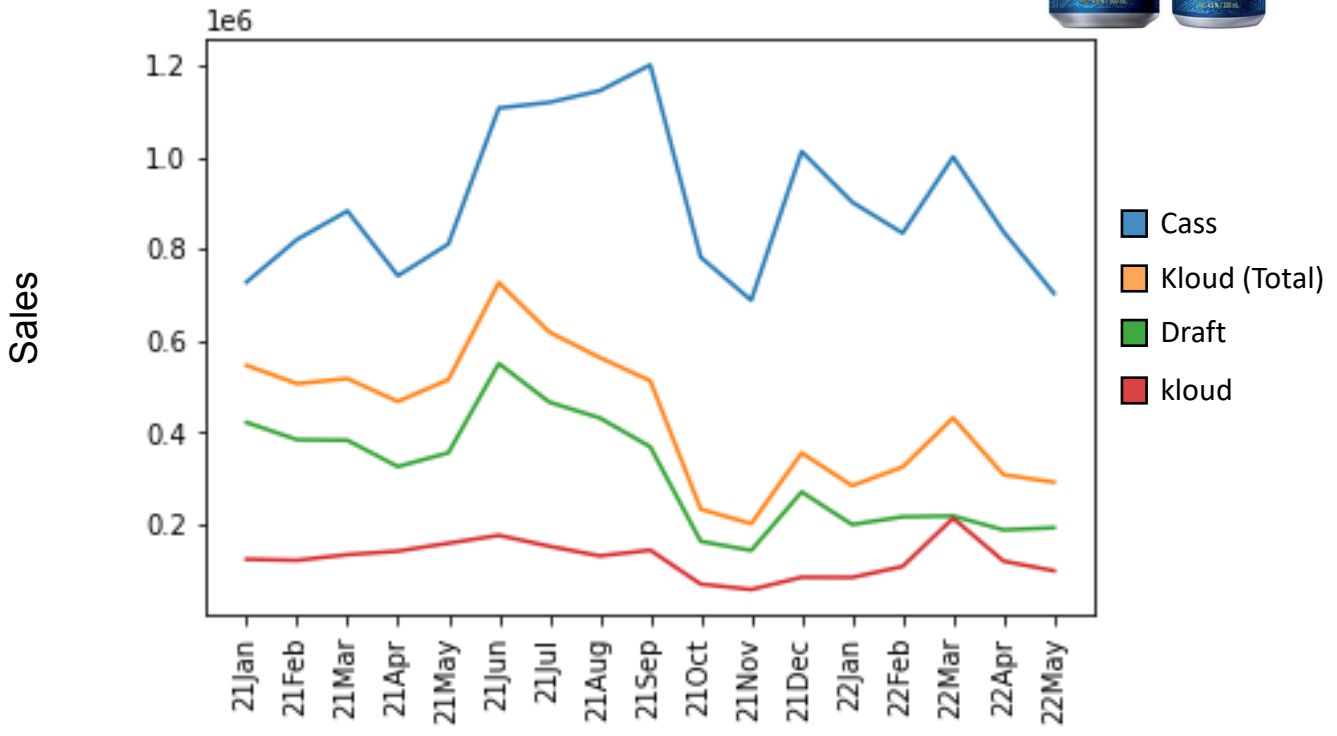

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Topic #3.

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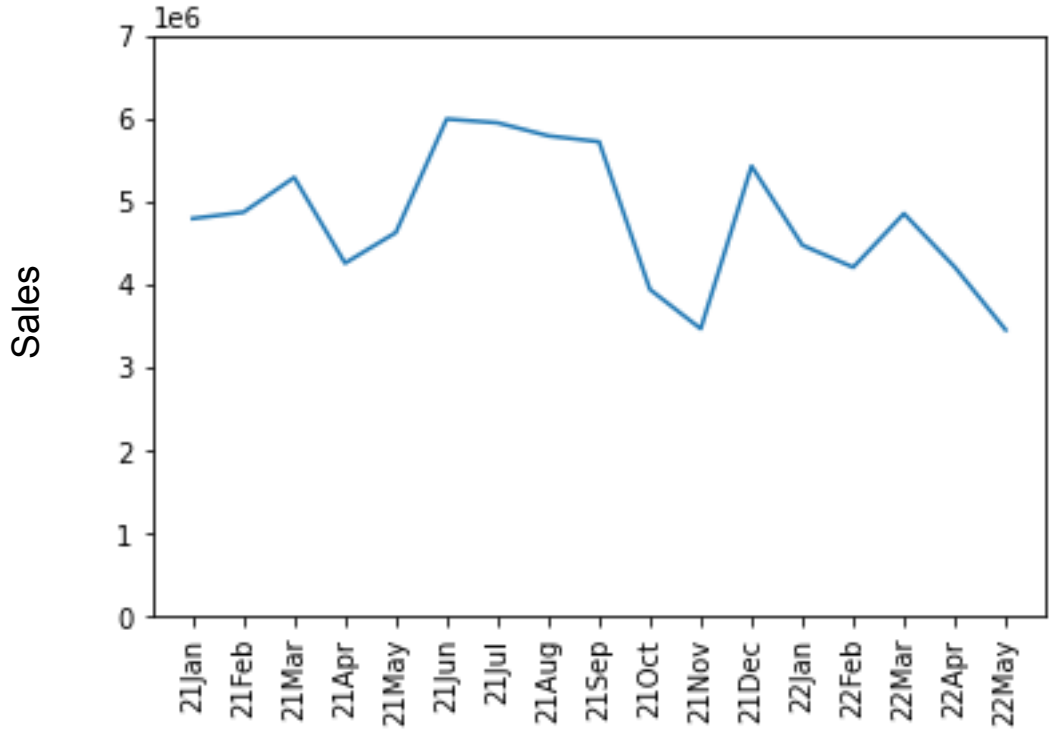
ALL DATA (Can)



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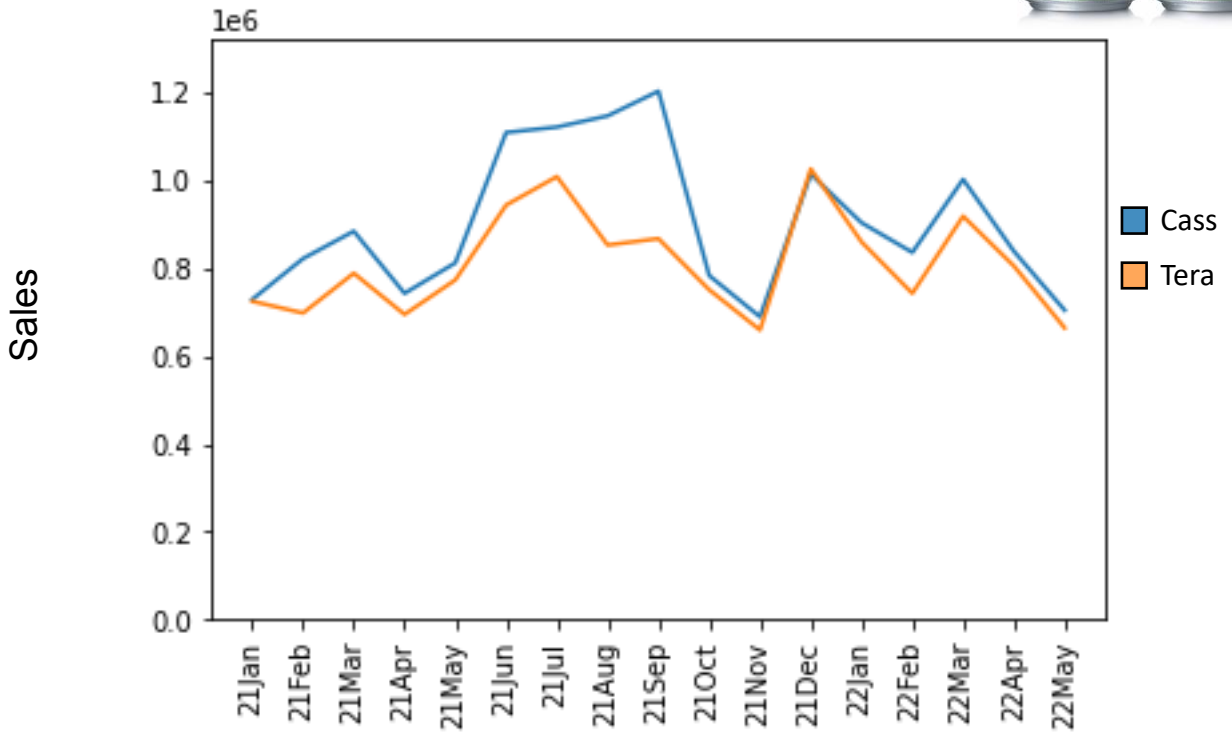
Tera (Can)



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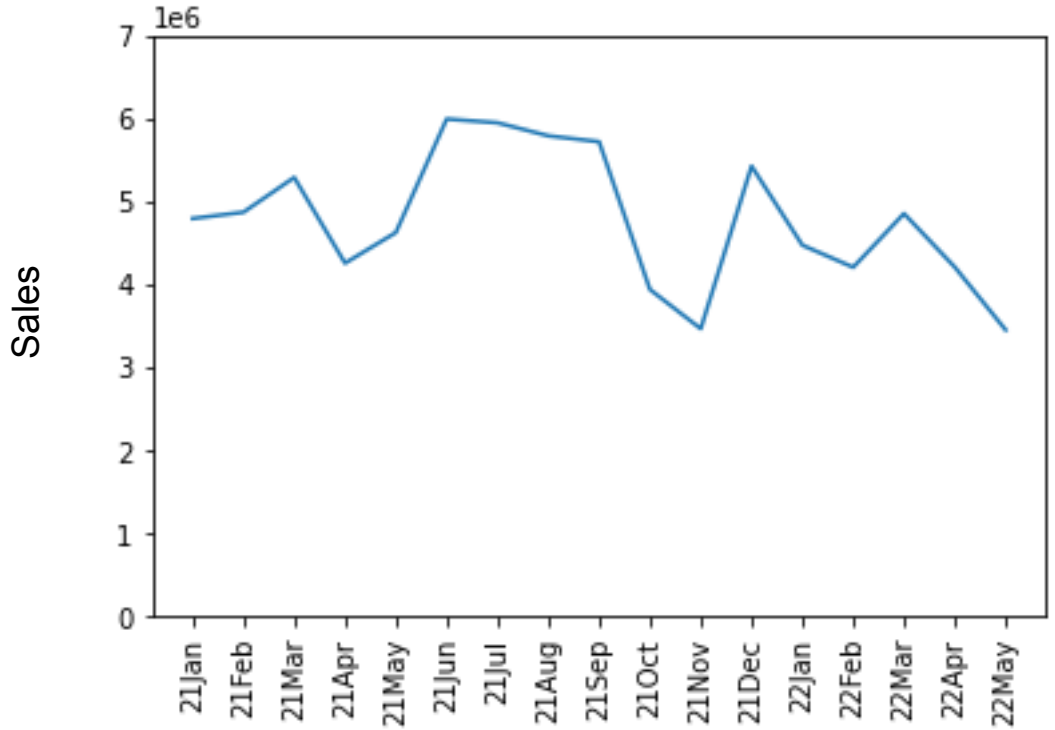
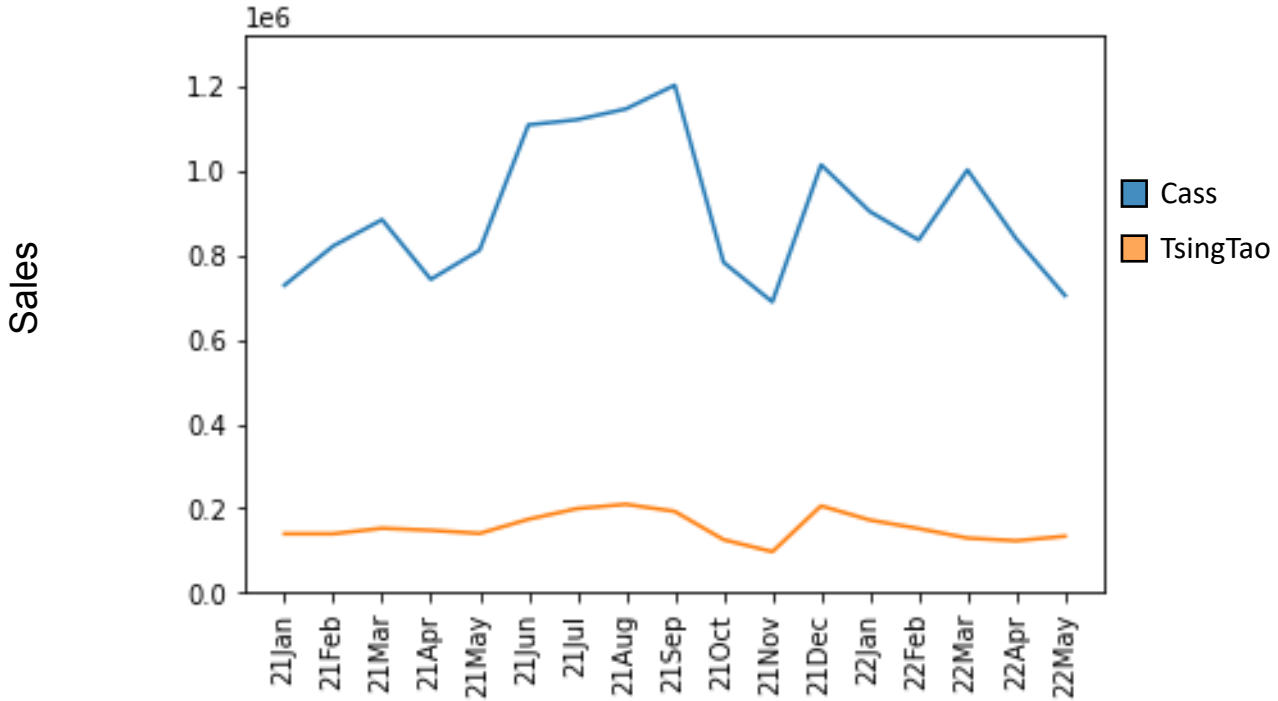
Topic #3.

ALL DATA (Can)



In 000 won

TsingTao (Can)



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
CORN OIL
Rice
Bread Mix
Cake
Cookies
CHICKEN Soup
Tagliatelle
SUGAR
STEVIA
MILK LIGHT
SunFlower
Vegetables
Swell CORN
Burgers
Spring
Color
Body Wash
HairColor
VODKA
COFFEE
Coffee
Drinking Chocolate
Rice
Finest Quality
NOODLE
BAKED BEAN
CHICKEN NOODLE SOUP
Nuts
Chocolate
Peanut
Chocolate
YOGURT
MARMALADE
YRUP
HAND CREAM
TEA
Cheese Pie
Keep Frozen
PIZZA
Spaghetti
Keep Frozen
Cheese Pie

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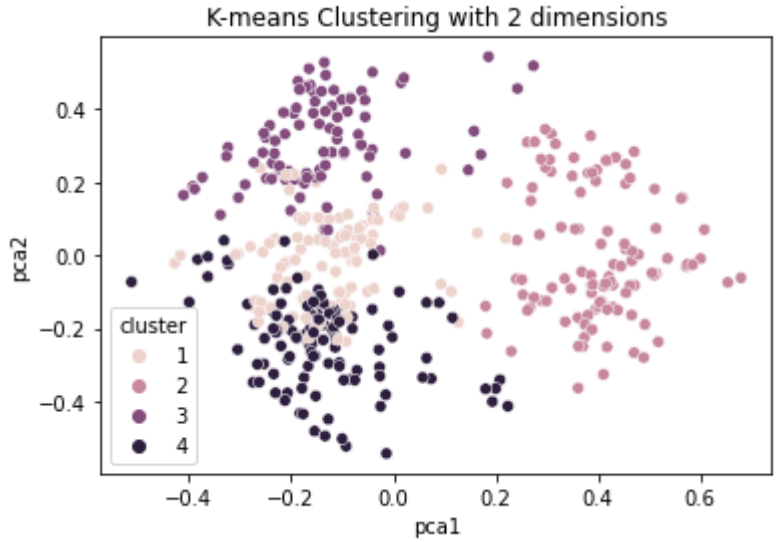
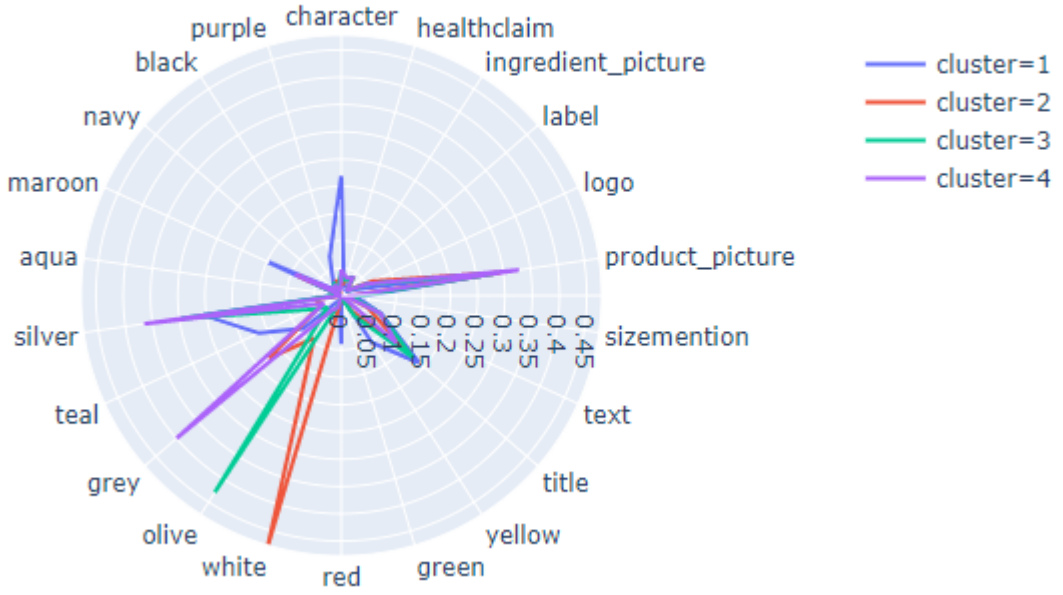
K-means Clustering





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

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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)

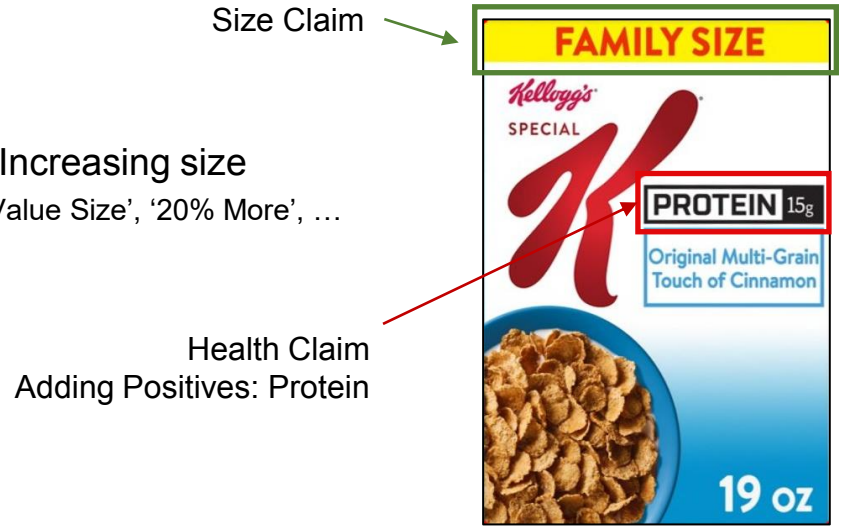
Why is it important?

"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

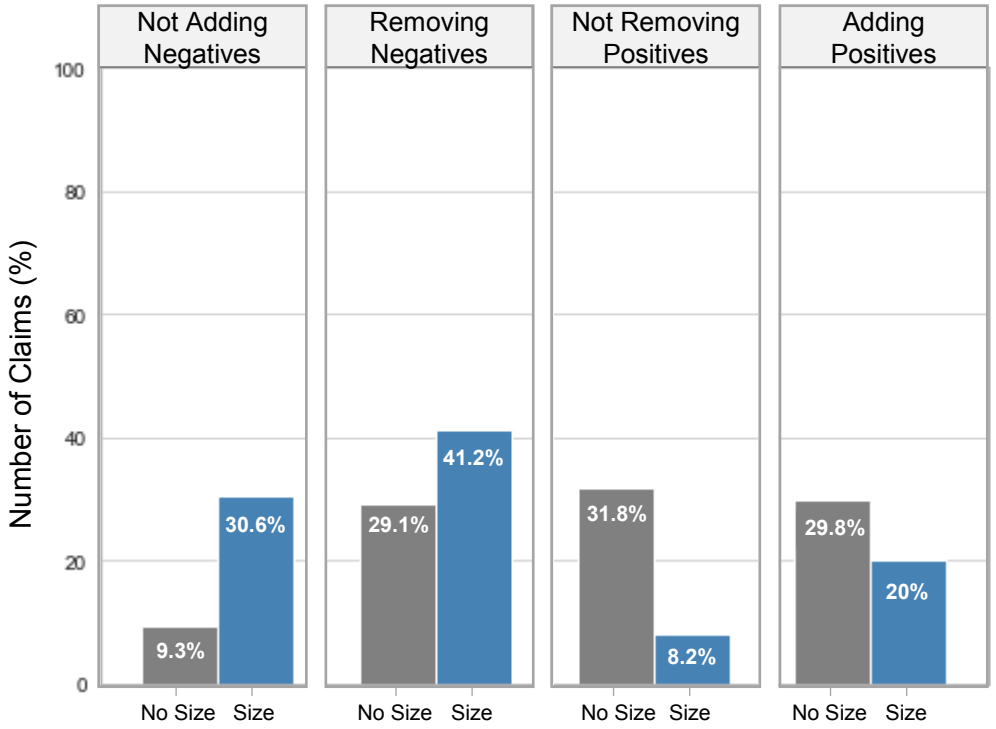
- A statement related to Increasing size
- Examples : 'Family Size', 'Value Size', '20% More', …



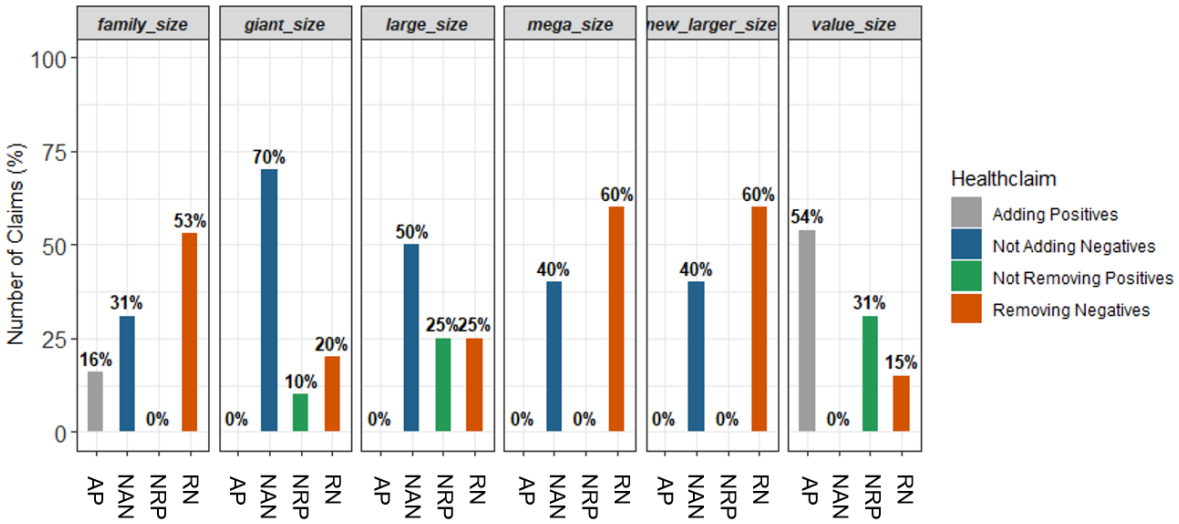
From our Data:

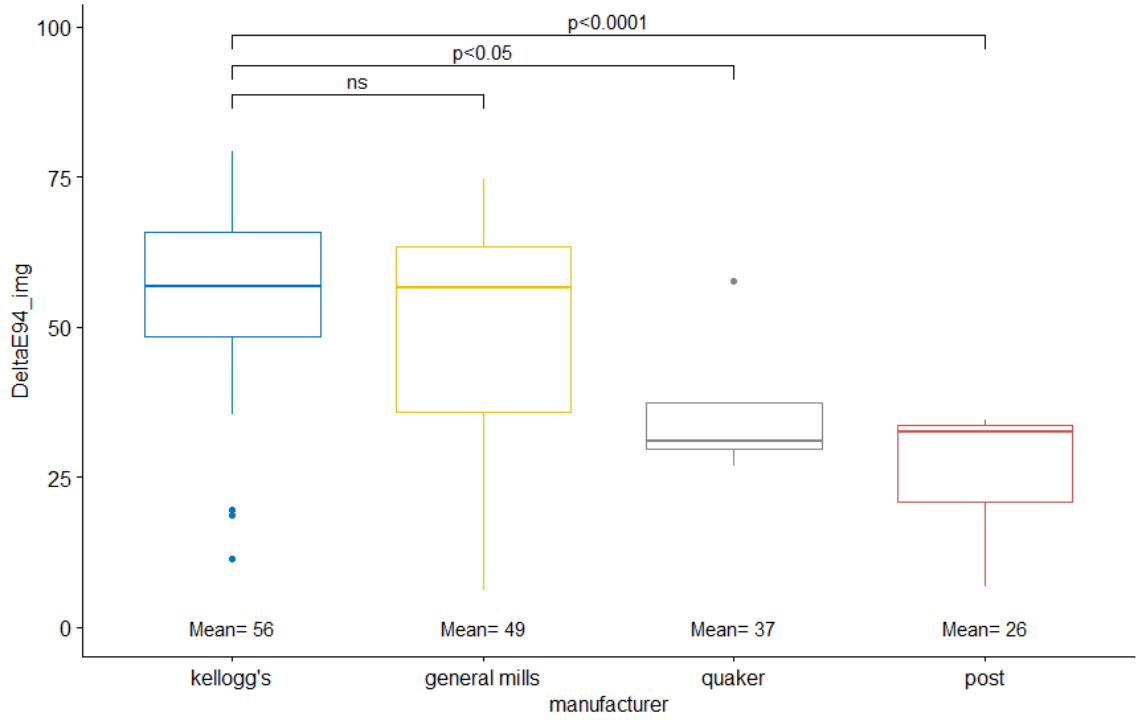
- It was confirmed that the proportion with and without size claim varies by Health Claim type.

→ 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
100
75
50
25
0
DeltaE94_img
Mean= 56
Mean= 49
Mean= 37
Mean= 26
kellogg's
general mills
quaker
post
manufacturer

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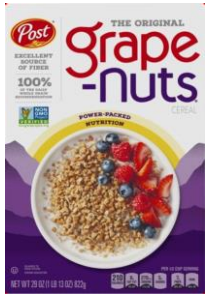
Color Extraction
K-means Clustering



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

Appendix

Text Recognition