Consumer Insights

Mixed Methods in Research Workshop Series
The Erdős Institute
April 2023

Brief Review

Market Research

Market Research involves studying an industry to determine:

- What problems are facing the field
- How other companies have tried to solve these problems
- How your company can meet the need in a better way than your competition

The goal of market research is to **shape business development plans and product development**

User eXperience (UX)

User Experience Research focuses on the study of end users: the people actually using your product

- Analyzing the behaviors, requirements, and expectations of end users
- Focuses on a specific product or service
- Often digital products, such as apps or websites

The goal of UX is to **improve end user experience through the interaction with a product**

Attitudinal Research

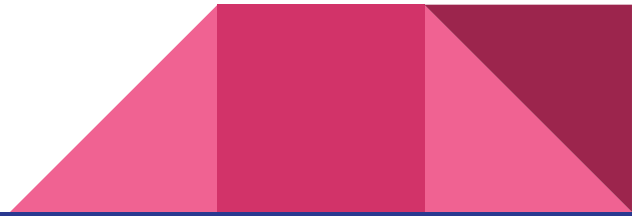
Consumer Insights

- Customer experience as a whole
- Examples
  - Evaluating customer experience (VoC, emotions, brand perception, satisfaction)
  - Evaluating customer behaviors (expectations, aversions, drivers)
  - Understanding loyalty behaviors (likelihood to keep using the product, recommendations to others)
  - Understanding physical products (comparing products in retail and hospitality space)

Survey Design

Surveys can be used to measure:

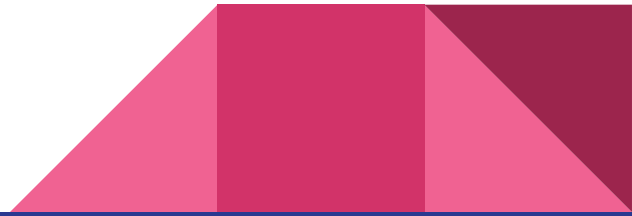
- Brand / company awareness (market research)
- Comparison with competitors (market research)
- Interest in new product directions (market research)
- Product usage (UX)
- Product feasibility (UX)
- Attitudes about the product (consumer insights)
- Loyalty behaviors (consumer insights)



Survey Design

Surveys should ideally be:

- Short
- Easy to understand
- Free from jargon
- Motivating (not boring)



Survey Design

Surveys should ideally be:

- Short
- Easy to understand
- Free from jargon
- Motivating (not boring)

Participants are people, and most likely are people who have not thought about your study nearly as much as you have. Most often, they don't want complicated terms or nuanced instructions and you don't need that kind of information from them.

Step 1. Define area of inquiry

How engaged are people when using my app?

Success?

Completion?

Positive referrals?

More money in purchases?

Making a single purchase?

All these definitions of **engagement** require different methodological designs and different data analyses

Step 1. Define area of inquiry

Does prior theory inform your work?

- May want to use constructs as defined by previous scholars
- Can look at psychometric validity and generalizability of different operationalizations and measurement scales
- More likely to use inferential statistical methods

Step 1. Define area of inquiry

Do you know what you expect at all?

Sometimes, it's not possible. If it's March 2020 and you're studying the ***effect of the coronavirus pandemic on retail shopping***, you might not have directional hypotheses because there hasn't been a worldwide pandemic that has coincided with high usages of personal technology during a U.S. election year before now.

Step 1. Define area of inquiry

Conduct focus groups or interviews before designing your survey

- Helps you learn if you're asking the wrong questions
- Can help you clarify the best question wording

Step 2. Form your hypothesis

Theory

Product A isn't as easy to understand as Products B and C.

Why do you think that?

Product A sales are ½ the size of Product B sales and ⅓ the size of Product C sales.

Step 2. Form your hypothesis

- Try to identify possible causes/reasons for the problem
- Focus on problems that you can solve
- The solution should be related to whatever KPI your company identifies

Step 2. Form your hypothesis

Think about main effects and control variables *a priori* and test those as directly as possible.

You will not be able to control for everything or answer everything with one study / hypothesis. That’s okay.

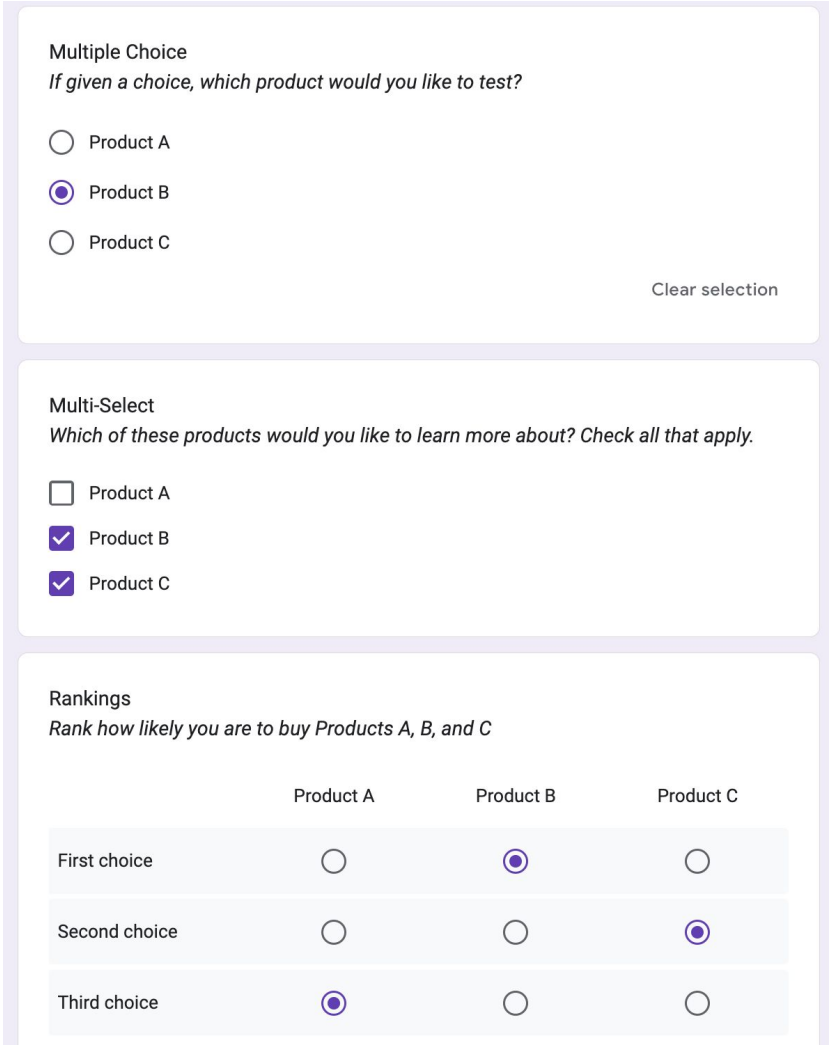
Step 3. Design your survey

- **Introduction**
  Briefly explain study goals, what the results will be used for, and expected duration
- **Screening questions**
  Ensure the participant meets the criteria (e.g., actually uses your service or product)
- **Main questions**
  Questions addressing the main area of interest.
  Group related questions together under a heading
- **Demographics**
  Age, gender, income
  These should be optional questions
- **Debrief**
  “Is there anything else you think we should know?”

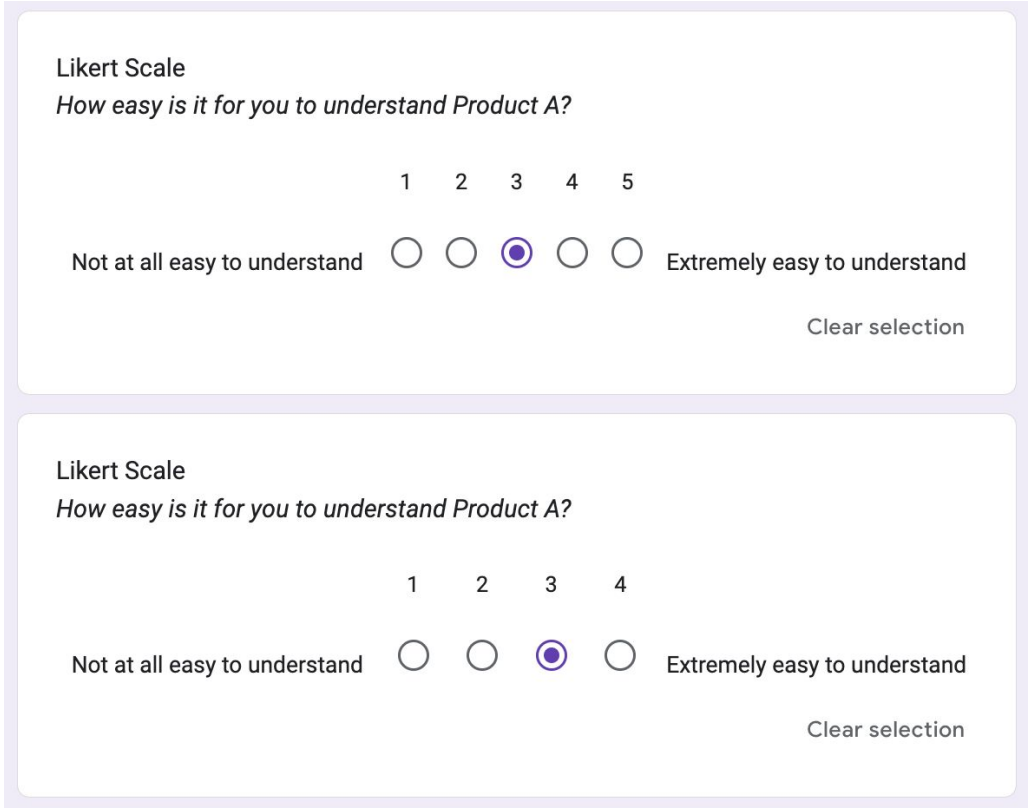
Step 3. Design your survey

- Multiple Choice – nominal data
- Multi-Select – nominal data
- Likert Scale – ordinal data
- Rankings – ordinal data
- Sliding Scale – continuous data
- Open Ended – text data

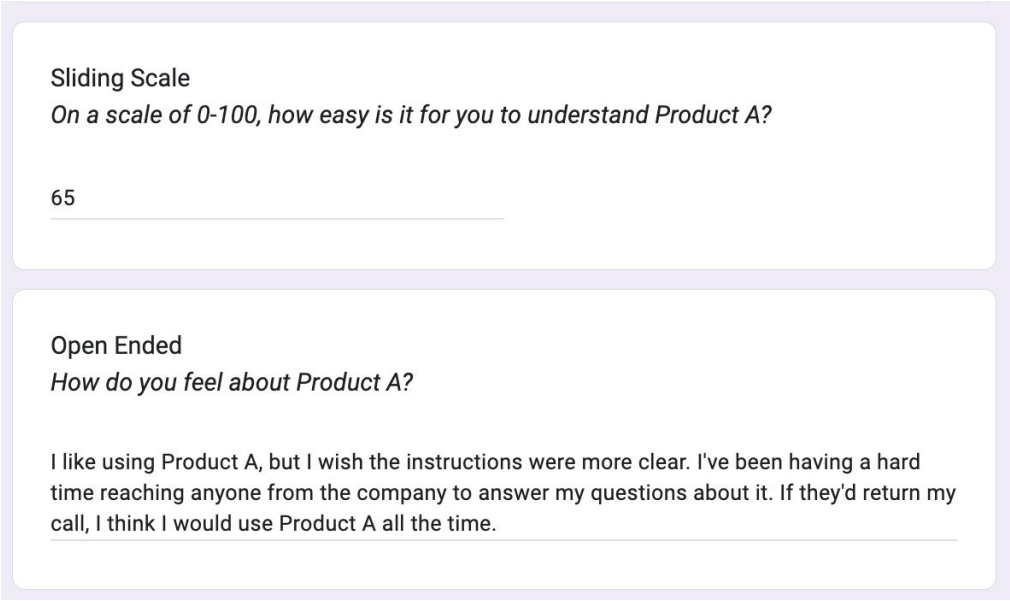
Step 3. Design your survey



Step 3. Design your survey



Step 3. Design your survey



Step 3. Design your survey

Aggregate Rating Scales

How well do these statements describe you from 0 (not at all) to 4 (extremely)?

1. I often have tender, concerned feelings for people less fortunate than me
2. Sometimes I don't feel very sorry for other people when they are having problems. (R)
3. When I see someone being taken advantage of, I feel kind of protective towards them
4. Other people's misfortunes do not usually disturb me a great deal (R)
5. When I see someone being treated unfairly, I sometimes don't feel very much pity for them (R)
6. I am often quite touched by things that I see happen
7. I would describe myself as a pretty soft-hearted person

Empathy score = sum or average of scores for each question

Step 3. Design your survey

Randomization

- Question order matters
  - Recency and primacy effects
  - Open ended before closed questions (in some cases)

- Questions should be grouped by topic
  - Randomize questions within the block
  - Randomize blocks

Group Project

Voice of the Customer Analysis

You work for a makeup company that offers membership-based services. Your boss has noticed that memberships have decreased steadily over the last three business quarters. Your boss wants to learn if this decrease is due to internal factors, like customer satisfaction, or external factors, like inflation. Your job is to assess the drivers contributing to membership churn.

Present your proposed survey and expected insights to a member of the C-suite (CEO, CIO, CPO, etc.).

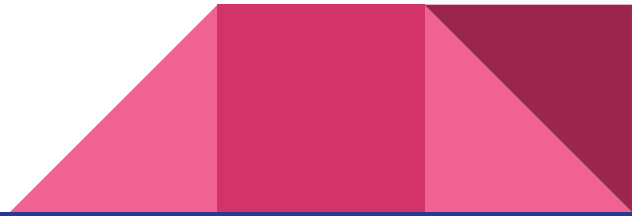
Behavioral Research

A/B Testing

- A/B tests are the most basic kind of randomized controlled experiments

- Goals
  - Test effectiveness of website pages, mobile app design
  - Get more revenue from the same amount of web traffic

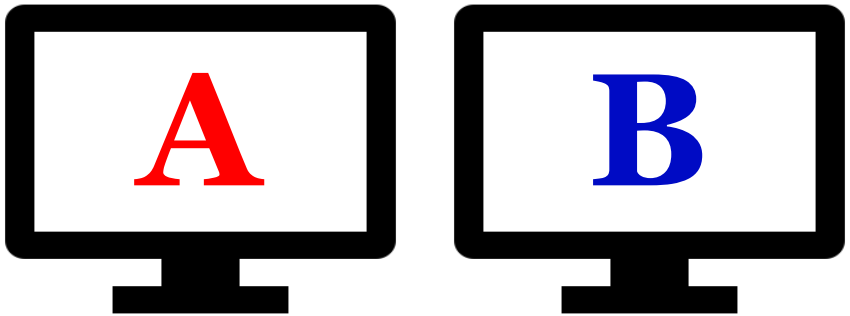
- Different types of A/B testing
  - Classic
  - Split tests/redirect tests
  - Multivariate tests



A/B Testing

Hypothesis

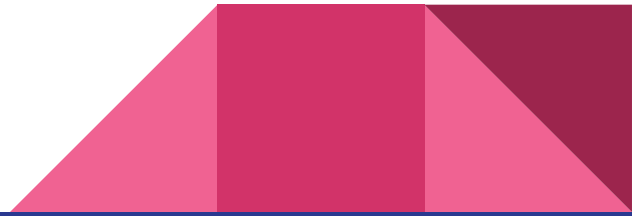
The submit button is **red**. I expect that having a **blue** button would result in increased purchases, perhaps because it stands out more to color-blind shoppers.



Sequential vs. Multivariate Testing

- **Sequential testing**
  - *Test ONE variable per experiment. Run many experiments.*

- **Multivariate testing**
  - *Test MULTIPLE variables at the same time.*



Sequential vs. Multivariate Testing

Sequential testing

Test ONE variable per experiment. Run many experiments

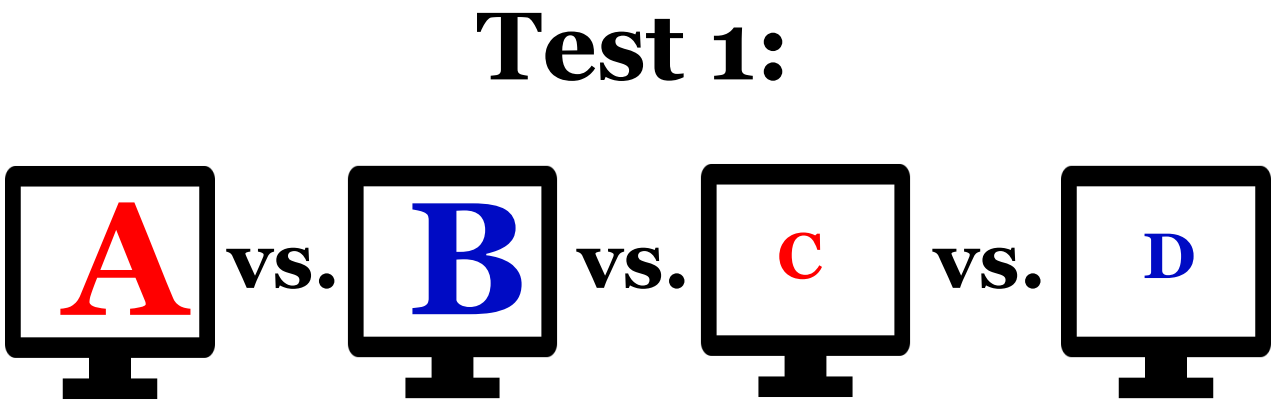
Test 1:

Test 2:

Sequential vs. Multivariate Testing

Multivariate testing

Test MULTIPLE variables at the same time.



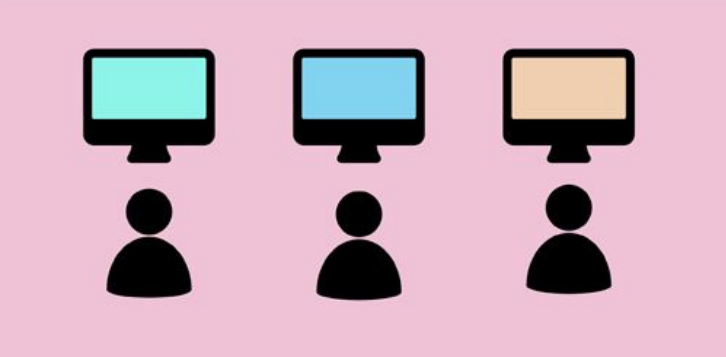
Sequential vs. Multivariate Testing

Sequential Tests	Multivariate Tests
Pros	**Pros**
• Can investigate causality (if approached correctly)	• Can find the best combination/interaction of features • Saves time (which, in business, is money)
Cons	**Cons**
• Cannot investigate interactions among features: can be led to the wrong conclusion • Takes a long time	• Cannot make any causal inferences about features • Need more people (usually)

Dependent vs. Independent Groups

Independent Groups (Between—Subjects Design)

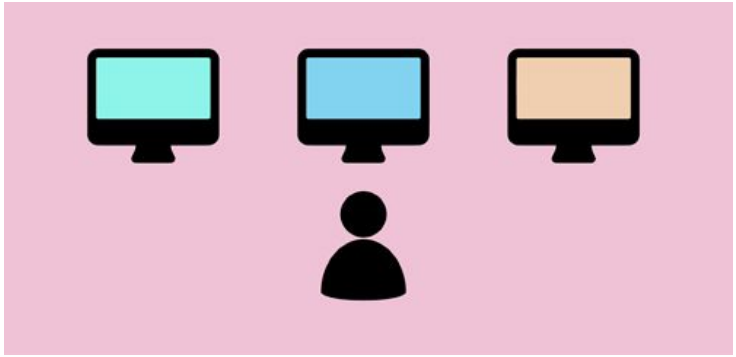
- *Different groups of people see A and B*
- *People are unrelated*



Dependent vs. Independent Groups

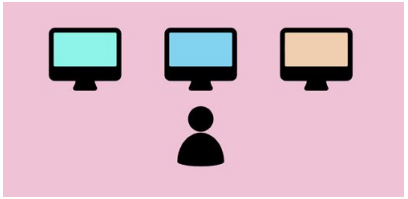
Dependent Groups (Within—Subjects Design)

- *The same person sees A and B*
- *Husband vs. Wife*
- *Person sees A, then later also sees A*

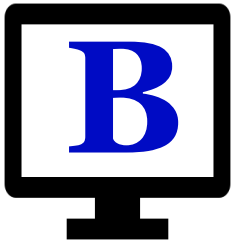


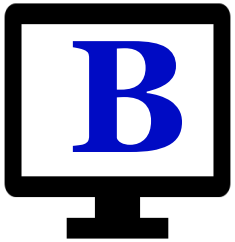
Counterbalancing

Dependent Groups (Within—Subjects Design)



Group 1: 

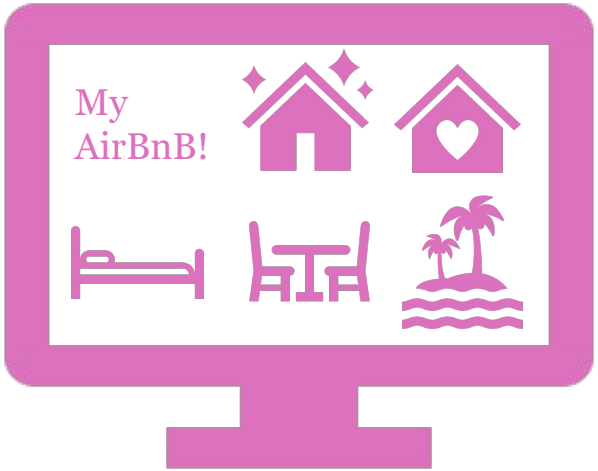
then 

Group 2: 

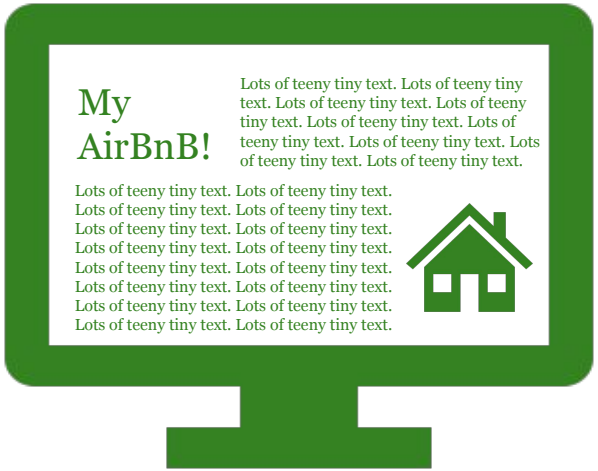
then 

How likely are you to rent an AirBnB in July?

Website A (5 pictures)

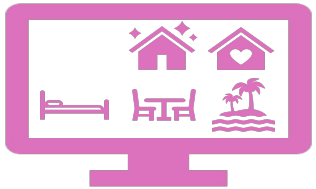


Website B (1 picture)



How likely are you to rent an AirBnB in July?

Website A (5 pictures) vs. *Website B (1 picture)*



- Let's say that, for the sake of this example, we are 100% sure that Website A is always preferred to Website B.
- People who see Website A are more likely to rent the AirBnB in Florida in July.

How likely are you to rent an AirBnB in July?

Groups

People in Group A just randomly happen to love hot weather whereas people in Group B randomly hate hot weather

Group A

Group B

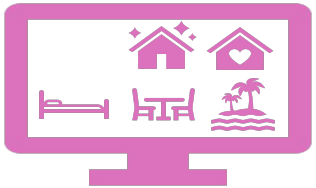
How likely are you to rent an AirBnB in July?

What we know

1. People like the design of Website A more than Website B.

2. People in Group A are more likely to rent than people in Group B.

Website A



Website B

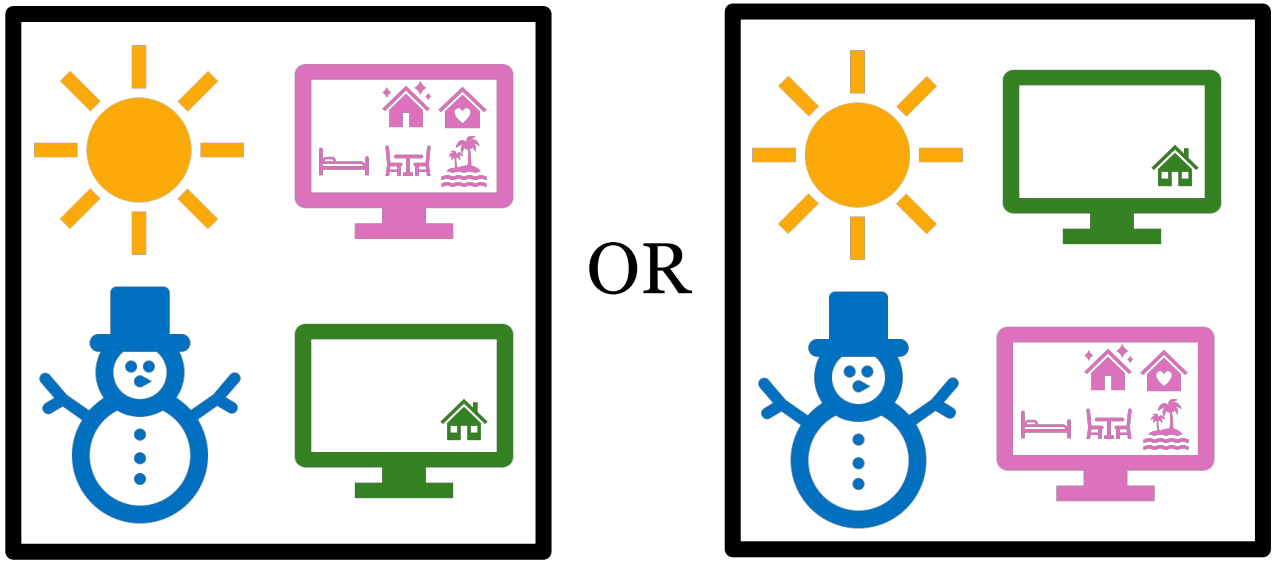
Group A

Group B

How likely are you to rent an AirBnB in July?

Independent Groups

People who *love* hot weather see Website A OR Website B.
People who *hate* hot weather see the other website.



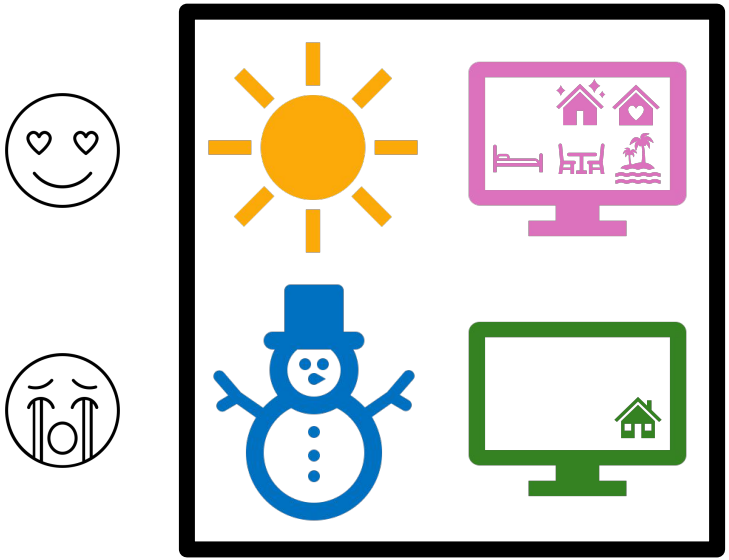
How likely are you to rent an AirBnB in July?

Independent Groups

Possible Results

- **We get the expected result!**

People who saw Website A were more likely to rent the AirBnB than people who saw Website B



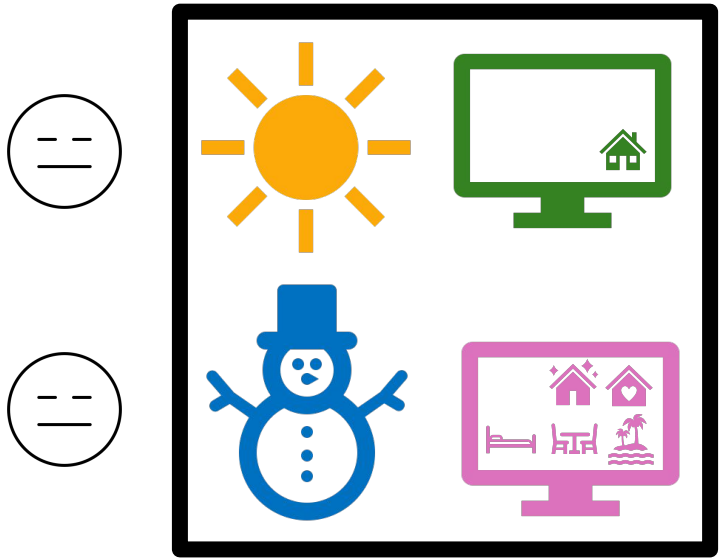
How likely are you to rent an AirBnB in July?

Independent Groups

Possible Results

- **The two factors cancel each other out (incorrectly fail to reject the null hypothesis).**

There is no difference in rentals between people who saw Website A vs. Website B.



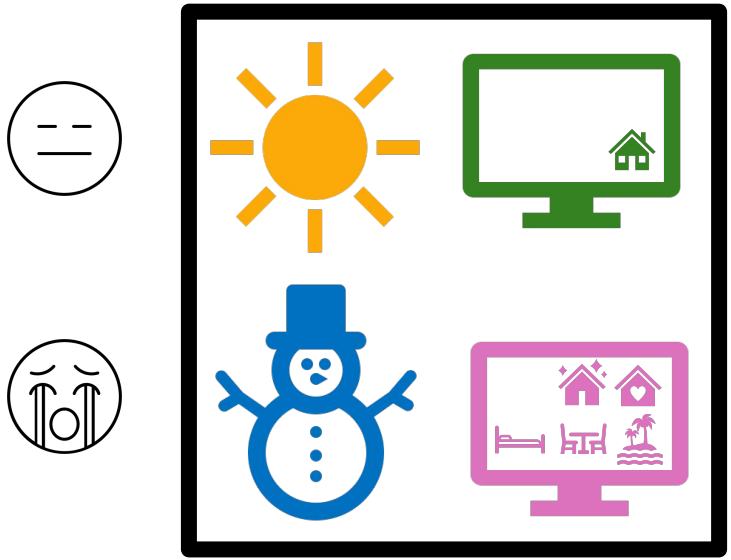
How likely are you to rent an AirBnB in July?

Independent Groups

Possible Results

- **False result.**

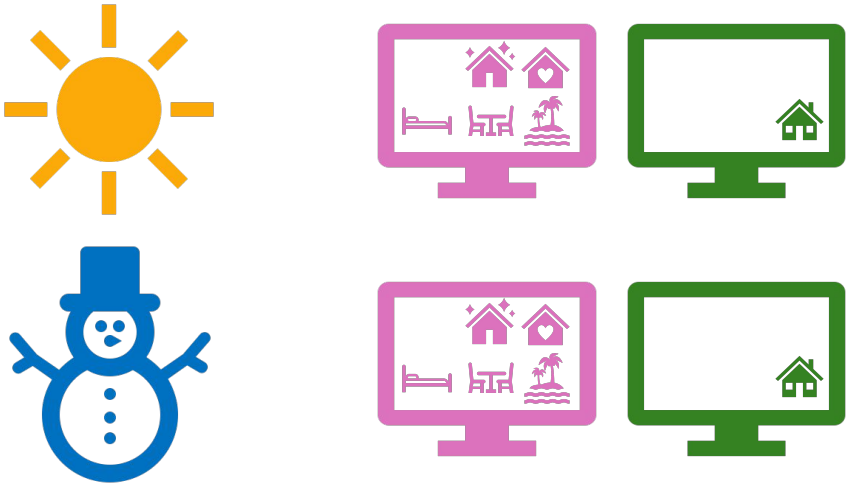
  No one in Group B wants to go to Florida at all, so Website B results in more rentals than Website A



How likely are you to rent an AirBnB in July?

Dependent Groups

People who *love* hot weather see BOTH Website A and Website B.
People who *hate* hot weather see BOTH Website A and Website B.



How likely are you to rent an AirBnB in July?

Dependent Groups

Possible Results

People in both Groups A and B will be MORE likely to rent the AirBnB when they see Website A than when they see Website B.

How likely are you to rent an AirBnB in July?

Dependent Groups

Possible Results

People in both Groups A and B will be MORE likely to rent the AirBnB when they see Website A than when they see Website B.

Reduced noise in data = increased likelihood of finding the *true result* (Website A > Website B)

*Using dependent groups helps **control for** people's weather preferences.*

What can you really understand from hypothesis testing?

It depends on how you designed your experiment!

You work for a makeup company that offers membership-based services. Your boss has noticed that memberships have decreased steadily over the last three business quarters. Your boss wants to learn if this decrease is due to internal factors, like customer satisfaction, or external factors, like inflation. Your job is to assess the drivers contributing to membership churn.

Design an A/B test to evaluate how varying membership criteria (e.g., cost, monthly / yearly bills, additional perks) affects membership rates.

Statistical Analysis

Descriptive vs. Inferential Analysis

- Descriptive analysis (Exploratory Data Analysis)
  - Methods to describe data
  - Find patterns and relationships among variables
  - Cannot test any hypotheses

- Inferential analysis
  - Uses statistics / mathematics
  - Make claims about an unknown variable (or multiple variables) based on data
  - Can test hypotheses

Exploratory Data Analysis (EDA)

- A way to learn more about your data
  - Summarize main features
  - Show distributions of each variable (or relationships among variables)
  - Spot anomalies and discover patterns
  - Identify errors (duplicate values, null values)

- Look at data before making any assumptions
  - Helps you confirm that the analytic methods you want to use are applicable
  - Once you finish EDA, you may move on to more rigorous statistics / modeling

Exploratory Data Analysis (EDA)

Summary statistics

- Measures of “central tendency”
  - **Mean, median, mode**
  - A “typical” measurement in a group of measurements
  - A value that is representative of the group

- Measures of “dispersion”
  - **Range, standard deviation, variance**
  - Quantifies how different the measurements are from each other
  - Measures how spread out the measurements are from the c

Exploratory Data Analysis (EDA)

Summary statistics

- Measures of “central tendency”
  - **Mean, median, mode**
- Measures of “dispersion”
  - **Range, standard deviation, variance**

Age of Participants

count	mean	std	min	25%	50%	75%	max
5113.0	44.2	16.2	18.0	31.0	43.0	57.0	91.0

Exploratory Data Analysis (EDA)

Tables

Frequency Table

- Shows the frequency (counts, percents) of occurrence of each unique value in a group of observations
- Not that useful if there's lots of unique values
- Nominal or ordinal data

Cross Tabulation

- Shows the frequency of one type of observation at different values of a second type of observation
- Nominal or ordinal data
- Can be a comparison of means and SDs across different groups of a nominal category

Exploratory Data Analysis (EDA)

Tables

Frequency Table

Country	Participants
France	983
Germany	872
India	891
Italy	892
UK	621
US	854

Cross Tabulation

	Italy	UK	USA
Alone	10.54 %	9.98 %	17.10 %
Child	23.88 %	28.02 %	33.96 %
Elderly	1.68 %	2.25 %	2.34 %
Friend	0.56 %	5.15 %	2.22 %
Parent	16.03 %	26.57 %	15.34 %
Partner	63.68 %	49.28 %	56.56 %

Exploratory Data Analysis (EDA)

Plots

Bar Chart

- Frequency table in visual form
- Only useful when the measurement is discrete (e.g., ordinal, nominal)

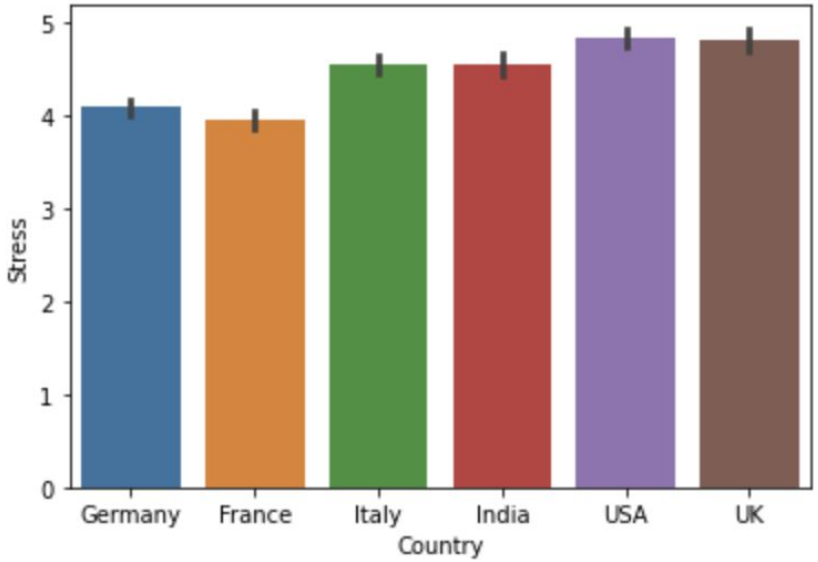
Histogram

- Represents a continuous distribution
- Takes a continuous measurement, breaks it into pieces, and displays the number of counts within certain ranges of the data

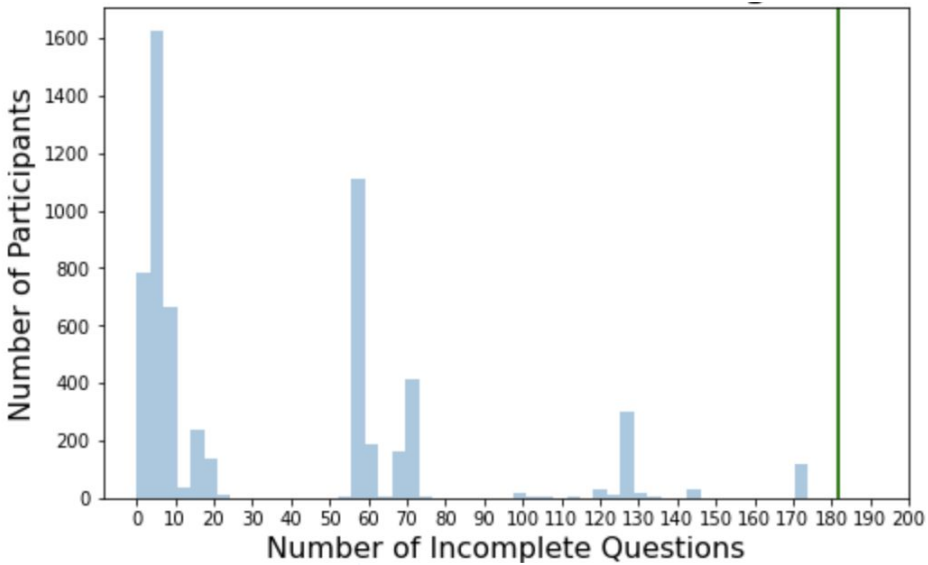
Exploratory Data Analysis (EDA)

Plots

Bar Chart



Histogram



EDA

Plots

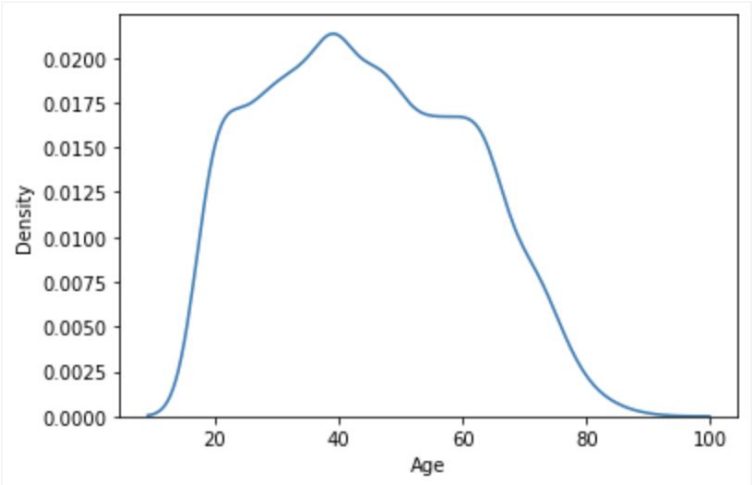
Density plots

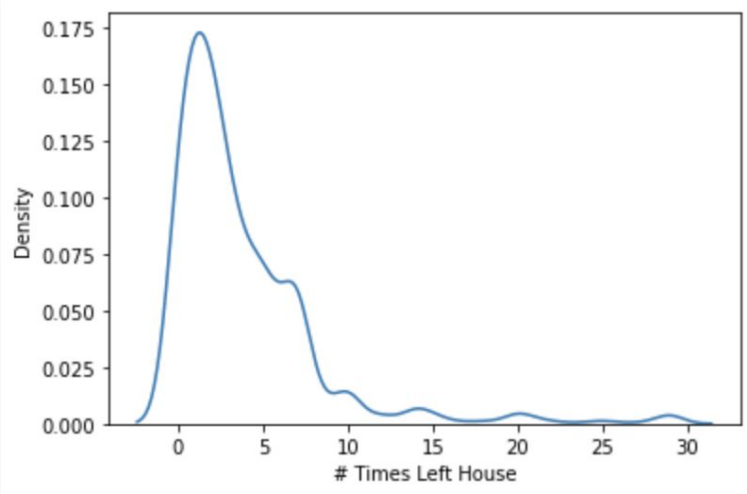
- Aka kerney density estimation (KDE) plots
- Smoothed version of a histogram
- Represents a continuous distribution

EDA

Plots

Density plots





Exploratory Data Analysis (EDA)

Plots

Box plots

- Represents a continuous distribution
- Displays a summary of the data: minimum value, first quartile, median, third quartile, and maximum value

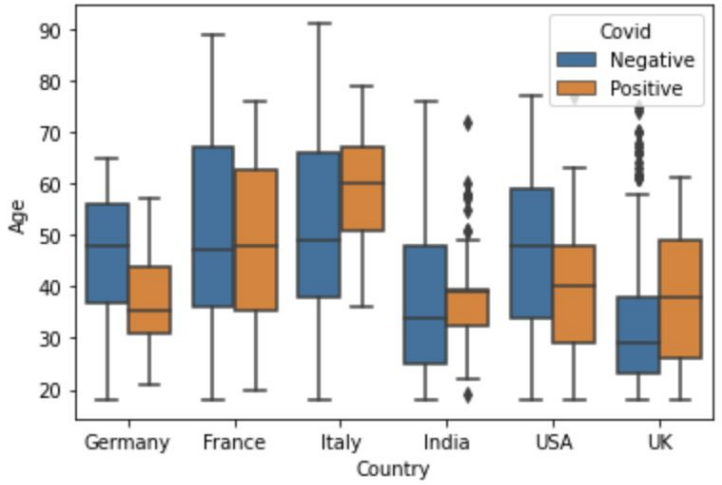
Violin plots

- Represents a continuous distribution
- Hybrid of KDE plot and a box plot
- Unlike a box plot, it shows the full distribution of the data

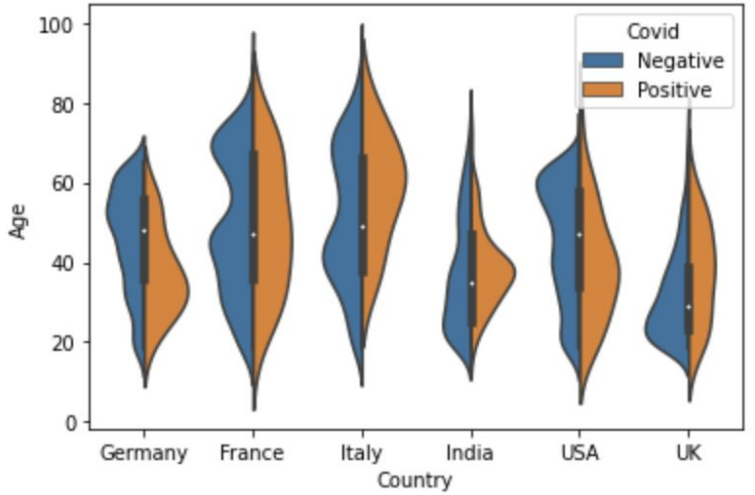
Exploratory Data Analysis (EDA)

Plots

Box plots



Violin plots



EDA

Correlation

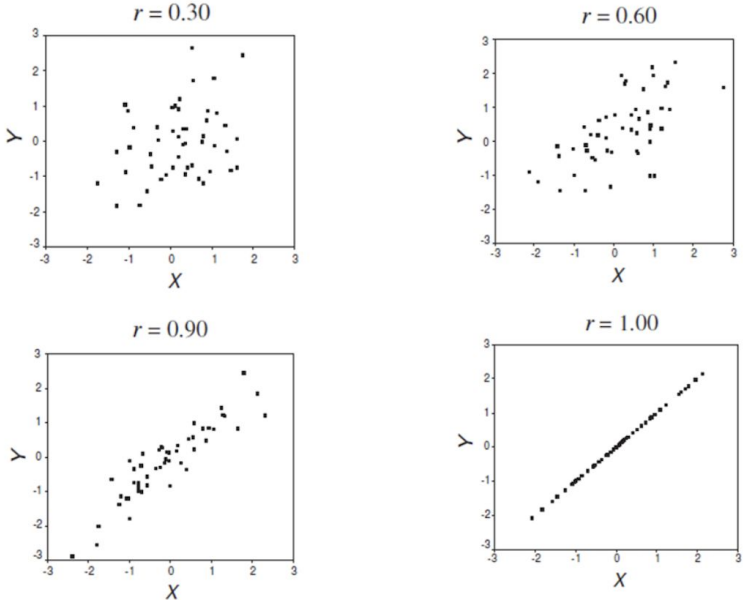
- + value = if you have a high X value, you likely have a high Y value (or low X and low Y)
- - value = if you have a high X value, you likely have a low Y value (or low X and high Y)

- The number's distance from 0 shows the strength of the association
- Closer to +1 or -1 means the association is stronger
- Closer to 0 means the two variables could be linearly independent

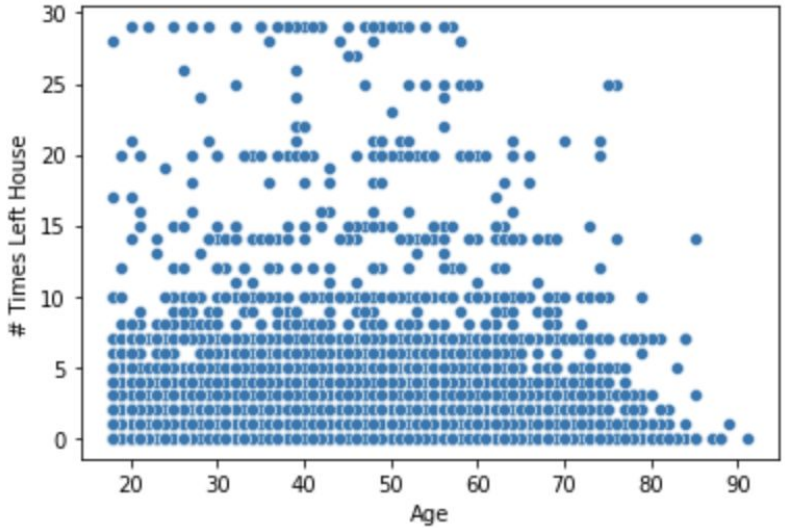
EDA

Plots

Scatterplot (synthetic)



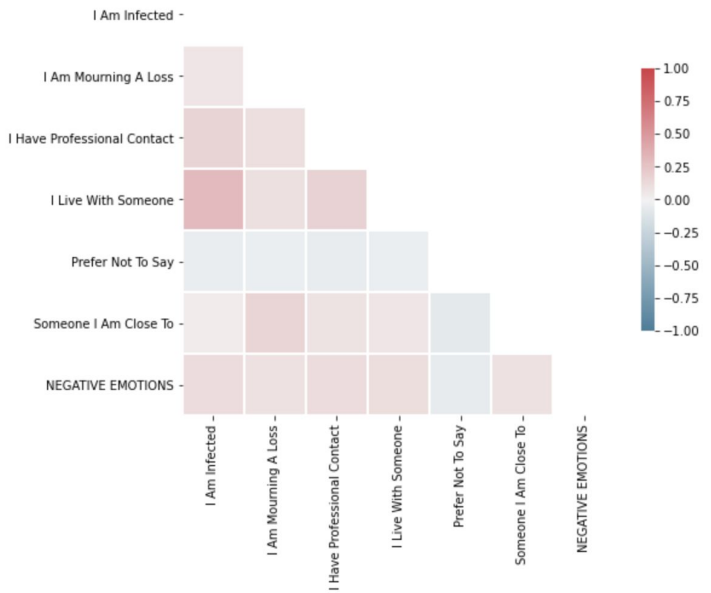
Real data (r = 0.03)



EDA

Plots

Heatmap



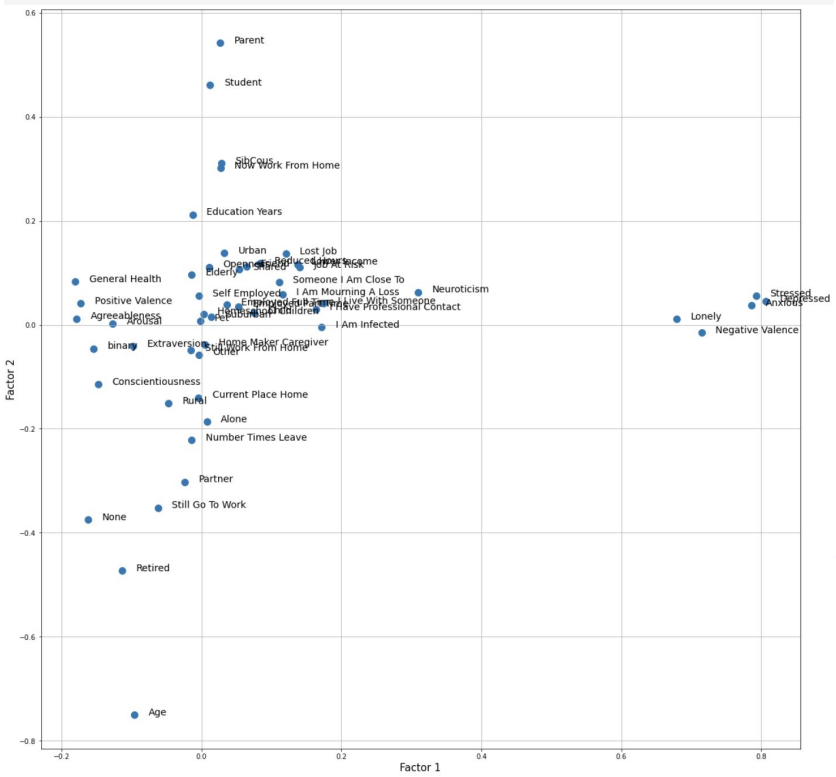
(Corresponding correlation matrix)

	I Am Infected	I Am Mourning A Loss	I Have Professional Contact	I Live With Someone	Prefer Not To Say	Someone I Am Close To	NEGATIVE EMOTIONS
I Am Infected	1.00	0.07	0.17	0.31	-0.04	0.03	0.12
I Am Mourning A Loss	0.07	1.00	0.10	0.10	-0.04	0.16	0.09
I Have Professional Contact	0.17	0.10	1.00	0.18	-0.05	0.08	0.12
I Live With Someone	0.31	0.10	0.18	1.00	-0.04	0.06	0.11
Prefer Not To Say	-0.04	-0.04	-0.05	-0.04	1.00	-0.08	-0.06
Someone I Am Close To	0.03	0.16	0.08	0.06	-0.08	1.00	0.09
NEGATIVE EMOTIONS	0.12	0.09	0.12	0.11	-0.06	0.09	1.00

Exploratory Data Analysis (EDA)

Advanced

Factor Analysis



Basic Hypothesis Testing

Hypothesis testing involves investigating how an independent variable impacts a dependent variable

- Does store location affect sales rates?
- Does price affect brand perception?
- Does customer age affect loyalty behaviors?

Basic Hypothesis Testing

We need to formulate our theory into two versions of reality that are mutually exclusive.

H_0 = “null hypothesis”

H_a = “alternative hypothesis”

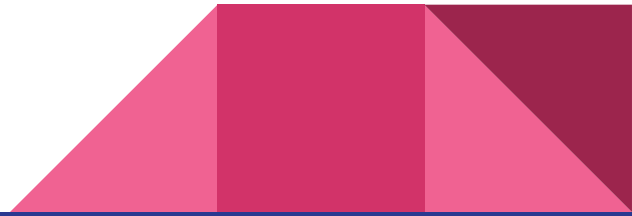
Basic Hypothesis Testing

Hypothesis

You are scouting a location for a new coffee shop. You want to test the idea that coffee shops within 1 mile of campus have higher Saturday morning sales than shops more than 1 mile from campus.

H_0: sales for shops <= 1 mile are ***the same as*** sales for shops > 1 mile

H_a: sales for shops <= 1 mile are ***greater than*** sales for shops > 1 mile



Basic Hypothesis Testing

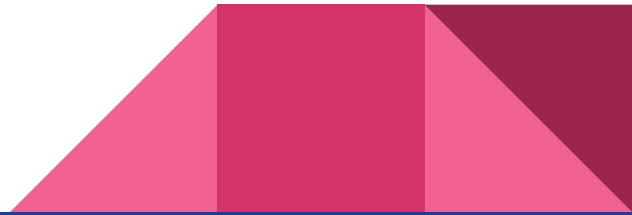
To test our hypothesis, we want to *disconfirm the null*.

H_0 = "null hypothesis"

H_a = "alternative hypothesis"

We always start by assuming the null hypothesis is true.

- If we **do not have enough evidence** to disconfirm the null, we say the null adequately describes reality.
- If we **do have enough evidence** to disconfirm the null, we must accept the alternative.



Basic Hypothesis Testing

Hypothesis

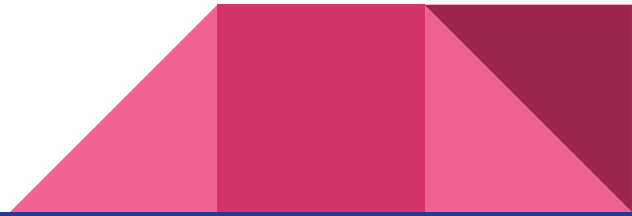
Store A = 1 mile from campus

Store B = 2 miles from campus

H_0: Shop A sales = Shop B sales

H_a: Shop A sales > Shop B sales

We assume that reality matches the null – there's no difference in sales based on shop distance from campus. We need enough evidence to convince us that the null hypothesis is not true.



Basic Hypothesis Testing

We collect data on Store A and B's Saturday morning coffee sales for one year.

Store A – 1 mile from campus

Week	Sales
1	514.9
2	515.0
3	514.5
4	513.8
5	513.1
6	514.2
7	517.0
8	517.3
9	514.8
10	513.5

Mean: 514.83
SD: 1.88

Store B – 2 miles from campus

Week	Sales
1	508.7
2	512.9
3	509.7
4	512.2
5	509.5
6	509.1
7	504.7
8	507.2
9	511.2
10	511.5

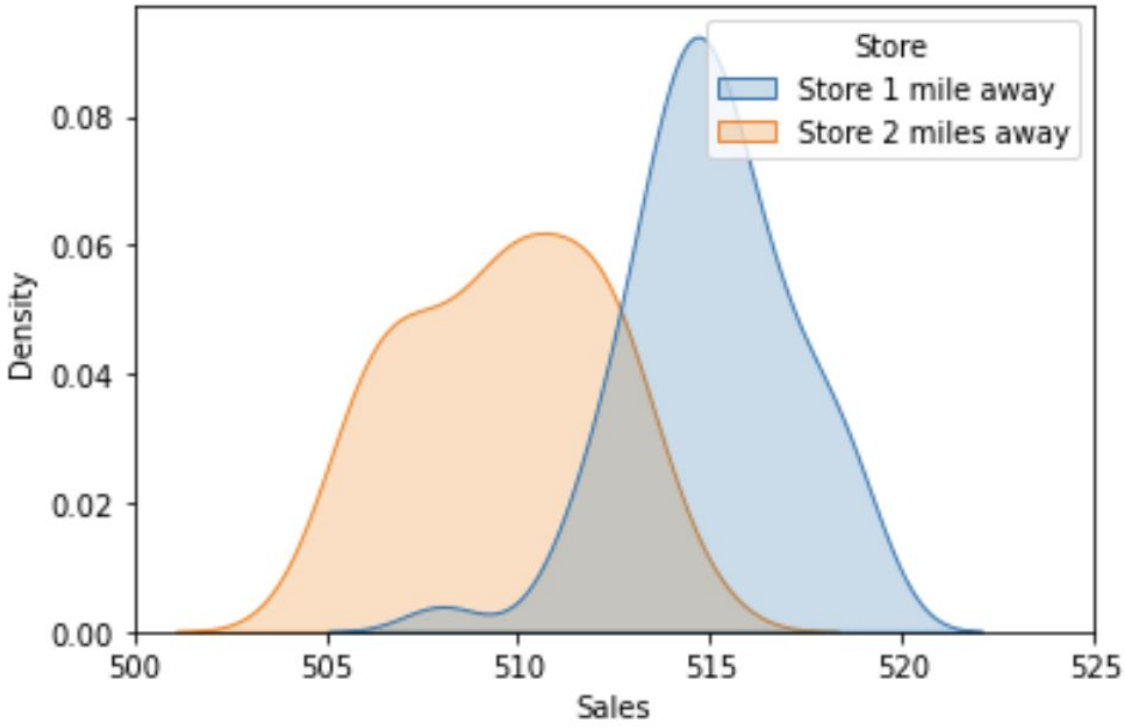
Mean: 510.02
SD: 2.71

Basic Hypothesis Testing

Now, we need to look at the consistency between the sales result from our data and the sales data under the null hypothesis.

In other words, do we have enough evidence to disprove the null hypothesis – that the sales from Store A and Store B are the same?

Basic Hypothesis Testing



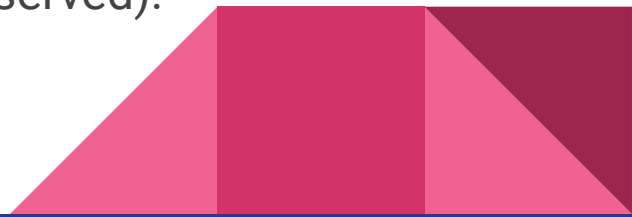
Basic Hypothesis Testing

P values

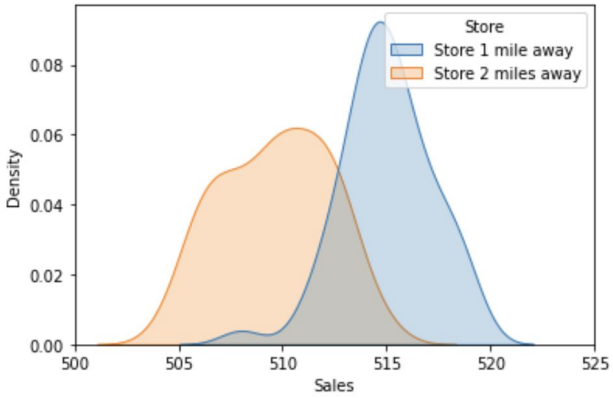
- Assumes the null hypothesis is true
- The probability that the obtained result, or a result even more discrepant from the null hypothesis than the obtained result

Typically, we reject the null hypothesis if the p-value is < 0.05.

This means that, if the null hypothesis is true, there is a 5% chance of obtaining your result (or a value more extreme than the one you observed).



Basic Hypothesis Testing



T-test

- A statistical test to compare the means of two groups
- A p-value will be associated with the t-test

For our data

A (one-tailed) t-test comparing the Saturday coffee sales of Store A and Store B

- t = 11.403
- *p* = 3.26 e-20 – we can reject the null hypothesis!

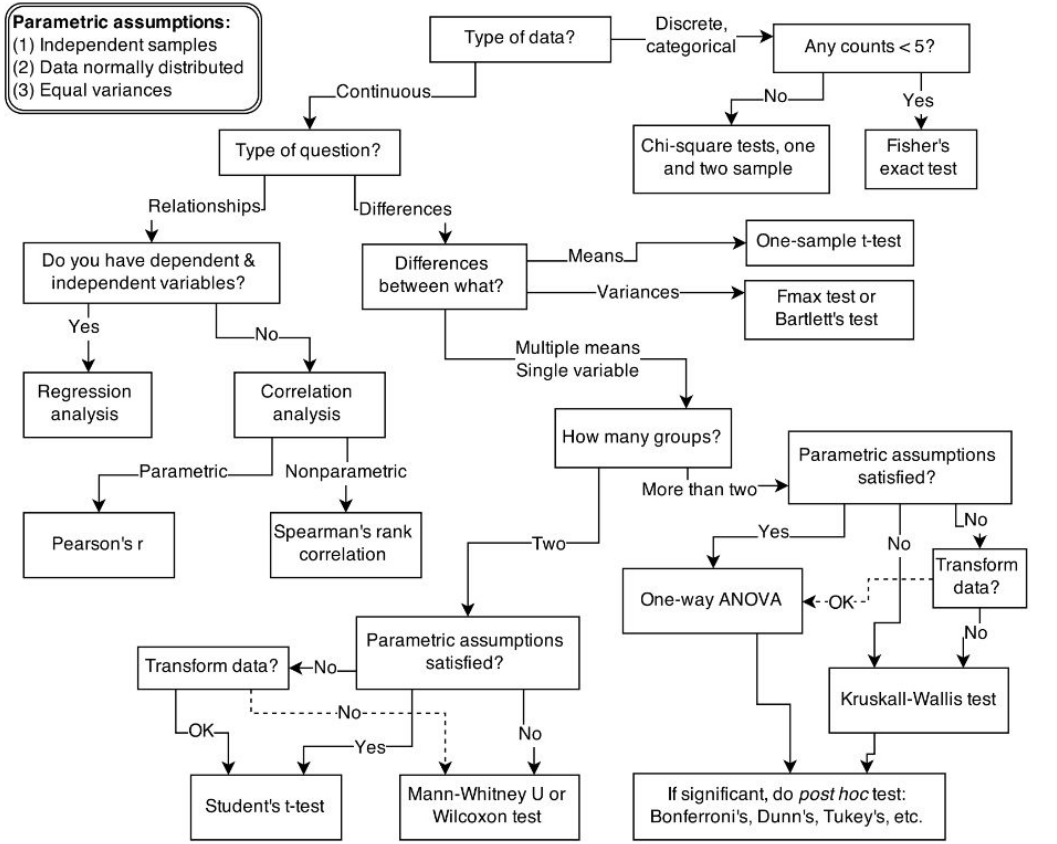
On average, a store 1 mile from campus sold more coffee (mean = $514, SD = 1.88) than a store 2 miles from campus (mean = $510, SD = 2.71), t(51) = 11.403, *p < 0.001* (one-tailed).

Basic Hypothesis Testing

Type of dependent variable	Type of independent variable						
	Ordinal/categorical				Normal/interval (ordinal)	More than 1	None
	Two groups		More groups				
	Paired	Unpaired	Paired	Unpaired			
2 categories	McNemar Test, Sign-Test	Fisher Test, Chi-squared-Test	Cochran's Q-Test	Fisher Test, Chi-squared-test	(Conditional) Logistic Regression	Logistic Regression	Chi-squared-Test
Nominal	Bowker Test	Fisher Test, Chi-squared-Test		Fisher Test, Chi-squared-test	Multinomial logistic regression	Multinomial logistic regression	Binomial Test
Ordinal	Wilcoxon Test, Sign-Test	Wilcoxon-Mann-Whitney Test	Friedman-Test	Kruskal-Wallis Test	Spearman-rank-test	Ordered logit	Median Test
Interval	Wilcoxon Test, Sign-Test	Wilcoxon-Mann-Whitney Test	Friedman-Test	Kruskal-Wallis Test	Spearman-rank test	Multivariate linear model	Median Test
Normal	t-Test (for paired)	t-Test (for unpaired)	Linear Model (ANOVA)	Linear Model (ANOVA)	Pearson-Correlation-test	Multivariate Linear Model	t-Test
Censored Interval	Log-Rank Test		Survival Analysis, Cox proportional hazards regression				
None	Clustering, factor analysis, PCA, canonical correlation						

https://www.r-bloggers.com/2019/03/overview-of-statistical-tests/

Basic Hypothesis Testing



https://xcelab.net/rm/statistical-rethinking

You work for a makeup company that offers membership-based services. Your boss has noticed that memberships have decreased steadily over the last three business quarters. Your boss wants to learn if this decrease is due to internal factors, like customer satisfaction, or external factors, like inflation. Your job is to assess the drivers contributing to membership churn.

Write down a quantitative analysis plan for either your survey or A/B test results. What types of information do you expect to get from each step of your analysis? How are these methods directly tied to any actionable insights you hope to gain from your survey (or A/B test)?

So you want to be a consumer insights researcher…

- Create a personal website that includes portfolio projects – these can include projects from your PhD research or new side projects
- Create a GitHub for any statistical analysis / modeling
- Highlight skills using business terminology (e.g., experimental design → A/B testing)
- Focus on results, rather than process

My work has shown that *melancholic* and *grieving* musics exhibit different structural characteristics, convey different emotions to listeners, and result in distinctive emotional experiences.

Some of my findings:

1. *Melancholic* music tends to be quieter, lower-in-pitch, and contains narrow pitch intervals. *Grieving* music tends to contain sustained tones, gliding pitches, and harsh timbres.

2. Listeners perceive different emotions in *melancholic* and *grieving* music. This finding was replicated using a separate methodological design.

3. Listeners feel different emotions when they listen to *melancholic* and *grieving* music. This finding was also replicated using a separate methodological design.

    - **Grieving** music tends to elicit feelings of Crying, Distress, Turmoil, Death, and Loss.
    - **Melancholic** music tends to elicit feelings of Sadness, Depression, Reflection, and Nostalgia.

My work on experienced emotions, published in ***Music & Science***, showed that:

- People experience more **mixed emotions to melancholic music** than to tender music or grieving music.
- People with **different levels of empathy differ in their emotional responses to music**—people with a higher level *empathic concern* experienced more positive emotions than others, but people with a higher level of *personal distress* reported feeling more negative emotions than others.

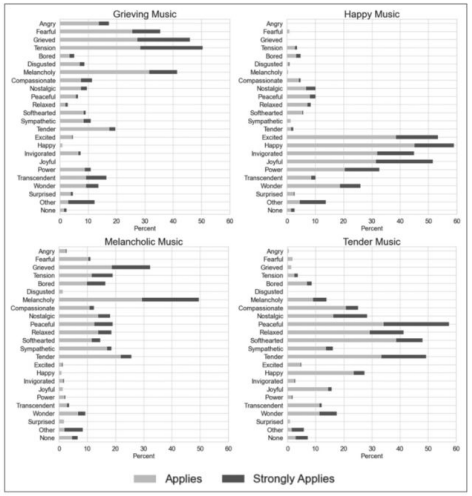


Figure 1. Induced emotions from the four stimulus types (melancholy, grief, tender, and happy) in Study 1.

An overview of my work on melancholic and grieving music.

Coronavirus Music Questionnaire (CMQ)

Description

Beyond immediate health risks, the COVID-19 pandemic poses a variety of a
expensive or unavailable strategies during a pandemic (e.g., therapy, socializ
music might serve as a tool for socio-emotional coping. We surveyed the mu
over 5000 people, with representative samples from 6 countries (3 continer

Main Takeaways

1. **During the COVID-19 lockdown, people have turned to music for regulating their emotions.**
2. **People experiencing different degrees of emotional changes showed different patterns of musical engagement.**
3. **Music listening and music making may provide different coping potentials.**
4. **Coronamusic played a key role in socio-emotional coping.**

Back to Overview

Participants

We surveyed 5113 participants with representative samples (in terms of gender, age, and education) in 6 countries on 3 continents.

The survey took place during the first lockdown of the COVID-19 pandemic, from mid-April through mid-May, 2020.

Country	Number of Participants
France	983
Germany	872
India	891
Italy	892
UK	621
USA	854

Link *Complete demographic information can be found in* `Descriptive_Statistics.ipynb` .

Music as a tool for socio-emotional coping

During the pandemic, people are less able to rely on some methods of coping, like ones that may be expensive (therapy) or unavailable (socializing inside). We used a machine learning approach to investigate how people are using music to cope with the stress of the coronavirus crisis.

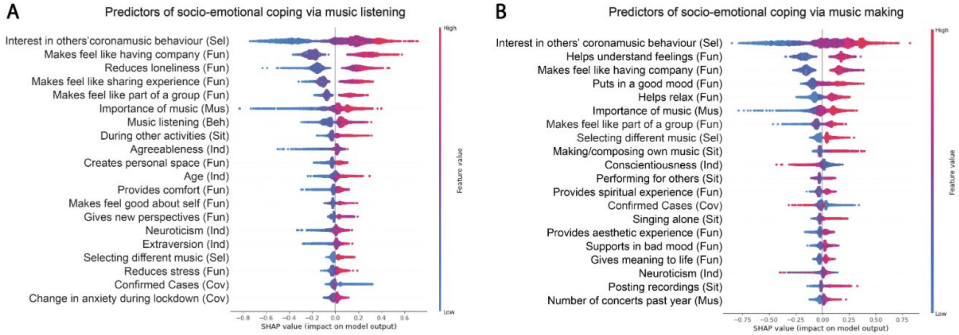
We defined music-related coping as listening to or making music in order to:

> Feel connected to others

> Serve as a replacement for social interaction

> Cope emotionally with the present situation

Two LGBM regression analyses were conducted: one about ***music listening*** and the other about ***making music***. The results are summarized in the SHAP value plots below.



Top 20 features predicting socio-emotional coping via (A) music listening and (B) making music. Data points represent SHAP values for every person on each of the top 20 most predictive features.

Music listening script: `Music_Listening_LGBM.ipynb` .

Music making script: `Music_Making_LGBM.ipynb` .

Thank You!

Contact Lindsay on Slack