Card Sorting Analysis Techniques

706.414-Seminar-Project

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Agenda

- Introduction

- Manual Analysis
  - Preprocessing
  - Category Standardisation
  - Mindset Management
  - Participant, Card, and Category Statistics

- Statistical Analysis:
  - Similarity and Co-Occurrence Matrix
  - Similarity Map
  - Dendrogram
  - Label Suggestions

Introduction

- What is card sorting? What problem does it solve?
- Create information hierarchies.
- Collaborative technique
- Sort and organize cards into meaningful groups.
- Gives good insight into how users think.
- Open card sorting.
- [Closed card sorting.]

Card Sorting

- Give participants unsorted stack of cards.
- Ask participants to sort cards into meaningful groups
- Ask participants to label the groups.
- Ask participants to explain sorting strategy (mindset).

1. Group the cards

2. Label the groups
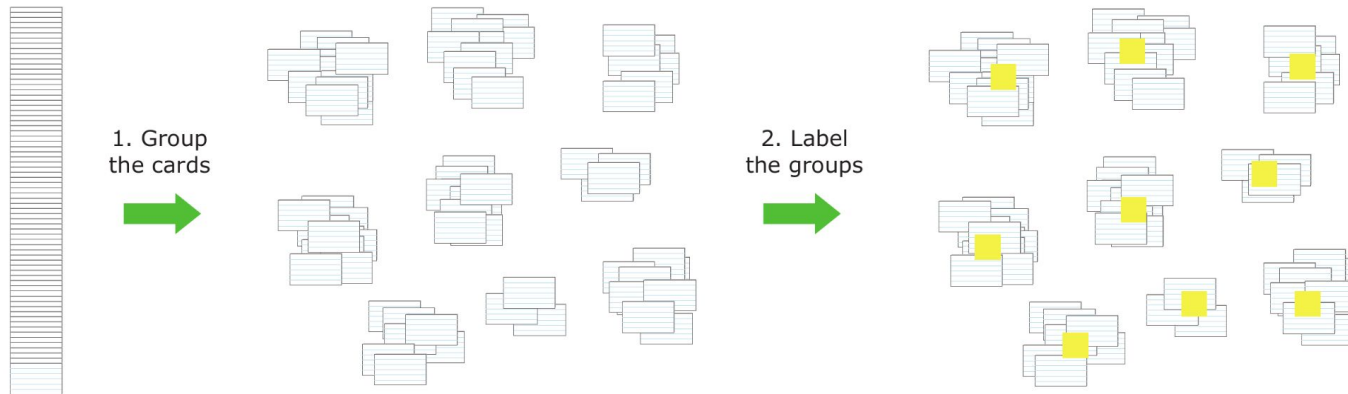
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Raw Card Sorting Data

- A typical card sorting result dataset:

Individual sorts of each participant

List of all used cards

Category labels

#	Card	Sort 1	Sort 2	Sort 3	Sort 4
1	Sausages	Fleischwaren	Wurst	Fleischiges	Fisch, Fleisch, Geflügel
2	Beer	Getränke	Getränke Alkohol	Alkohol	alkoholische Getränke
3	Parsley	Gemüse	Gewürze	Gemüse	Gewürze
4	Mustard	Gewürze	Gewürze	Würzen	Essig, Öl, Saucen
5	Hand Cream	Toilettartikel	Hygiene	Körperpflege	Pflegeprodukte
6	Teabags	Grundnahrungsmittel	Getränke alkoholfrei	Tee & Kaffee	nicht alkoholische Geträ
7	After Shave	Toilettartikel	Hygiene	Körperpflege	Pflegeprodukte
8	Honey	Süßigkeiten	Gewürze	Frühstück	Frühstück
9	Whipping Cream	Süßigkeiten	Milchprodukte	Kühlregal	Milchprodukte
10	Biscuits	Süßigkeiten	Nascherei	Naschen	Naschen
11	Strawberries	Obst	Obst	Obst	Obst
12	Walnuts	Nüsse	Nüsse u.ä.	Backen	Nüsse
13	Cucumbers	Gemüse	Gemüse	Gemüse	Gemüse
14	Beef	Fleischwaren	Hauptspeisen	Fleischiges	Fisch, Fleisch, Geflügel
15	Kitchen Roll	diverse	Hygiene	Haushalt	Sanitärbedarf
16	Apple Juice	Getränke	Getränke alkoholfrei	Anti-Alkohol	nicht alkoholische Geträ

Card Sorting Analysis Goals

- Spot key patterns in your data.
- Derive useful insights for your project.
- Improve your information architecture.
- Understand how your users think.
- People group items in a way that makes sense to them.
- Understand the user's mindset.

Types of Card Sorting Analysis

- Manual analysis:
  - Intuitive and creative.
  - What groups do people form? (Categories)
  - Identify the user's mindset (Organisational Schemes).
  - What labels and descriptions were used?
  - Card placement - which card is placed into which group?
  - How accurately participants have grouped the cards?

- Statistical analysis
  - Identify most consistent pattern.
  - Compare results from different groups of people.
  - Justify a recommendation.
  - Use of statistical methods (e.g. hierarchical clustering, k-means).

Manual Analysis

Card Sorting Analysis Process

- Preprocessing:
  - Remove invalid or dubious sorts.

- Category standardisation:
  - Merge similar groups and give them a single meaningful name.

- Identify the participants mindset:
  - Participants may have used a different organisational scheme.
  - Split data by mindset.
  - Use resulting datasets as individual sorting results.

- Standardised matrix for each mindset:
  - Use as a base for further processing.

Preprocessing

- Participants, who did not make a serious attempt.
- Can negatively affect results.
- Hard to spot. Some Rules of thumb:
  - Number of categories: Too few or too many. Compare to average.
  - Quality of labels: Use of vague category names (e.g. stuff, miscellaneous). Duplicates or synonyms.
  - Time taken: Unusual short or long time.

Category Standardisation

- Participants use similar but not identical words to describe things.
- Create a list of all categories created by participants.
- Merge categories with similar names or ideas.

Original Category	Standard Category (DE)
Körperpflege	Hygieneartikel
Pflegeprodukte	Hygieneartikel
Sanitärbedarf	Hygieneartikel
Hygieneartikel für den Körper	Hygieneartikel
Hygieneartikel	Hygieneartikel
Artikel-Hygiene	Hygieneartikel
Hygiene/Waschartikel	Hygieneartikel
Körperpflege	Hygieneartikel
Körperpflege	Hygieneartikel
Hygieneprodukte	Hygieneartikel
Toilette-Artikel	Hygieneartikel
hygiene	Hygieneartikel
Drugstore items	Hygieneartikel

Original Category	Standard Category (DE)
Lang haltbare Nahrung	Dosenkonserven
Dosenprodukte	Dosenkonserven
Non-perishable foods	Dosenkonserven
Dosengemüse	Dosenkonserven
Konserven	Dosenkonserven
Dosenprodukte	Dosenkonserven
Vorratskammer	Dosenkonserven
Haltbares (Vorratsschrank)	Dosenkonserven
stored food	Dosenkonserven
stationery	Dosenkonserven
Lang-haltbare Lebensmittel	Dosenkonserven
Cans	Dosenkonserven

Category Standardisation

Standardized category name

Animal supplies

Update your standardized category by including or excluding participant categories.

Agreement

42%

Categories

Select a category name to show which cards your participant sorted into this category.

Include	Unique Cards
☑ 📁 Pets	3
☑ 📁 Pet supplies	3
☑ 📁 Pet supplies	3
☑ 📁 Animal-based food	10
☑ 📁 Animal supplies	3

Cards

Select a card to show which categories your participants sorted this card into.

	Frequency
Sausages	1
Beef	1
Cheese	1
Butter	1
Milk	1
Ham	1
Dog Food	4
Yoghurt	1
Eggs	1

- **Attention:**
  - Always check category's content!
  - Similar name does not necessarily mean similar idea!

- **Agreement:**
  - Measure of agreement among participants on which cards should belong to a (standardised) category.

Category Standardisation

Standardized category name

Animal supplies

Agreement

100% ████████████████████████████████

Update your standardized category by including or excluding participant categories.

Categories

Select a category name to show which cards your participant sorted into this category.

Cards

Select a card to show which categories your participants sorted this card into.

Include		Unique Cards
☑	📁 Pets	3
☑	📁 Pet supplies	3
☑	📁 Pet supplies	3
☐	📁 Animal-based food	10
☑	📁 Animal supplies	3

	Frequency
Dog Food	4
Cat Food	4
Cat Litter	4

Cancel   Create

Standardised Matrix

- Transform raw card sort data into standardised matrix.

#	Card	Sort 1	Sort 2	Sort 3	Sort 4
1	Sausages	Fleischwaren	Wurst	Fleischiges	Fisch, Fleisch, Geflügel
2	Beer	Getränke	Getränke Alkohol	Alkohol	alkoholische Getränke
3	Parsley	Gemüse	Gewürze	Gemüse	Gewürze
4	Mustard	Gewürze	Gewürze	Würzen	Essig, Öl, Saucen
5	Hand Cream	Toilettartikel	Hygiene	Körperpflege	Pflegeprodukte
6	Teabags	Grundnahrungsmittel	Getränke alkoholfrei	Tee & Kaffee	nicht alkoholische Geträ▶
7	After Shave	Toilettartikel	Hygiene	Körperpflege	Pflegeprodukte
8	Honey	Süßigkeiten	Gewürze	Frühstück	Frühstück
9	Whipping Cream	Süßigkeiten	Milchprodukte	Kühlregal	Milchprodukte
10	Biscuits	Süßigkeiten	Nascherei	Naschen	Naschen

#	Card	Sort 1	Sort 2	Sort 3	Sort 4
1	Sausages	Meat	Meat	Meat	Meat
2	Beer	Drinks	Alcoholic Drinks	Alcoholic Drinks	Alcoholic Drinks
3	Parsley	Vegetables	Sauces & Spices	Vegetables	Sauces & Spices
4	Mustard	Sauces & Spices	Sauces & Spices	Sauces & Spices	Dressings
5	Hand Cream	Hygiene	Hygiene	Hygiene	Hygiene
6	Teabags	Staple Food	Non-Alcoholic Drink▶	Coffee & Tea	Non-Alcoholic Drinks
7	After Shave	Hygiene	Hygiene	Hygiene	Hygiene
8	Honey	Sweets	Sauces & Spices	Breakfast	Breakfast
9	Whipping Cream	Sweets	Milk Products	Fridge	Milk Products
10	Biscuits	Sweets	Sweets	Sweets	Sweets
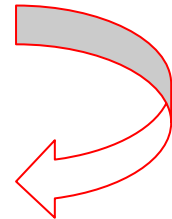
Correlation Count

- How many participants have sorted a card into a certain category:

Total participants   0 ▬▬▬▬▬▬▬▬▬▬▬ 5

Name	Alcaholic ...	Animal-b...	Beverages	Breakfast	Fish
After Shave					
Almonds					
Apple Juice			4	1	
Apples					
Bananas				1	
Batteries					
Beef		1			
Beer	3		2		
Biscuits					

Mindset Management

#	Cards	Sort 1	Sort 2
1	Muesli	Breakfast	Staple food
2	Yoghurt	Breakfast	Milk products
3	Bananas	Breakfast	Fruits
4	Bread Rolls	Breakfast	Staple food
5	Ham	Breakfast	Meat
6	Kitchen Roll	Cooking	Household items
7	Olive Oil	Cooking	Sauces & Spices
8	Salt	Cooking	Sauces & Spices
9	Pepper	Cooking	Sauces & Spices
10	Vinegar	Cooking	Sauces & Spices
11	Potting Soil	Gardening	Household items
12	Cat Litter	Pet-keeping	Pet supplies
13	Dog Food	Pet-keeping	Pet supplies
14	Cat Food	Pet-keeping	Pet supplies
15	Pencils	Workplace	Office supplies
16	Copier Paper	Workplace	Office supplies
17	Sticky Tape	Workplace	Office supplies
Mindset		*Activities*	*Groceries in a Supermarket*

- Identify grouping strategy (mindset) used for each individual sort.
- For example: shelf in supermarket, activity of use, ingredients for recipe, country of origin, ...
- Ask the user to explain their mindset:
  - In-person (supervised), or post-study question (unsupervised).

Participant Statistics

	Participant ⌃⌄	Status ⌄	Time taken ⌄	Question responses ⌄	Cards sorted ⌄	Categories created ⌄	Categories named ⌄	
☐	Participant 1	Completed	23:16	0	100%	17	100%	Exclude from results
☐	Participant 2	Completed	28:13	0	100%	26	100%	Exclude from results
☐	Participant 3	Completed	13:00	0	100%	10	100%	Exclude from results
☐	Participant 4	Completed	14:39	0	100%	17	100%	Exclude from results
☐	Participant 5	Completed	9:43	0	100%	17	100%	Exclude from results

Category Statistics

	Standard Category (EN)	Sorters who used this	Total cards in this category	Unique cards	Agreement
2	Alcoholic Drinks	20	112	7	0.80
3	Baking	7	30	13	0.33
4	Breakfast	18	73	26	0.16
5	Canned Food	7	17	19	0.13
6	Cereals	2	5	7	0.36
7	Coffee & Tea	6	13	3	0.72
8	Convenience Products	7	24	24	0.14
9	Dressings	8	32	12	0.33
10	Drinks	12	106	26	0.34
11	Fresh Food	1	14	27	0.52
12	Fridge	3	18	37	0.16

- Agreement = Total cards / (Sorters * Unique cards)
- E.g. 100 % = 12 / (3 * 4)
  - All 3 participants have sorted the same cards into this category.

Card Statistics

Analyse card placement:

- Categories: # categories each card sorted to.
- Frequency: # participants who placed each card in a category.
- Position: Average position (rank) of card in group [optional].

Card	Sorted into	Categories	Frequency	Position
After Shave	1 category	Personal hygienie	5	6.2
Almonds	3 categories	Fruits	3	4.0
		Nuts	1	1.0
		Fruits and Vegetables	1	17.0
Apple Juice	2 categories	Beverages	4	6.3
		Breakfast	1	5.0
Apples	2 categories	Fruits	4	8.3
		Fruits and Vegetables	1	18.0
Bananas	3 categories	Fruits	3	3.7
		Fruits and Vegetables	1	2.0
		Breakfast	1	7.0

Demo

Statistical Analysis

Similarity Matrix

- Shows, how often two cards get sorted into the same category.

	A	B	C	D	E	F	G	H
1	**Cards**	Sausages	Beer	Parsley	Mustard	Hand Cream	Teabags	After Shave
2	Sausages	38	1	3	3	0	4	0
3	Beer	1	38	0	0	0	9	0
4	Parsley	3	0	38	16	0	2	0
5	Mustard	3	0	16	38	0	4	0
6	Hand Cream	0	0	0	0	38	2	38
7	Teabags	4	9	2	4	2	38	2
8	After Shave	0	0	0	0	38	2	38

Total number of cards: 38

Co-Occurrence Matrix

- % participants who grouped two cards together.
- Colour coding: start manual grouping with darker shades of blue.

Co-Occurrence Matrix

- Matrix permutations: most closely related pairings clustered along diagonal.
- Clusters of related cards appear.
- Can be used to visually separate cards into categories.
- Darker color means higher agreement.

Similarity Map

Similarity Map (t-SNE)

- Similarity between cards shown as 2D relationship.
- Algorithms:
  - Transform distance matrix into 2D map.
  - Dimension reduction but preserve similarity.
  - PCA, t-SNE, FDP
- Each point represents an individual card.
- Two cards close to each other were more frequently sorted into same category.

Similarity Map

Similarity Map (t-SNE)

- Manually select dense areas to create potential categories.

Similarity Map 3D

3D cluster view ⓘ

View potential groupings ^

Show **6** groups

6

− ○ +

1   100

Reset to suggested

Reset

Explore individual groups ∨

Options ∨

ⓘ + − ⟳

No group selected
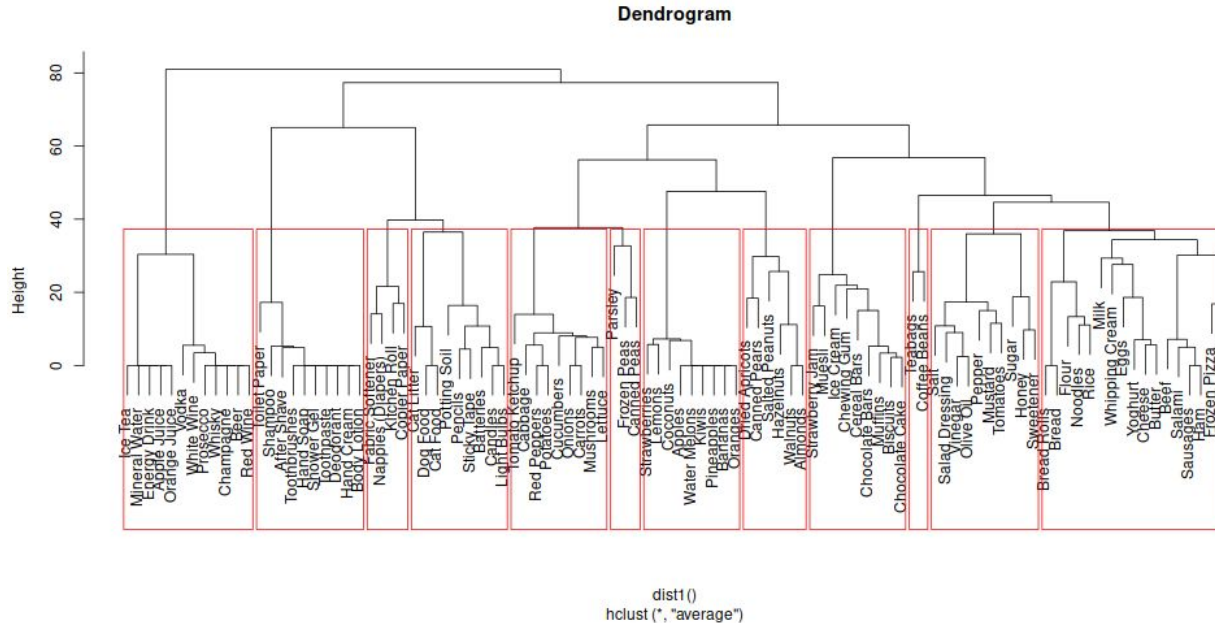
- Similarity visualised as 3D spatial relationship.

- Multidimensional Scaling:
  - Translate a table of similarities into a 3D map.
  - Dimension reduction so that similarity is preserved.

- Potential categories are marked as polygons.

Dendrograms

- Hierarchical clustering
- Cards are grouped into clusters depending on their distance.
- Start with N clusters (each card).
- Recursively merge clusters.
- Choose granularity:
  - # of categories.

Label Suggestions

- Suggest a category name for each resulting cluster.
- Frequency of category:
  - # participants who used a specific category for each item.
  - Use top 3 category labels.

Drinks:68.7%, Alcoholic Drinks:25.2%, Non-Alcoholic Drinks:6.1%
Beer
Apple Juice
Red Wine
Orange Juice
Energy Drink

Spices:35.4%, Food:34.9%, Meat:29.7%
Sausages
Mustard
Teabags
Honey

Hygiene:97.6%, Household:1.9%, Fruit:0.5%
Hand Cream
After Shave
Body Lotion
Deodorant

Vegetables:47.4%, Fruit:39%, Fruit and Vegetables:13.6%
Parsley
Strawberries
Walnuts

Demo