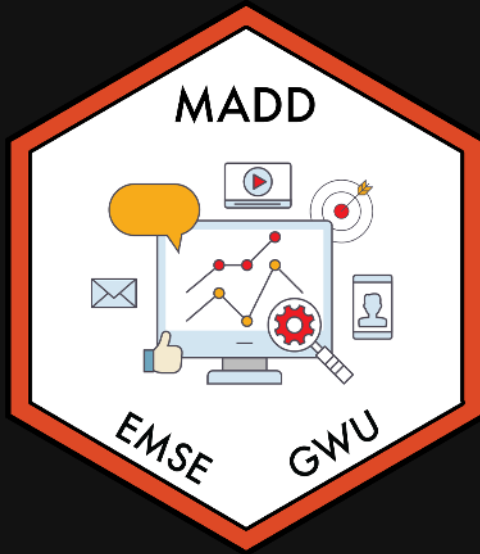




Week 6: *Conjoint Questions*

 EMSE 6035: Marketing Analytics for Design Decisions

 John Paul Helveston

 October 01, 2025

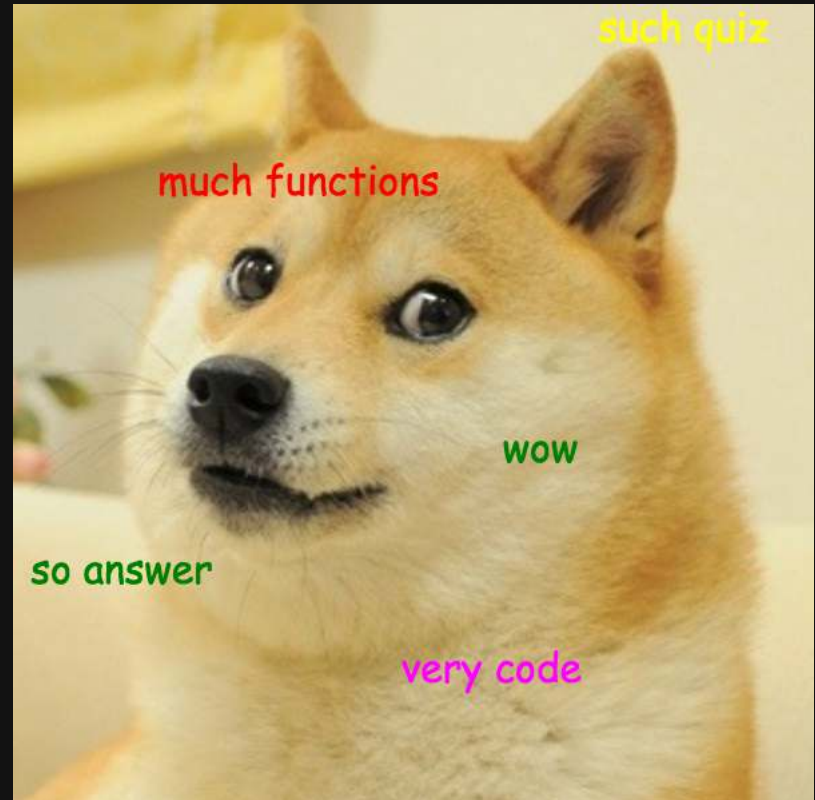
Quiz 2

12:00

Write your name on the quiz!

Rules:

- Work alone; no outside help of any kind is allowed.
- No calculators, no notes, no books, no computers, no phones.



Some Quarto tips

Convert a data frame to a markdown table with `kable()`

```
library(tidyverse)
```

```
mtcars %>%  
  kable()
```

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2
Valiant	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
Duster 360	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
Merc 230	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4
Merc 280C	17.8	6	167.6	123	3.92	3.440	18.90	1	0	4	4

Example from last year

```
library(tidyverse)
library(here)

df <- read_csv(here("data", "competitors.csv"))
df %>%
  kable()
```

brand	volumelnOz	quantity	price	pricePerCup	biodegradability	opacity	logo
greatValue	9	50	\$2.98	\$0.06	FALSE	TRUE	FALSE
decorRack	9	50	\$5.99	\$0.12	FALSE	TRUE	FALSE
tigerChef	9	100	\$7.99	\$0.08	FALSE	TRUE	FALSE
smartly	9	80	\$2.79	\$0.03	FALSE	FALSE	FALSE
solo	9	50	\$4.04	\$0.08	FALSE	FALSE	FALSE
greatValue	9	100	\$3.76	\$0.04	FALSE	FALSE	FALSE
ecoProducts	9	1000	\$187.69	\$0.19	TRUE	FALSE	TRUE
worldCentric	9	2000	\$220.00	\$0.11	TRUE	FALSE	TRUE
hefty	18	50	\$3.98	\$0.08	FALSE	TRUE	FALSE
hefty	18	50	\$3.98	\$0.08	FALSE	TRUE	FALSE

More `kable()` formatting options:
`{kableExtra}` package

References

Simple approach: Insert a footnote with `^[]`

This markdown...

```
The Eiffel Tower is 324 meters  
tall^[From the [Eiffel Tower  
wikipedia page]  
(https://en.wikipedia.org/wiki/  
/Eiffel_Tower)]
```

...renders as this

The Eiffel Tower is 324 meters tall¹

¹From the [Eiffel Tower wikipedia page](https://en.wikipedia.org/wiki/Eiffel_Tower)

References

Complex (but more complete) approach: Use bibtex

<https://quarto.org/docs/authoring/footnotes-and-citations.html>

You can insert citations with `[@citekey]`, and a "References" table will be automatically created.

Footnotes are perfectly fine for this class

Week 6: *Conjoint Questions*

1. Defining choice questions in R
2. Displaying choice questions in surveydown

Week 6: *Conjoint Questions*

1. Defining choice questions in R
2. Displaying choice questions in surveydown

Download & unzip:

- logitr-cars
- today's practice notes (2 survey templates)

Open `logitr-cars.Rproj`

We'll be using the `{cbcTools}` package today

Install with:

```
pak::pak("jhelvy/cbcTools")
```

Choice question components

1. Generate **profiles** for each attribute and level
2. Create a survey **design** data frame from **profiles**

Basic Design

Any combination of attributes can be shown in each choice question

Question 1

Option:	1	2	3
Price:	\$15	\$25	\$25
Fuel Economy:	25 (mpg)	25 (mpg)	25 (mpg)
Accel. Time:	6 (s)	7 (s)	8 (s)
Powertrain:	Electric	Gasoline	Electric

Question 2

Option:	1	2	3
Price:	\$20	\$25	\$25
Fuel Economy:	25 (mpg)	20 (mpg)	25 (mpg)
Accel. Time:	7 (s)	6 (s)	7 (s)
Powertrain:	Gasoline	Gasoline	Electric

Labeled Design

One attribute is used as the "label" - choice options are fixed according to the label

Question 1

Option:	Gasoline	Electric
Price:	\$20	\$25
Fuel Economy:	20 (mpg)	25 (mpg)
Accel. Time:	8 (s)	8 (s)

Question 2

Option:	Gasoline	Electric
Price:	\$20	\$25
Fuel Economy:	20 (mpg)	20 (mpg)
Accel. Time:	6 (s)	8 (s)

Design with a "None" option

A "none" option means they can choose an "other" option

Question 1

Option:	1	2	3	None
Price:	\$15	\$20	\$15	
Fuel Economy:	25 (mpg)	25 (mpg)	30 (mpg)	
Accel. Time:	8 (s)	8 (s)	7 (s)	
Powertrain:	Gasoline	Gasoline	Gasoline	

Question 2

Option:	1	2	3	None
Price:	\$15	\$15	\$25	
Fuel Economy:	25 (mpg)	30 (mpg)	30 (mpg)	
Accel. Time:	6 (s)	8 (s)	6 (s)	
Powertrain:	Gasoline	Electric	Electric	

Attribute-specific features

Some attributes may only be valid for certain levels of other attributes

Example: The driving range of an electric vehicle (EV) only applies to EVs and not gasoline-powered vehicles.

To implement this, you may need to add restrictions to your `profiles` with `cbc_restrict()`

(see `logitr-cars` code 1.2)

Warning: Restrictions can lead to imbalances

Use `balance_by` in `cbc_design()` to fix imbalances

(see `logitr-cars` code 1.2)

Your Turn

20:00

Open `survey.Rproj` in "conjoint_buttons" template

With your team, discuss the specific choice question design for your project

- Regular or labeled?
- Include a "none" option (outside good) or not?
- Include restrictions?

Then edit the `make-choice-questions.R` file to design your choice questions.

Week 6: *Conjoint Questions*

1. Defining choice questions in R
2. **Displaying choice questions in surveydown**

Displaying choice questions in your survey

1. Read in the design file (`choice_questions.csv`)
2. Sample and store a random respondent ID
3. Filter the design for the respondentID
4. Define a function to create question options
5. Create the options for each choice question
6. Create each choice question (6 in total)

1. Read in the design file (`choice_questions.csv`)

```
design <- readr::read_csv("choice_questions.csv")
```

2. Sample and store a random respondent ID

Sample a random respondentID

```
respondentID <- sample(design$respID, 1)
```

Store the respondentID

```
sd_store_value(respondentID, "respID")
```

In your survey data, you will have a **respID** column

3. Filter the design for the respondentID

```
df <- design %>%  
  filter(respID == respondentID) %>%  
  mutate(image = paste0("images/", image))
```

Images are stored in "images" folder, so we paste on that path

Result looks like this:

```
head(df)
```

```
#> # A tibble: 6 × 9  
#>   respID  qID altID obsID profileID type      price freshness image  
#>   <dbl> <dbl> <dbl> <dbl>      <dbl> <chr>    <dbl> <chr>    <chr>  
#> 1    299     1     1  2385        103 Honeycrisp     4    Poor  images/honeycrisp.jpg  
#> 2    299     1     2  2385         54 Pink Lady    2.5 Average images/pinkLady.jpg  
#> 3    299     1     3  2385         22 Gala         3 Excellent images/gala.jpg  
#> 4    299     2     1  2386         66 Fuji         4 Average images/fuji.jpg  
#> 5    299     2     2  2386         76 Fuji         1.5 Poor  images/fuji.jpg  
#> 6    299     2     3  2386         44 Pink Lady    1.5 Average images/pinkLady.jpg
```

4. Define a function to create question options

```
make_cbc_options <- function(df) {  
  alt1 <- df |> filter(altID == 1)  
  alt2 <- df |> filter(altID == 2)  
  alt3 <- df |> filter(altID == 3)  
  
  options <- c("option_1", "option_2",  
"option_3")  
  
  names(options) <- c(  
    glue("  
      **Option 1**<br>  
      <img src='{alt1$image}' width=100><br>  
      **Type**: {alt1$type}<br>  
      **Price**: $ {alt1$price} / lb  
    "),  
    glue("  
      **Option 2**<br>  
      <img src='{alt2$image}' width=100><br>  
      **Type**: {alt2$type}<br>  
      **Price**: $ {alt2$price} / lb  
    "),  
    glue("  
      **Option 3**<br>  
      <img src='{alt3$image}' width=100><br>  
      **Type**: {alt3$type}<br>  
      **Price**: $ {alt3$price} / lb  
    ")  
  )  
  return(options)  
}
```

4. Define a function to create question options

Make one-row data frames for each alternative.

For example, `alt1` looks like this:

```
#> Rows: 1
#> Columns: 9
#> $ respID      <dbl> 299
#> $ qID         <dbl> 1
#> $ altID       <dbl> 1
#> $ obsID       <dbl> 2385
#> $ profileID   <dbl> 103
#> $ type        <chr> "Honeycrisp"
#> $ price       <dbl> 4
#> $ freshness   <chr> "Poor"
#> $ image       <chr>
"images/honeycrisp.jpg"
```

```
make_cbc_options <- function(df) {
  alt1 <- df |> filter(altID == 1)
  alt2 <- df |> filter(altID == 2)
  alt3 <- df |> filter(altID == 3)

  options <- c("option_1", "option_2",
               "option_3")

  names(options) <- c(
    glue("
      **Option 1**<br>
      <img src='{alt1$image}' width=100><br>
      **Type**: {alt1$type}<br>
      **Price**: $ {alt1$price} / lb
    "),
    glue("
      **Option 2**<br>
      <img src='{alt2$image}' width=100><br>
      **Type**: {alt2$type}<br>
      **Price**: $ {alt2$price} / lb
    "),
    glue("
      **Option 3**<br>
      <img src='{alt3$image}' width=100><br>
      **Type**: {alt3$type}<br>
      **Price**: $ {alt3$price} / lb
    ")
  )
  return(options)
}
```

4. Define a function to create question options

```
alt1[c('image', 'type', 'price')]
```

```
#> # A tibble: 1 × 3  
#>   image          type  
price  
#>   <chr>         <chr>  
<dbl>  
#> 1 images/honeycrisp.jpg Honeycrisp  
4
```

Highlighted section renders as:

```
#> **Option 1**<br>  
#> <img src='images/honeycrisp.jpg'  
width=100><br>  
#> **Type**: Honeycrisp<br>  
#> **Price**: $ 4 / lb
```

```
make_cbc_options <- function(df) {  
  alt1 <- df |> filter(altID == 1)  
  alt2 <- df |> filter(altID == 2)  
  alt3 <- df |> filter(altID == 3)  
  
  options <- c("option_1", "option_2",  
"option_3")  
  
  names(options) <- c(  
    glue("  
      **Option 1**<br>  
      <img src='{alt1$image}' width=100><br>  
      **Type**: {alt1$type}<br>  
      **Price**: $ {alt1$price} / lb  
    "),  
    glue("  
      **Option 2**<br>  
      <img src='{alt2$image}' width=100><br>  
      **Type**: {alt2$type}<br>  
      **Price**: $ {alt2$price} / lb  
    "),  
    glue("  
      **Option 3**<br>  
      <img src='{alt3$image}' width=100><br>  
      **Type**: {alt3$type}<br>  
      **Price**: $ {alt3$price} / lb  
    ")  
  )  
  return(options)  
}
```

5. Create the options for each choice question

```
cbc1_options <- make_cbc_options(df |> filter(qID == 1))
```

Value stored in your data:

```
#> option_1
```

Label:

```
#> [1] "  **Option 1**<br>\n  <img  
src='images/honeycrisp.jpg' width=100>  
<br>\n  **Type**: Honeycrisp<br>\n  **Price**: $ 4 / lb"
```

Renders as:

Option 1



Type: Honeycrisp

Price: \$ 4 / lb

5. Create the options for each choice question

Now make the options for each question

```
cbc1_options <- make_cbc_options(df |> filter(qID == 1))  
cbc2_options <- make_cbc_options(df |> filter(qID == 2))  
cbc3_options <- make_cbc_options(df |> filter(qID == 3))  
cbc4_options <- make_cbc_options(df |> filter(qID == 4))  
cbc5_options <- make_cbc_options(df |> filter(qID == 5))  
cbc6_options <- make_cbc_options(df |> filter(qID == 6))
```

6. Create each choice question (6 in total)

Code:

```
sd_question(  
    type    = 'mc_buttons',  
    id      = 'cbc_q1',  
    label   = "(1 of 6) If these were your  
only options, which would you choose?",  
    option  = cbc1_options  
)
```

Renders as:

Option 1  Type: Red Delicious Price: \$ 1 / lb	Option 2  Type: Red Delicious Price: \$ 2 / lb	Option 3  Type: Fuji Price: \$ 2 / lb
--	--	---

TABLE layout: Show options in a table with `kable()`

```
library(dplyr)

alts <- df %>%
  filter(qID == 1) %>%
  mutate(
    # Add $ sign to price and html code for image path
    price = paste(scales::dollar(price), "/ lb"),
    image = paste0('<img src=""', image, '" width=100>')) %>%
  # Make nicer attribute labels
  select(
    `Option:`      = altID,
    ` `            = image,
    `Price:`       = price,
    `Type:`        = type,
    `Freshness:`   = freshness)

# Drop row names
row.names(alts) <- NULL
```

Option: Show options in a table with `kable()`

Display the *transpose*, `t(alts)`

```
kbl(t(alts), escape = FALSE) %>%  
  kable_styling(  
    bootstrap_options = c("striped", "hover", "condensed"),  
    full_width = FALSE,  
    position = "center"  
  )
```

Option:	1	2	3
			
Price:	\$4.00 / lb	\$2.50 / lb	\$3.00 / lb
Type:	Honeycrisp	Pink Lady	Gala
Freshness:	Poor	Average	Excellent

TABLE layout: Show options in a table with `kable()`

Your choice question can be defined in the `survey.qmd` file as it is just choosing one of three options:

If these were your only options, which would you choose?

Option 1 Option 2 Option 3

Option:	1	2	3
			
Price:	\$4.00 / lb	\$2.50 / lb	\$4.00 / lb
Type:	Fuji	Gala	Honeycrisp
Freshness:	Excellent	Excellent	Average

Next

Your Turn

20:00

With your team, choose a format to work with (buttons or table) for your choice question, then modify the example survey to match your project.

Versions:

Buttons layout: `conjoint_buttons`

Table layout: `conjoint_tables`