Statistics with R
Exercise Sheet №0

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1)

Example of measurement variables from HCI:

Continuous variable : System Response Time (SRT)

It is the amount of time taken by an interactive system to return results after a user submits a request. For example - 0.1 s, 3 s, 200ms

Scale - Ratio. Can be added, subtracted, divided and multiplied. Actual zero exists.

Discrete Variable : Type of User

Some research experiments may involve clustering of users of an interface based on age, ethnicity, educational qualifications etc. For example - To establish the ease of using an interface, users could be divided into categories based on their age.

Scale - Nominal/Ordinal based on the experiment.

2)

Research question: Does using a particular personalized learning software increase speed of learning a new language in adults?

Population: All adults in the world

Sample: Adults sampled from online Spanish language learning forums

How this sample can be chosen : By posting ads in Spanish language learning forums online to recruit beginners. Typically, participants would be recruited by posting ads in relevant venues.

3)

This is not a random sample because people wanting to learn Spanish may mostly be from Europe or North America.

These participants may not represent adults who speak vastly different languages, who are from different countries or ethnicities.

Also internet forums to learn a language may be used by already highly interested and motivated language learners. This leaves out the vast majority of adults with no remarkable interest to learn a new language.

4)

Identify the Independent (IV) and Dependent variable (DV) and mention its scale:

4.1.

IV : Mode of transportation

DV : Time taken by the mode of transport

Scale : Ordinal

Explanation :

- Data clearly ordered. For e.g. - The result could be time taken by bus < time taken by car < time taken by train. Hence, not nominal scale.
- The difference between time taken by bus & train, train & car, train & bus, bus & car may not be the same. Hence, not interval scale.
- Time taken can be divided and multiplied but there's no "natural" zero. It isn't possible for any of those modes of transportation to take "zero" time. Hence, not ratio scale.

4.2.

IV : Popularity of green revolution

DV : Number of "YES" votes, number of "NO" votes

Scale : Nominal

Explanation :

- There's no order in the "number of YES" and "number of NO". Hence, not ordinal.

4.3.

IV : Caffeine intake

DV : Hunger level

Scale : Ordinal

Explanation :

- The options in a 5point Likert scale are clearly ordered, so not nominal.
- There's also no "natural" zero amongst the 5 options. Hence, not ratio.
- The differences among the 5 options may be considered somewhat similar to each other. But it's not interval scale. We may somehow consider it a quasi-interval scale.

5)

Paper:

A Robotic Positive Psychology Coach to Improve College Students' Wellbeing (Jeong et al., 2020)
https://dam-prod.media.mit.edu/x/2020/09/03/RO_MAN_2020_5nanLmO.pdf

a)

"We hypothesize that positive psychology interventions provided by a social robot companion that builds rapport with users can improve college students' psychological wellbeing, mood, and readiness to change behavior in an on-campus dormitory setting." (Jeong, 2020, September)

b)

All college students in the world living in an on-campus dormitory.

c)

Sample:
42 undergraduate students at MIT. They all lived in on-campus dormitories.

Random:
The sample was not random, since all participants were recruited via an email advertisement. Therefore the participants decided whether or not they wanted to participate in the study. The researchers accepted every signed-up participant into the sample set.
Another reason for the sample being not random is that the chosen participants were only students from MIT.

d)

Since the robot collected raw video and audio footage during each session, the process of data-collection seems to be unbiased. The collected data on the other hand might have been biased due to privacy concerns of the participants.

e)

The study was designed as a multiple session experimental study.

f)

The participants' psychological wellbeing (based on Ryff's Psychological Wellbeing Scale), their mood (based on the Brief Mood Introspection Scale) and their readiness to change behavior (based on a Readiness to Change Ruler).

g)

The social robot companion and his skills. (i.e with or without the robot)

i)

Responses for all variables were taken in Likert scale which is interpreted as interval scale in this study.

h)

Discrete:
Ryff's Psychological Wellbeing Scale
Brief Mood Introspection Scale
Readiness to Change Ruler

The robot companion can not be measured as continuous or discrete.

j)

For the data analysis, participants were separated into two groups based on the k-means algorithm. Also, standard derivations and mean values were calculated for each independent variable. The differences between these independent variables were determined via paired t-tests with the specifications being using the robot and not using the robot.

k)

The k-means algorithm was used to separate the participants based on their neuroticism and conscientiousness levels.

The paired t-test was used because each participant was measured in two dimensions: (1) using the robot, (2) not using the robot.

Sources

Jeong, S. a.-F. (2020, September). *A Robotic Positive Psychology Coach to Improve College Students' Wellbeing.* In 2020 29th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN) (pp. 187-194).