

# Sharing Data and Knowledge: Exploring Relationships and Difference Among Day, Time, Gender, Place, and Smartphone Use

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## Introduction

- Recently, mobile phone ownership rate meets a high percentage in different places.
- 95.4% of women and 96.8% of men in Hong Kong own mobile phone (Census and Statistics Department, 2016)
- 92% of American adults own mobile phone and 68% of American adults have a smartphone (Pew research center, 2015)
- Different from traditional cell phone, smartphone combines the pocket-sized communication device with computer like capabilities (Carroll & Heiser, 2010).

# Introduction

## 01

Smartphone has four main usages, namely user interactions, application use, network traffic and energy drain (Falakiet al., 2010).

## 02

Apps were not appeared until 10<sup>th</sup> July 2008 which was the day that App Store went online. There were only 500 apps available at the beginning but App store hosted more than 10 million download within 3 days (Apple, 2008a; 2008b).

## 03

Application use in smartphone is not only a time-consuming user activity for users, but also an activity that beneficial for learning and health (Dennison, Morrison, Conway, & Yardley, 2013; Tossell, Kortum, Shepard, Rahmati, & Zhong, 2015).

## Research Objective

- Determine the basic information of smartphone use

## Research questions

- What kind of app do people use in smartphones?
- Does gender affect smartphone use?
- Does place affect smartphone use?
- Does time or day affect smartphone use?

# Method - How data collection is conducted

- This study was started in the summer of 2016, with a view to suggest a new way to collect smartphone use data.
- A mobile app was developed (SY MediaLab Big Data Project, 2016) to allow researchers to observe and to collect smartphone use.
- Researchers went to different public places to observe how people were using smartphone use.
- They recorded the data by choosing among eight different uses, including Game, Instant Communication, Video, Social Media, Phone Call, Information Browsing, Photo, and Listening. Researchers could record the smartphone use of any five people around them.

# Method - How data collection is conducted

- The screen displayed eight blue buttons for male; and another eight pink buttons for female. Researchers then pressed the submit button to send the data which would be saved in the server.
- If the researcher pressed the wrong button and wanted to change, they could press the icon once more to remove it in order to select the correct button again.
- The server recorded the smartphone use, the date, the time, the gender, and the GPS location, without any individual or personal identities.

# Method - How data collection is conducted

- The project website would automatically update the database and show real-time generated graphs on the website (<http://www.symedialab.org.hk/symlbd/index.php>).
- The project website would also provide a download link for the public in order to download the raw data. The public could therefore suggest their own way to analyze the data. Hence, the project achieves the goal of sharing data and knowledge.

# Method - Rationale to data collection method

- We are used to conduct survey for data collection and it is appropriate when the data is related to respondents' opinion or attitude.
- However, it is not always accurate if we collect smartphone use which is depended on respondents' memory.
- It would be much accurate if we could collect the data, for example, through telecommunication companies or communication platforms.

# Method - Rationale to data collection method

- While each company could only cover their customers or members and such confidential data would not easily be shared.
- Therefore, this project proposed an alternative: to recruit a large number of researchers who help to collect data at different time, different date, and different places. This project could be conducted all over the world.

# Method - Classification of smartphone use

- In this study, smartphone use were classified into eight different uses, including Game, Instant Communication, Video, Social Media, Phone Call, Information Browsing, Photo, and Listening.
- Firstly, Phone Call is a traditional and basic function of smartphone that the public use to communicate with others.
- Secondly, Photo, Audio (Listening) and Video are multimedia production and presentation tools for a smartphone. Users could make and play multimedia elements with smartphones.

# Method - Classification of smartphone use

- Thirdly, smartphone provides game for entertaining and for fun.
- Fourthly, smartphones provide frequent social interactions through connection to the Internet. According to the media richness theory (Daft & Lengel, 1986), whether a medium is rich or lean, is depended on four dimensions, including the capability of providing immediate feedback, number of cues and channel utilized, personalization, and natural language. We classified computer-like functions in smartphone use into three groups based on their level of media richness, namely Information Browsing, Social Media and Instant Communication.
- The above classification covers most of smartphone use. It might sacrifice providing further details but it offers a strict forward data collection for smartphone use.

# Results

- In this study, we reported the pilot data collected during the 90 days, from 18<sup>th</sup> July to 15<sup>th</sup> October, 2016. There were 4760 data sets.
- Researchers randomly collected data at different time and places, the weekday of data collection ranged from 355 to 1355; time of data collection ranged from 5 to 705; male users consisted of 2245 and female users consisted of 2515.

# Results

- From the 4760 data sets, most people played Game (1061, 22.3%), followed by Instant Communication (915, 19.2%), Social Media (744, 15.6%), Phone Call (593, 12.5%), Information Browsing (563, 11.8%), Listening (433, 9.1%), Video (322, 6.8%) and Photo (129, 2.7%).
- Moreover, most of the data was collected at Hong Kong (3885, 81.6%), followed by Taiwan (510, 10.7%) and Singapore (365, 7.7%).

# Results - Descriptive Statistics of Weekday, Time and Gender

| Weekday   | f (%)        |
|-----------|--------------|
| Monday    | 460 (9.7%)   |
| Tuesday   | 685 (14.4%)  |
| Wednesday | 640 (13.4%)  |
| Thursday  | 820 (17.2 %) |
| Friday    | 1355 (28.5%) |
| Saturday  | 355 (7.5%)   |
| Sunday    | 445 (9.3%)   |

| Time  | f (%)       |
|-------|-------------|
| 00:00 | 55 (1.2%)   |
| 01:00 | 35 (.7%)    |
| 02:00 | 10 (.2%)    |
| 03:00 | 15 (.3%)    |
| 04:00 | 0           |
| 05:00 | 10 (.2%)    |
| 06:00 | 5 (.1%)     |
| 07:00 | 50 (1.1%)   |
| 08:00 | 100 (2.1%)  |
| 09:00 | 705 (14.8%) |
| 10:00 | 115 (2.4%)  |
| 11:00 | 200 (4.2%)  |
| 12:00 | 295 (6.2%)  |
| 13:00 | 180 (3.8%)  |
| 14:00 | 235 (4.9%)  |
| 15:00 | 175 (3.7%)  |
| 16:00 | 185 (3.9%)  |
| 17:00 | 340 (7.1%)  |
| 18:00 | 525 (11%)   |
| 19:00 | 395 (8.3%)  |
| 20:00 | 345 (7.2%)  |
| 21:00 | 420 (8.8%)  |
| 22:00 | 180 (3.8%)  |
| 23:00 | 185 (3.9%)  |

| Gender | f (%)        |
|--------|--------------|
| Male   | 2245 (47.2%) |
| Female | 2515 (52.8%) |

# Results - Descriptive Statistics of Smartphone Use and Places

| Smartphone Use        | f (%)        |
|-----------------------|--------------|
| Game                  | 1061 (22.3%) |
| Instant Communication | 915 (19.2%)  |
| Video                 | 322 (6.8%)   |
| Social Media          | 744 (15.6%)  |
| Phone Call            | 593 (12.5%)  |
| Information Browsing  | 563 (11.8%)  |
| Photo                 | 129 (2.7%)   |
| Listening             | 433 (9.1%)   |

| Places    | f (%)        |
|-----------|--------------|
| Hong Kong | 3885 (81.6%) |
| Taiwan    | 510 (10.7%)  |
| Singapore | 365 (7.7%)   |

# Results - chi-square test

- A chi-square test was performed and significant relationships were found between smartphone use and gender ( $\chi^2 = 151.19, df = 7, p < .001$ ) ; smartphone use and places ( $\chi^2 = 778.77, df = 14, p < .001$ ) (see Table 4); smartphone use and weekday ( $\chi^2 = 240.23, df = 42, p < .001$ ) (see Table 5); and smartphone use and time ( $\chi^2 = 782.38, df = 154, p < .001$ ) (see Table 6).

# Results - chi-square test

Table 3.

*Chi-square Test between Smartphone Use and Gender*

| Gender | Smartphone Use |                       |       |              |            |                      |       |           |         | $\chi^2$ | df | p-value |
|--------|----------------|-----------------------|-------|--------------|------------|----------------------|-------|-----------|---------|----------|----|---------|
|        | Game           | Instant Communication | Video | Social Media | Phone Call | Information Browsing | Photo | Listening | Total N |          |    |         |
| Male   | 650            | 340                   | 122   | 309          | 275        | 293                  | 50    | 206       | 2245    | 151.19   | 7  | .000    |
| Female | 411            | 575                   | 200   | 435          | 318        | 270                  | 79    | 227       | 2515    |          |    |         |

Table 4.

*Chi-square Test between Smartphone Use and Places*

| Places    | Smartphone Use |                       |       |              |            |                      |       |           |         | $\chi^2$ | df | p-value |
|-----------|----------------|-----------------------|-------|--------------|------------|----------------------|-------|-----------|---------|----------|----|---------|
|           | Game           | Instant Communication | Video | Social Media | Phone Call | Information Browsing | Photo | Listening | Total N |          |    |         |
| Hongkong  | 682            | 783                   | 297   | 693          | 470        | 494                  | 70    | 396       | 3885    | 778.77   | 14 | .000    |
| Taiwan    | 296            | 51                    | 11    | 33           | 19         | 33                   | 59    | 8         | 510     |          |    |         |
| Singapore | 83             | 81                    | 14    | 18           | 104        | 36                   | 0     | 29        | 365     |          |    |         |

Table 5.

*Chi-square Test between Smartphone Use and Weekday*

| Weekday   | Smartphone use |                       |       |              |            |                      |       |           |         | $\chi^2$ | df | p-value |
|-----------|----------------|-----------------------|-------|--------------|------------|----------------------|-------|-----------|---------|----------|----|---------|
|           | Game           | Instant Communication | Video | Social Media | Phone Call | Information Browsing | Photo | Listening | Total N |          |    |         |
| Monday    | 101            | 87                    | 37    | 92           | 35         | 55                   | 9     | 44        | 455     | 240.23   | 42 | .000    |
| Tuesday   | 122            | 110                   | 59    | 116          | 101        | 94                   | 4     | 79        | 685     |          |    |         |
| Wednesday | 170            | 139                   | 37    | 77           | 70         | 83                   | 10    | 54        | 640     |          |    |         |
| Thursday  | 144            | 158                   | 71    | 150          | 136        | 81                   | 8     | 72        | 820     |          |    |         |
| Friday    | 374            | 254                   | 73    | 153          | 168        | 135                  | 69    | 129       | 1355    |          |    |         |
| Saturday  | 66             | 58                    | 23    | 52           | 47         | 63                   | 17    | 29        | 355     |          |    |         |
| Sunday    | 84             | 109                   | 22    | 104          | 36         | 52                   | 12    | 26        | 455     |          |    |         |

# Results - chi-square test

Table 6.

*Chi-square Test between Smartphone Use and Time*

| Time  | Smartphone Use |                       |       |              |            |                      |       |           |     | Total N | $\chi^2$ | df   | p-value |
|-------|----------------|-----------------------|-------|--------------|------------|----------------------|-------|-----------|-----|---------|----------|------|---------|
|       | Game           | Instant Communication | Video | Social Media | Phone Call | Information Browsing | Photo | Listening |     |         |          |      |         |
| 00:00 | 13             | 12                    | 4     | 8            | 9          | 3                    | 4     | 2         | 55  | 782.38  | 154      | .000 |         |
| 01:00 | 2              | 4                     | 6     | 6            | 5          | 5                    | 2     | 5         | 35  |         |          |      |         |
| 02:00 | 2              | 1                     | 1     | 1            | 0          | 2                    | 0     | 3         | 10  |         |          |      |         |
| 03:00 | 3              | 1                     | 2     | 1            | 4          | 2                    | 0     | 2         | 15  |         |          |      |         |
| 04:00 | 0              | 0                     | 0     | 0            | 0          | 0                    | 0     | 0         | 0   |         |          |      |         |
| 05:00 | 0              | 0                     | 0     | 2            | 0          | 7                    | 0     | 1         | 10  |         |          |      |         |
| 06:00 | 1              | 1                     | 2     | 0            | 0          | 0                    | 0     | 1         | 5   |         |          |      |         |
| 07:00 | 9              | 10                    | 3     | 5            | 6          | 11                   | 1     | 5         | 50  |         |          |      |         |
| 08:00 | 15             | 21                    | 4     | 23           | 2          | 24                   | 1     | 10        | 100 |         |          |      |         |
| 09:00 | 154            | 97                    | 50    | 142          | 58         | 120                  | 1     | 83        | 705 |         |          |      |         |
| 10:00 | 11             | 37                    | 4     | 30           | 9          | 14                   | 0     | 11        | 115 |         |          |      |         |
| 11:00 | 25             | 45                    | 20    | 28           | 27         | 15                   | 3     | 37        | 200 |         |          |      |         |
| 12:00 | 59             | 46                    | 20    | 39           | 50         | 33                   | 21    | 27        | 295 |         |          |      |         |
| 13:00 | 15             | 33                    | 14    | 31           | 41         | 16                   | 16    | 14        | 180 |         |          |      |         |
| 14:00 | 51             | 39                    | 14    | 28           | 63         | 21                   | 6     | 13        | 235 |         |          |      |         |
| 15:00 | 33             | 31                    | 18    | 27           | 28         | 20                   | 2     | 16        | 175 |         |          |      |         |
| 16:00 | 37             | 37                    | 10    | 31           | 28         | 18                   | 15    | 9         | 185 |         |          |      |         |
| 17:00 | 86             | 64                    | 11    | 44           | 53         | 34                   | 18    | 30        | 340 |         |          |      |         |
| 18:00 | 131            | 107                   | 37    | 65           | 52         | 74                   | 12    | 47        | 525 |         |          |      |         |
| 19:00 | 85             | 112                   | 17    | 47           | 61         | 46                   | 9     | 18        | 395 |         |          |      |         |
| 20:00 | 71             | 84                    | 20    | 83           | 34         | 40                   | 4     | 9         | 345 |         |          |      |         |
| 21:00 | 204            | 50                    | 29    | 40           | 38         | 29                   | 6     | 24        | 420 |         |          |      |         |
| 22:00 | 24             | 39                    | 18    | 35           | 16         | 9                    | 4     | 35        | 180 |         |          |      |         |
| 23:00 | 30             | 44                    | 18    | 28           | 9          | 20                   | 4     | 32        | 185 |         |          |      |         |

## Discussion

- **Research objective: Determine the basic information of smartphone use**
- This research aimed to explain a social phenomenon which was the smartphone use among people. We investigated the smartphone use by finding what people used, when people used, where people used and tried to provide evidence to explain why they used and how they used.
- We used the collected data to find (1) the smartphone use; (2) the relationship between smartphone use and gender; (3) the relationship between smartphone use and places; (4) the relationship between smartphone use and weekdays; and (5) the relationship between smartphone use and time.

## Discussion

- This project used the collected data and found different angles to compare smartphone use among people and tried to explain the smartphone use behavior. It is because the research has just started for 90 days, the pilot data we collected is limited where data from some places, some weekdays and some time slots are few. When the research continuously conducts in the future, the data will be richer and the result will be more meaningful.

## Discussion

- **Results: Trend of smartphone use**
- The results showed the smartphone use of people. Significant relationships were found between smartphone use and gender, smartphone use and place, smartphone use and weekday, smartphone use and time.

## Discussion

- **Data sharing: Sharing the knowledge**
- This study suggested an alternate way to recruit a large number of researchers to collaboratively collect data together. This study developed an app to implement this data collection method. With this app, it makes possible that researchers from all over the world can collect data together. This project offers the raw data download link. It provides a rich pool of data so that smartphone use data around the globe could be shared.
- Data could be analyzed according to researcher's needs, for example, only analyzed data with a lower limit of data (e.g. >200) in order to reduce systematic bias. Another example like only compare any 2 places (e.g. Hong Kong and Taiwan) is also feasible.

# Limitations and future studies

- It was because the data was collected by observation, the recording process should be simple and fast and context should not be too much and complex. Also, people were passing to and fro which made the number of data that collected in one time was limited.
- Therefore, the design of the app is direct, simple and easy to understand. In the future, it would be possible to add more elements in it if there is a need.
- Although the data we collected is monotonic, it could accurately record the action at that time.
- If we continuously conduct the research at different time and places, the database could provide useful raw data like the long-term change and trend.
- There might be bias towards some researchers who collected more data than the others. Similarly, there might be problems in certain time interval, or in certain places.
- To solve the potential problems, for example, we could use random sampling method to extract same amount of data from each researcher.
- This could also be applied to day, time, or place. Once we obtain the raw data, we could set up analysis method and procedure that we need. In addition, such potential problem could be reduced if we have large enough number of researchers.

# Conclusion

- This project has some pilot results which already show significant relationships among time, weekday, gender, place, and smartphone use.
- In the future, so long as the data collection continues, there would be more data over time, and we would be able to analyze the data in different ways, such as, trends.
- This project has already developed app for both IOS and Android platforms. The app is free to download at App Store and Google Play. This project openly invites researchers from the world to join the data collection.
- Download the app, register, collect data and share the data and knowledge together.