



SCHOOL OF INFORMATICS & IT

## Storytelling Dashboard - Data Visualisation

Student Name (Matric Number) : JAVEN LAI LE YU

Tutorial Group : P03

Tutor : Nami Imanishi

Submission Date : 27/10/2023

### Declaration of Originality

I am the originator of this work and I have appropriately acknowledged all other original sources used as my references for this work.

I understand that Plagiarism is the act of taking and using the whole or any part of another person's work, including work generated by AI, and presenting it as my own.

I understand that Plagiarism is an academic offence and if I am found to have committed or abetted the offence of plagiarism in relation to this submitted work, disciplinary action will be enforced.

## Declaration on the use of Generative AI tools for assignments

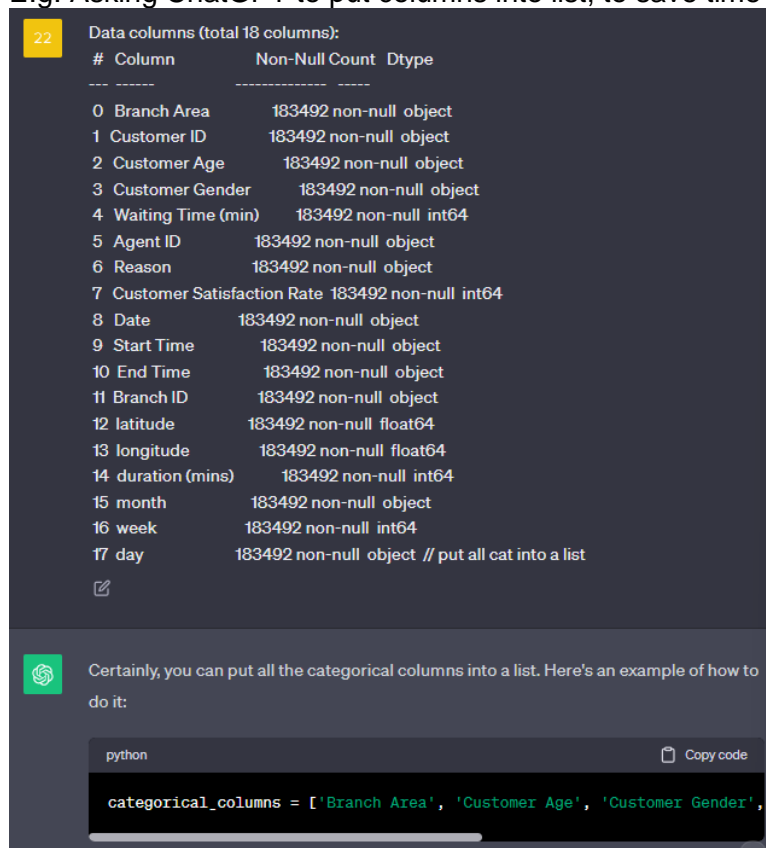
Describe how you have used Generative AI tools such as ChatGPT or Dall.E-2 in your assignment.

Show snapshots of the conversations with the AI tool (i.e., the prompts you used and the response you get from the AI tool).

For purpose of Report, I used ChatGPT to clarify the project requirements stated in the specifications and used it to generate content for my report. Additionally, I used it to rewrite my explanations to sound more fluent, clear, and professional. Lastly, I also used it to clarify some math logical calculation when listing out statistical figures at task 3.

For purpose of Tableau and Alteryx, I asked ChatGPT to construct the formula to perform data transformation based on my given description. The formula was constructed with ChatGPT, and not taken completely off ChatGPT, as the AI wasn't able to always produce a formula that works exactly as I want, and I had to adjust.

E.g. Asking ChatGPT to put columns into list, to save time from copying one by one:



22 Data columns (total 18 columns):

#	Column	Non-Null Count	Dtype
0	Branch Area	183492 non-null	object
1	Customer ID	183492 non-null	object
2	Customer Age	183492 non-null	object
3	Customer Gender	183492 non-null	object
4	Waiting Time (min)	183492 non-null	int64
5	Agent ID	183492 non-null	object
6	Reason	183492 non-null	object
7	Customer Satisfaction Rate	183492 non-null	int64
8	Date	183492 non-null	object
9	Start Time	183492 non-null	object
10	End Time	183492 non-null	object
11	Branch ID	183492 non-null	object
12	latitude	183492 non-null	float64
13	longitude	183492 non-null	float64
14	duration (mins)	183492 non-null	int64
15	month	183492 non-null	object
16	week	183492 non-null	int64
17	day	183492 non-null	object // put all cat into a list

Certainly, you can put all the categorical columns into a list. Here's an example of how to do it:

```
python
categorical_columns = ['Branch Area', 'Customer Age', 'Customer Gender',
```

### Asking ChatGPT to make explanations more fluent:

22

2. **Branch Performance Impact:** Examining individual branches, a clear factor affecting unsatisfactory performance appears to be longer waiting times. Branches with poor satisfaction ratings are correlated with significantly extended waiting times. It is also proven that it is not due to geographical location as Bedok has multiple branches but only the branch with substantially longer waiting time has a poor average rating. This suggests a direct relationship between customer satisfaction and waiting time. // is there a way to rephrase "proven"



1. **Branch Performance Impact:** When scrutinizing individual branches, a distinct factor contributing to unsatisfactory performance becomes evident: longer waiting times. Branches with lower satisfaction ratings exhibit a strong correlation with considerably prolonged waiting times. Notably, this relationship doesn't appear to be influenced by geographical location. For instance, in Bedok, where multiple branches are present, only the branch with significantly extended waiting times experiences poorer average ratings. This strongly implies a direct link between customer satisfaction and waiting time.

### Asking ChatGPT to rephrase a word with something more appropriate:

22

4. No Feedback [Set for NULL values in Feedback]

This field contains records with missing values for Feedback. It is required for segregating missing values to prevent these records from hindering the analysis. // replace hindering with an appropriate word that means polluting/contaminating the result



1. No Feedback [Set for NULL values in Feedback]

This field contains records with missing values for Feedback. It is required for segregating missing values to prevent these records from **tainting** the analysis.



### Asking ChatGPT to calculate by putting ? in the value:

22

4. Analysing the demand for inquiries throughout the day, it is evident that demand is consistently high from 10 AM (opening hour) till 2 PM. Demand for inquiries is still present from 3 PM till the closing hour of 5 PM. The amount of helpdesk staff available for each working hour closely follows the trend line of the customer service demand, with a supply-to-demand ratio of 0.76-0.78. This means that 1 helpdesk staff has to attend to ? customer inquiry for an hour on average.



1. Analyzing the demand for inquiries throughout the day, it is evident that demand is consistently high from 10 AM (opening hour) till 2 PM. Demand for inquiries is still present from 3 PM till the closing hour of 5 PM. The number of helpdesk staff available for each working hour closely follows the trend line of the customer service demand, with a supply-to-demand ratio of 0.76-0.78. This means that, on average, 1 helpdesk staff has to attend to approximately 1.28 to 1.32 customer inquiries per hour.

ChatGPT to assist with creation of formula to create new calculated field:

22

End Time and Start Time are DATETIME. using tableau calculate the duration in mins and secs

To calculate the duration in minutes and seconds between the 'Start Time' and 'End Time' columns in Tableau, you can follow these steps:

1. Open Tableau and connect to your dataset.
2. In the Data Source tab, right-click on your data source and select "Edit Data Source..."
3. In the Data Source tab, locate your dataset (e.g., call\_2021, call\_2022, or walkin\_2021, walkin\_2022).
4. To calculate the duration, create a calculated field. Click on "Analysis" in the top menu, and then select "Create Calculated Field..."
5. In the calculated field dialog, you can use the following calculation to calculate the duration in minutes and seconds:

sql

Copy code

```
(DATEDIFF('second', [Start Time], [End Time]) / 60) as Duration (mins),  
(DATEDIFF('second', [Start Time], [End Time]) % 60) as Duration (secs)
```

This calculation uses the **"DATEDIFF"** function to calculate the difference in seconds between the 'Start Time' and 'End Time' and then converts it to minutes and seconds.

1. Click OK to create the calculated field.
2. Now you should have two new fields in your dataset: 'Duration (mins)' and 'Duration (secs)'.
3. You can use these fields in your Tableau visualizations or analysis as needed.

By following these steps, you can calculate the duration in minutes and seconds

Read full conversation here:

<https://chat.openai.com/share/f8ec7450-5b3d-4691-adb1-255d248c6a46>

### How do you indicate the reference?

The content generated by AI tools are not retrievable except by the user who generated them, so they are considered non-recoverable sources. Although non-recoverable data or quotations in APA Style papers are usually cited as personal communications, with ChatGPT-generated text there is no person communicating. Quoting text from ChatGPT chat is therefore more like sharing the output of an algorithm, with a reference list entry and the corresponding in-text citation.

According to the official APA Style site, ChatGPT references should be cited as:

E.g. OpenAI. (2023). *ChatGPT* (Sep 25 version) [Large language model].

<https://chat.openai.com/chat>

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## 1. Background and Business Requirement

1.1 Background: Overseas-Chinese Banking Corporation (OCBC) primarily relies on physical walk-in inquiries at our branches and phone calls for customer inquiries and complaints. However, these channels are often **overwhelmed by the volume of inquiries from customers**, and OCBC **customer service agents are struggling to keep up** with the demand and respond to all the inquiries. This not only **impacts operational efficiency**, but also leads to **inconsistent customer experiences** across different branches and customers.

1.2 Problem: This inconsistency in customer experience is a critical concern as it has the potential to **erode customer trust and loyalty**. In the highly competitive banking industry, where customers have a plethora of financial institutions to choose from, **poor customer service can drive them to seek services from competitors**. As such, there is an **urgent need to evaluate and enhance customer satisfaction** at OCBC, hence the need for this analysis.

1.3 Purpose: This analysis is driven by the imperative to **understand customer satisfaction** within OCBC. It endeavours to **understand and offer valuable insights about why our customers are reaching out** to us, along with actionable strategies to manage the overwhelming demand for OCBC helpdesk and support OCBC in its commitment to delivering a superior banking experience to every customer.

1.4 Objective: The objectives of this analysis are stated below:

- What is the most common reason for calls or branch visits?
- Are there correlations between the feedback score and other factors?
- During which time periods do both channels experience their highest activity?
- Is there a specific time of day when one channel is preferred over the other?

## 2. Data Management

### 2.1 Data Profiling

The datasets provided by OCBC Database Administrators include the bank's records of customer service agent engaged in phone calls and walk-in inquiries from 2021 and 2022. Additionally, a file containing the location of the branches is provided.

#### 2.1.1 Data Attributes

##### Call Log

Field Name	Description	Measurement	Format
Customer ID	Unique customer ID for call log	Nominal	C10001
Date	Date of the call	Interval	dd/MM/yyyy
Call Start Date and Time	When the agent begins engaging with the customer on the call	Interval	dd/MM/yyyy hh:mm
Call End Date and Time	When the agent ends the call	Interval	dd/MM/yyyy hh:mm
Phone Line Agent ID	Unique identifier for an agent	Nominal	A1001
Reason for Call	The reason why the customer contacted OCBC	Nominal	self service inb - enquiry
Feedback	Rating of the call from 1 to 5, with 5 being the highest rating	Ordinal	1

## Walk-in

Field Name	Description	Measurement	Format
Branch ID	Branch location ID	Nominal	B001
Branch Area	Location of the Branch	Nominal	North
Customer ID	Unique customer ID for walk-in	Nominal	W123456
Customer Age	Customer Age range	Interval	41-50
Customer Gender	Gender of Female & Male (F/M)	Nominal	F
Date	Date of the walk-in to the branch	Interval	dd/MM/yyyy
Waiting time (min)	Duration of the waiting time in minutes	Ratio	23
Start Date and Time	When the agent starts serving the customer	Interval	dd/MM/yyyy hh:mm
End Date and Time	When the agent ends the service	Interval	dd/MM/yyyy hh:mm
Agent ID	Unique identifier for an agent	Nominal	A0011001
Reason for visit	Purpose behind why customers visit the OCBC Branch	Nominal	Balance transaction enquiry
Customer Satisfaction Rate	Customer satisfaction rating from 1 to 5, with 5 being the highest rating	Ordinal	1

## Branch Location Singapore

Field Name	Description	Measurement	Format
Branch ID	Unique Branch location ID	Nominal	B001
Latitude	North-South position	Nominal	1.361562
Longitude	East-West position	Nominal	103.8415

### 2.1.2 Datasets Analysis

The **datasets for 2021 and 2022 were received separately** for both call log and walk-in. Both **call log and walk-in datasets had similar fields**: Customer ID, Date, Start Time, End Time, Agent ID, reason for inquiry, and rating score out of 5.

The walk-in dataset has additional fields like branch ID, branch area, and waiting time. The **Agent ID for walk-in and call logs varies in format** which indicates that the customer service agents are not related. Walk-in datasets have Branch ID with the same format as the Branch Location Singapore table, hence **Branch ID can be the common key to link and extract the coordinates** of the branch. However, **call logs have no Branch ID field and cannot be linked with an OCBC branch**.

Branch ID	latitude	longitude
B001	1.370405	103.874
B002	1.361562	103.8415
B003	1.426725	103.8359
B004	1.348676	103.7116
B005	1.340475	103.7043
B006	1.340486	103.7371
B007	1.357508	103.9466
B008	1.327163	103.9321
B009	1.332822	103.9152
B010	1.32456	103.936
B011	1.276376	103.8416
B012	1.292343	103.8507
B013	1.289681	103.831
B014	1.28517	103.8156
B015	1.283662	103.832

[Screenshot of Branch Location Singapore on Excel]

There are 15 OCBC Branches, and the coordinates have no data quality issue.

Alteryx Designer (ETL Software) was used for data inspection and cleaning. To discover potential quality issues for audit, I utilized the Field Summary Node to produce a report for each dataset.

## Call-Log 2021:

Record	Name	Field Category	Percent Missing	Unique Values	Remarks	Shortest_Value	Longest_Value
1	Phone Line Agent ID	String	0	50	Some values of this field...	A1000	A1000
2	Customer ID	String	0	17,124	Some values of this field...	10099	C10003
3	Call End Date and Time	String	0	121,610	Some values of this field...	1/1/2021 8:19	10/10/2021 10:39
4	Call Start Date and Time	String	0	109,103	Some values of this field...	1/1/2021 8:08	10/10/2021 10:27
5	Reason for Call	String	0	33	Some values of this field...	referral	fraud alert - deactivate internet and mobile b
6	Date	String	0	336	Some values of this field...	1/1/2021	10/10/2021
7	Feedback	String	30.002901	6	This field has over 10% m...	1	1

[Missingness percentage of Feedback, Missing 'C' at Customer ID records]

## Call-Log 2022:

Record	Name	Field Category	Percent Missing	Unique Va...	Remarks	Shortest_Value	Longest_Value
1	Phone Line Agent ID	String	0	50	Some values of this field have a small n...	A1019	A1019
2	Customer ID	String	0	17,081	Some values of this field have a small n...	C10000	C10000
3	Call End Date and Time	String	0	120,117	Some values of this field have a small n...	1/1/2022 0:13	10/10/2022 10:03
4	Call Start Date and Time	String	0	107,572	Some values of this field have a small n...	1/1/2022 0:03	10/10/2022 10:03
5	Reason for Call	String	0	33	Some values of this field have a small n...	referral	fraud alert - deactivate internet and mobile banki...
6	Date	String	0	383	Some values of this field have a small n...	1-Jan-22	10/10/2022
7	Feedback	String	30.002557	6	This field has over 10% missing values...	5	5

[Missingness percentage of Feedback, Inconsistent date format]

## Walk-in 2021:

Record	Name	Field Category	Percent Missing	Unique Values	Shortest_Value	Longest_Value
1	Customer Gender	String	0	4	F	Female
2	Waiting Time (min)	String	0	60	9	29
3	Reason	String	0	33	referral	fraud alert - deactivate internet and mobile banki...
4	Customer ID	String	0	59,446	W79107	W79107
5	End Date and Time	String	0	62,975	8/1/2021 16:22	29/11/2021 13:45
6	Agent ID	String	0	75	A0011001	A0011001
7	Date	String	0	302	8/1/2021	29/11/2021
8	Customer Age	String	0	7	21-30	Nov-20
9	Start Date and Time	String	0	61,896	8/1/2021 16:13	29/11/2021 13:38
10	Customer Satisfaction Rate	String	0	5	4	4
11	Branch Area	String	0	4	West	Central
12	Branch ID	String	0	15	B001	B001

[Unstandardized customer genders, customer age range auto-formatted into a date]

## Walk-in 2022:

Record	Name	Field Category	Percent Missing	Unique Values	Remarks	Shortest_Value	Longest_Value
1	End Time	String	0	65,031	Some values...	2/5/2022 16:51	11/11/2022 14:02
2	Waiting Time (min)	String	0	32	Some values...	7	43
3	Reason	String	0	33	Some values...	referral	fraud alert - deactivate internet and
4	Customer ID	String	0	60,699	Some values...	W00000	W00000
5	Agent ID	String	0	75	Some values...	A0141000	A0141000
6	Date	String	0	313	Some values...	2/5/2022	11/11/2022
7	Start Time	String	0	64,059	Some values...	2/5/2022 16:40	11/11/2022 13:47
8	Customer Age	String	0	7	Some values...	31-40	Nov-20
9	Branch ID	String	0	24	Some values...	6	B014
10	Customer Gender	String	0	2	[Null]	F	F
11	Customer Satisfaction Rate	String	0	5	[Null]	2	2
12	Branch Area	String	0	4	[Null]	East	Central

[column names differ from 2021 dataset, customer age range auto-formatted into a date, Problem with some Branch IDs]

## 2.1.3 Data Quality Analysis

**Accuracy:** The datasets are not in time-series sequential order. This makes the reliability and accuracy of the datasets questionable as the records should be automatically logged into the system after each call or walk-in inquiry ticket in a systematic order.

Refer to the photo below.

Record	Branch ID	Branch Area	Customer ID	Customer Age	Customer Gender	Date
7	B001	North	W80677	31-40	Female	26/2/2021
8	B001	North	W41171	Nov-20	F	1/3/2021
9	B001	North	W66293	21-30	F	24/3/2021
10	B001	North	W44879	21-30	F	15/4/2021
11	B001	North	W00179	41-50	F	16/4/2021
12	B001	North	W76919	21-30	F	4/5/2021
13	B001	North	W58099	21-30	Male	21/1/2021
14	B001	North	W19723	Nov-20	M	3/3/2021
15	B001	North	W55411	Nov-20	M	9/4/2021

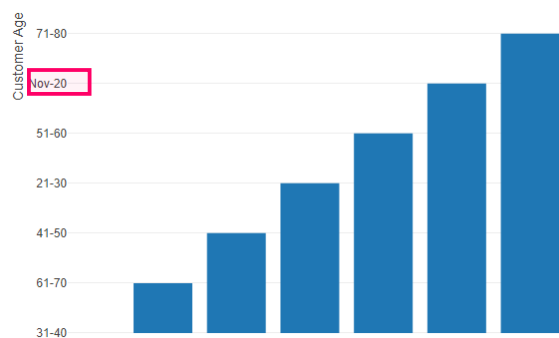
**Timeliness:** The datasets are recent as they are from the past 2 years.



### Consistency:

1. Call-log 2021 has inconsistency in **Customer ID** where some IDs were missing 'C' in front.
2. Call-log 2022 has **inconsistent date format in Date** where values to do follow the dd/MM/yyyy format.
3. Gender label for customers in walk-in 2021 records is inconsistent as there are values **Female/Male** when it should be **F/M**.

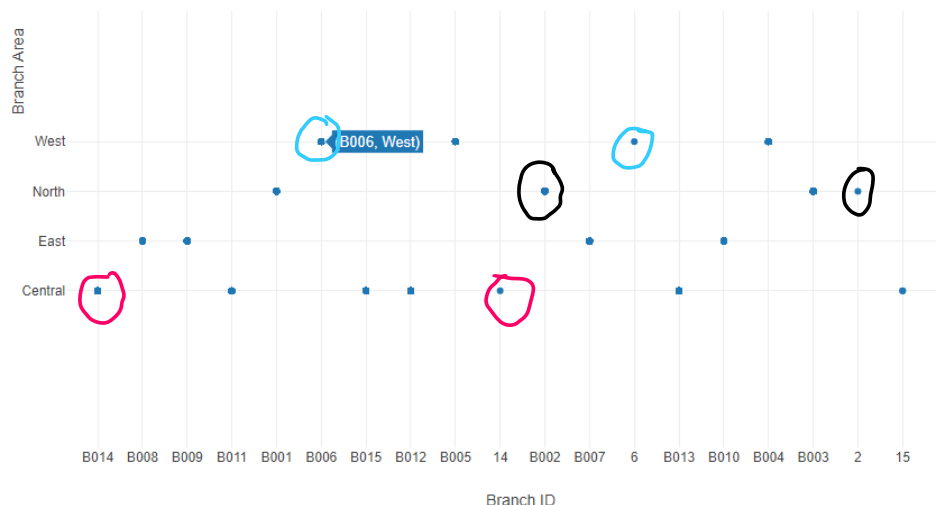
4. Customer Age range has **mislabelled range of Nov-20 instead of 11-20**. I discovered that Nov-20 was supposed to represent 11-20 as Nov represents 11 on the calendar. Therefore, it's justified to assume that the system misunderstood 11-20 and autoformatted into a date.



5. Column Start Date and Time and column End Date and Time have **different column names** for walk-in 2022. I need to standardize the column names in order to union walk-in 2021 with 2022 together.

6. Walk-in 2022 has inconsistencies with Branch ID as there are Branch IDs that don't start with B00.

The branch number has the same branch area as the branch ID where ID = B000 + number.



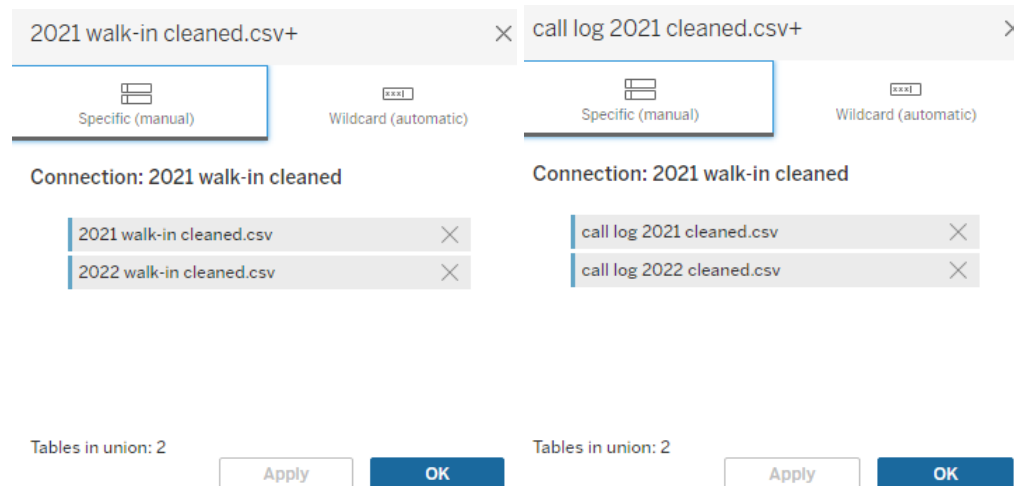
### Completeness:

1. There are **30% of Feedback scores for call-logs are missing**. Using context knowledge, these values are **MNAR** as it is likely that the customers refused to leave feedback after the call as they couldn't be bothered. Hence, **no imputation is required as the missing value has its own meaning**.
2. **Call logs are missing fields like waiting time**, customer age, and Branch ID, deeming call logs to be less useful than walk-in as there are fewer fields to work with.

**Relevance:** As the datasets contain a rating score that represents customer satisfaction, reason for inquiry, waiting time, customer age, and other factors about OCBC inquiry customers, the datasets provided are highly relevant for my analysis in understanding why customers are reaching out to OCBC.

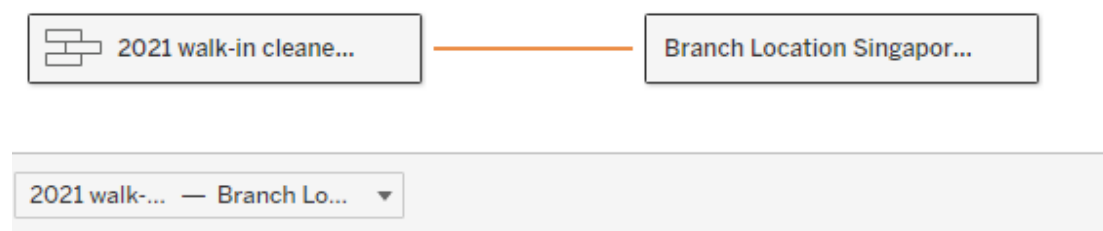
## 2.2 Data Integration

2.2.1 Union of datasets: After performing the necessary data cleaning to address the data issues stipulated in data profiling using Alteryx, I created the cleaned datasets into new CSV files. Then, I **union the 2021 and 2022 records for walk-in and call log respectively, as the columns for 2021 are the same for 2022 and 2022 is a continuation** of 2021 records for both walk-in and call log.

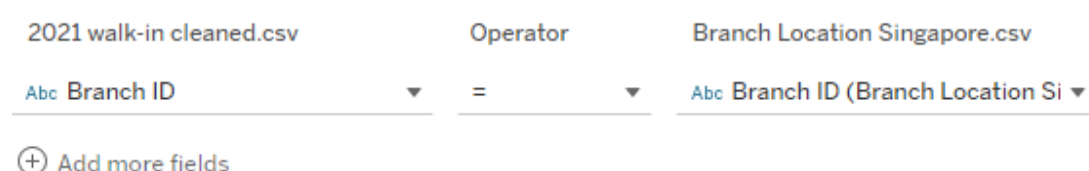


[Snapshots of how the datasets are union together using Tableau (Software)]

2.2.2 Relationship connection: A relationship between the 2021 union 2022 walk-in dataset and the Branch Location dataset is created, using Branch ID as a common key to link these 2 datasets together. This relationship allows the longitude and latitude of a branch to be accessed from the walk-in dataset, to enable the creation of map graphs. [Relationships are more flexible and dynamic than Joins](#), which is why it is chosen over Joins.



How do relationships differ from joins? [Learn more](#)



[Snapshot of relationship link between the 2 datasets using Tableau]

2.2.3 Organization of data source: The combined call dataset and combined walk-in dataset + branch location dataset are stored in different data sources as the requirements indicate to analyse call and walk-in separately.

## 2.3 Features Creation

### 2.3.1 Enquiry:

This field **summarizes the reason for the customer reaching out to OCBC in a maximum of 2 words**. This is useful as some Reason descriptions are very long, making it unsightly and difficult to read on a visualization, hence a brief and concise description would be better. This column will be used to identify the main reasons for call-in and walk-in inquiries.

Formula:

```
SPLIT(REPLACE([Reason], "_", " "), " ", 1)
+ " " +
SPLIT(REPLACE([Reason], "_", " "), " ", 2)
```

### 2.3.2 Duration:

This field represents **how long the inquiry session lasted, in minutes**. It is useful for understanding how long our customers consult OCBC for an inquiry. It can be added to tooltips or labels in a graph, contributing as an additional information which may assist with the derivative of insights.

Formula:

```
DATEDIFF('minute', [Start Time], [End Time])
```

### 2.3.3 Number of Agents present:

This field represents **how many customer service agents were present during a particular hour of a day**. It is useful for assessing the supply of customer service support to find out if OCBC is short-staffed, and by how much. It can be used as a measure to be compared with other measurements to create a graph.

Formula:

```
{ FIXED DATETRUNC('hour', [Call Start]): COUNTD([Phone Line Agent ID]) }
```

### 2.3.4 No Feedback [Set for NULL values in Feedback]:

This field contains **records with missing values for Feedback**. It is required for segregating missing values to prevent these records from interfering with or tainting the analysis of customer satisfaction. It can be used to differentiate records using filters.

Configuration:

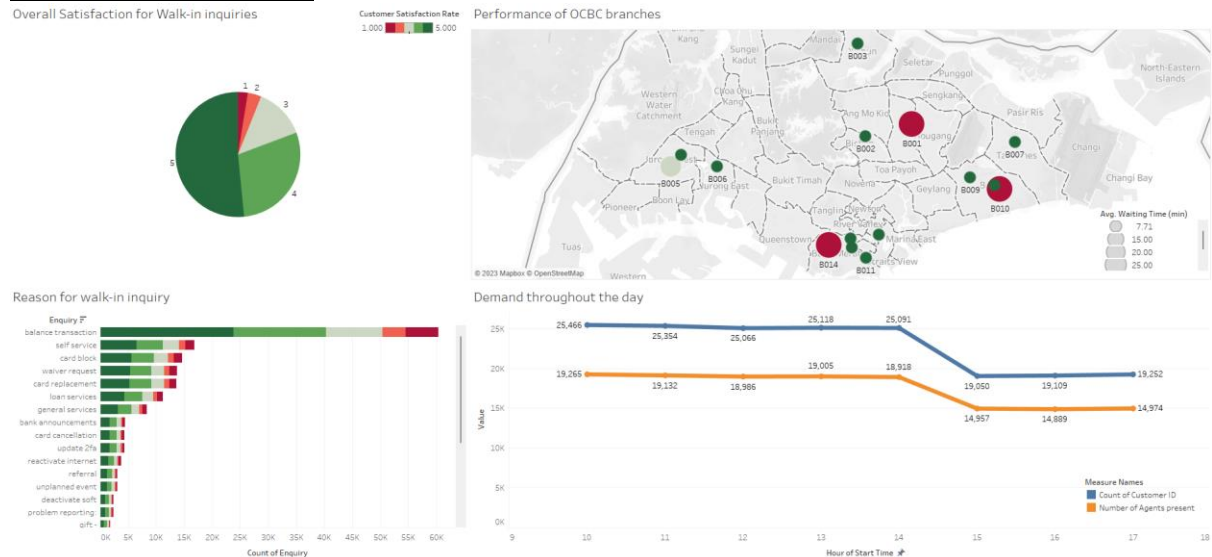
[Edit Set \[No Feedback\]](#)

Name:	No Feedback
Members (1 total):	
	Feedback
	Null

### 3. Data Exploration

The graphs within each dashboard will be analysed from left to right, top to bottom. The key takeaways for each analysis are **bolded**.

#### 3.1 Walk-in Dashboard



##### 3.1.1 Analysis

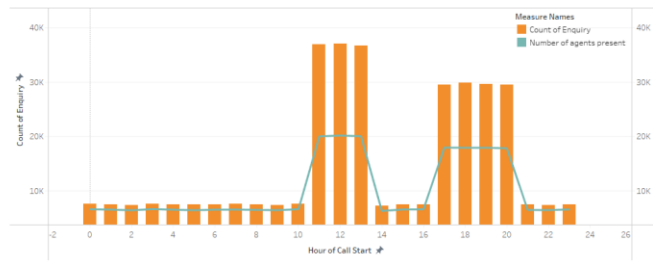
1. Overall Satisfaction Analysis: The pie chart on overall satisfaction reveals that **over 50% of customers who engaged with OCBC's customer service are completely satisfied** and gave a 5/5 rating. This indicates a commendable performance by the customer service agents. The majority of customers are satisfied as they give a rating of 3 to 5.
2. Branch Performance Impact: Examining individual branches, a **clear factor affecting unsatisfactory performance appears to be significantly longer waiting times**. Branches with poor satisfaction ratings are correlated with significantly extended waiting times. Notably, this relationship doesn't appear to be influenced by geographical location. For instance, Bedok has multiple branches, but only the branch with substantially longer waiting times experiences poorer average ratings. This strongly implies a direct link between customer satisfaction and waiting time.
3. Reasons for Walk-in Inquiries: The bar chart displays the frequency of walk-in inquiry types, ordered by popularity. The **most common inquiries are related to bank transactions**, followed by services and card-related inquiries. Breaking each inquiry down by satisfaction rate, there is no particular inquiry that has a prevalent bad satisfaction rate. This implies that OCBC's **customer service team is adept at handling various inquiries satisfactorily**.
4. Demand Analysis by Hour: The demand for inquiries is **consistently high from the opening hour of 10 AM to 2 PM**, with consistent medium demand from 3 PM to the closing hour at 5 PM. The number of **customer service agents available for each hour aligns with the demand trend**, with a supply-to-demand ratio of 0.76-0.78. On average, each agent handles approximately 1.3 customer inquiries at a time.

## 3.2 Call-in Dashboard

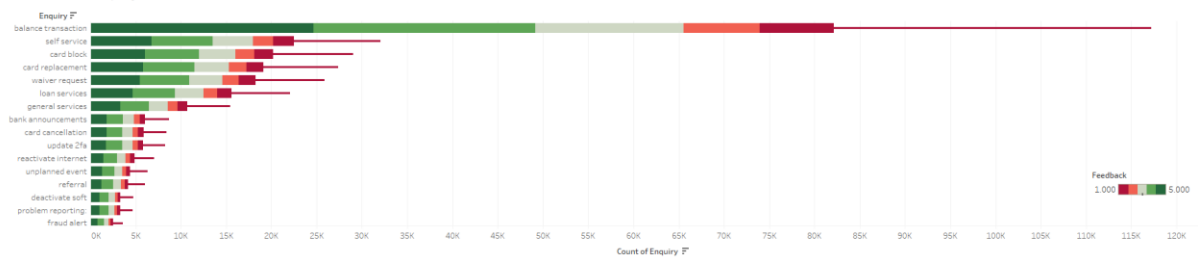
Overall Feedback for Call inquiries



Call volume throughout the day



Reason for call inquiry



### 3.2.1 Analysis

1. Overall Satisfaction: The **overall satisfaction with call-in customer service is slightly lower than walk-ins**, with fewer customers rating it as 5/5. This suggests a minor performance gap between the two channels.
2. Peak Hours Analysis: **Peak call-in hours are observed from 11 AM to 1 PM and 5 PM to 8 PM**. The afternoon peak hours align with the peak walk-in hours from 11 AM to 1 PM. Additionally, **high nighttime demand from 5 PM to 8 PM is only channeled through call-ins**, as all OCBC branches stop taking in walk-in inquiries after 5 PM.
3. Staffing Issue during Peaks: There's a clear **agent shortage during peak call-in hours**, indicated by a supply-to-demand ratio of 0.5 to 0.6. Each staff member has to attend to nearly 2 customers concurrently, highlighting the need for additional resources during these high-demand periods.
4. Reasons for Call-in Inquiries: Similar to walk-ins, the most common call-in inquiries are related to balance transactions, services, and card issues. This may indicate that certain **OCBC service products have user experience issues**, as customers frequently inquire about their usage.

*The thin red lines represent customers who did not leave feedback.*