SKY HACK 2024

United Airlines

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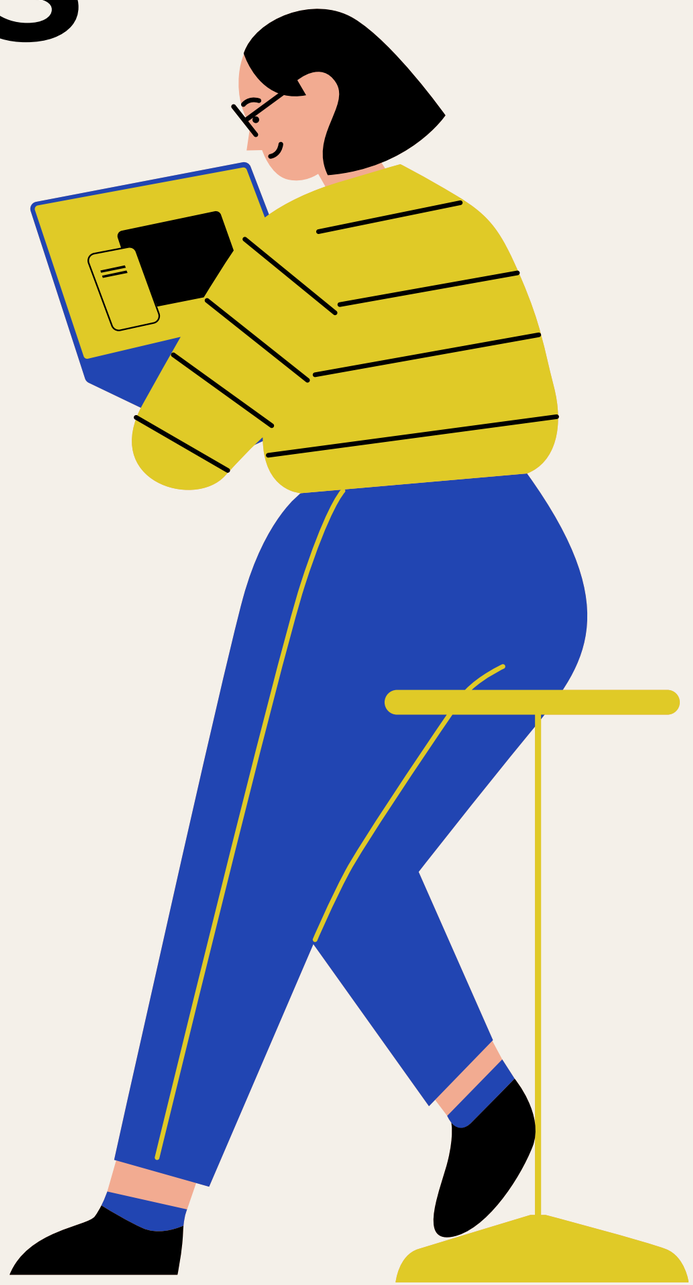

TEAM NAME AND MEMBERS

Data Pulse

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Problem Statement

As United Airlines strives to become the best airline in history, optimizing call center operations is crucial. Call center metrics like Average Handle Time (AHT) and Average Speed to Answer (AST) impact both operational efficiency and customer satisfaction. The current challenge is to identify inefficiencies causing long AHT and AST and find actionable solutions to enhance service quality while reducing costs. Furthermore, with the increasing complexity of customer requests and the high volume of calls received daily, it is essential to streamline processes to ensure faster, more efficient service.

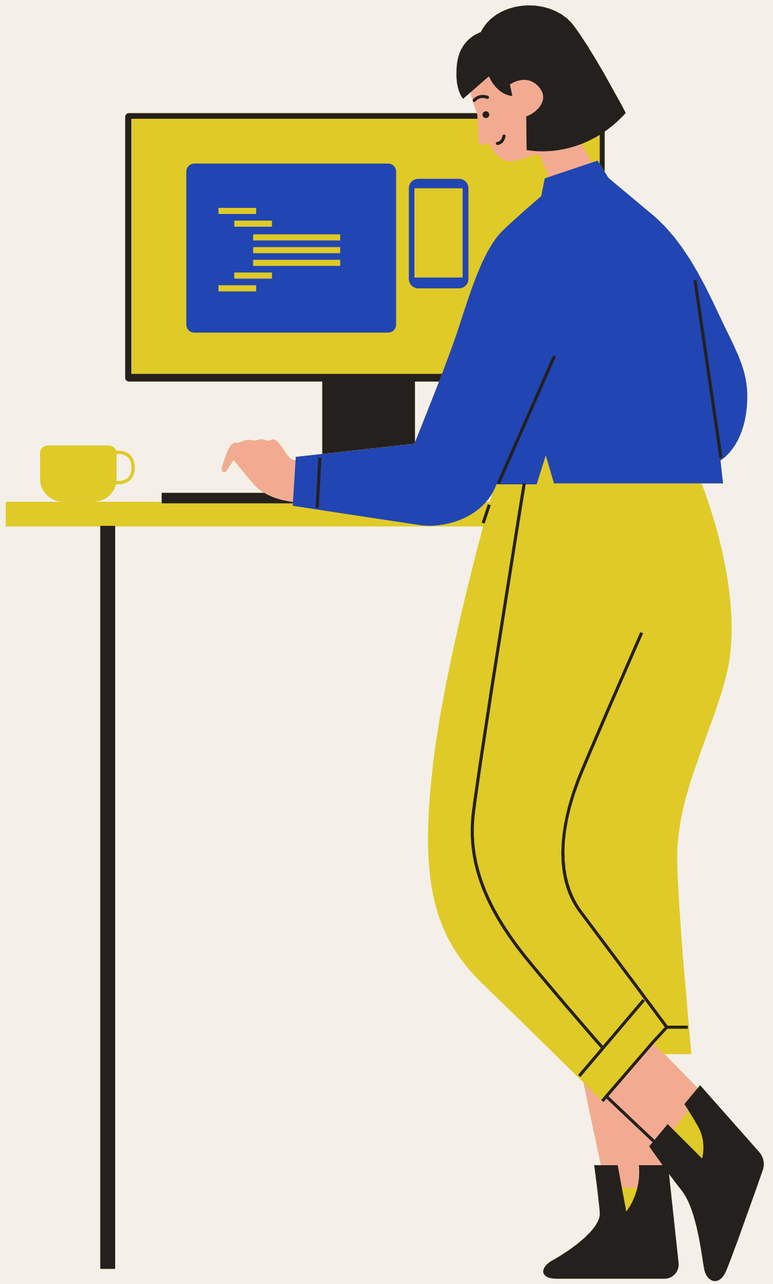
Objectives

- Reduce AHT (currently 1134 seconds) and AST (currently 437 seconds).
- Improve customer experience by streamlining call processes.

Data Description

Description of datasets used:

- **calls.csv:** Call metadata (e.g., call times, agent IDs)
- **customers.csv**: Customer data (e.g., loyalty status).
- **sentiment_statistics.csv**: Customer and agent sentiment analysis.
- **reason.csv**: Primary reasons for customer calls.



Key Data Columns and Influencing Variables

Key Data Columns:

- **call_id, customer_id, agent_id:** Track unique calls, customers, and agents to analyze performance and patterns.
- **call_start_datetime, agent_assigned_datetime, call_end_datetime:** Used to calculate AHT and AST, showing the total duration of calls and time taken to answer.
- **customer_tone, agent_tone:** Emotional tone detected during the call (e.g., calm, angry, frustrated). These tones impact AHT, with negative tones leading to longer calls.
- **primary_call_reason:** The reason for the call (e.g., IRROPS, Baggage, Voluntary Change), crucial for identifying high-impact call types.

Variables Influencing AHT/AST:

- **Tone:** Calm or polite tones result in shorter AHT; frustrated tones prolong call duration.
- **Call Reason:** Complex issues (e.g., Checkout) have higher AHT, while frequent reasons (e.g., IRROPS) tend to be quicker.
- **Sentiment & Silence:** Positive sentiment and less silence during calls help reduce AHT.

Exploratory Data Analysis

Data Cleaning Process

- We began by identifying missing values in key columns, handling duplicates, and correcting inconsistent data formats.
- Missing values were found in customer_tone, agent_tone, and average_sentiment. These were filled with reasonable defaults (e.g., 'neutral' for tones, median for sentiment).
- Duplicates were removed to ensure the dataset reflected unique call entries.
- Date and time columns (call_start_datetime and call_end_datetime) were standardized to allow accurate time calculations.

```
missing_data = df.isnull().sum()
print(missing_data)
# Dropping duplicates
df = df.drop_duplicates()
# Filling missing customer and agent tones with 'neutral'
df['customer_tone'].fillna('neutral', inplace=True)
df['agent_tone'].fillna('neutral', inplace=True)
# Filling missing sentiment with median value
df['average_sentiment'].fillna(df['average_sentiment'].median(), inplace=True)
```

Exploratory Data Analysis

Handling Missing and Erroneous Data

- Erroneous or missing date values were addressed to ensure accurate calculations of Average Handle Time (AHT) and Average Speed to Answer (AST).
- Calls with inconsistent date entries, such as call_end_datetime occurring before call_start_datetime, were removed.
- For columns with critical missing data (like missing call end times), rows were dropped to ensure integrity in key metric calculations.

```
# Dropping rows with missing call_end_datetime
df = df[df['call_end_datetime'].notnull()]

# Converting to datetime format
df['call_start_datetime'] = pd.to_datetime(df['call_start_datetime'])
df['call_end_datetime'] = pd.to_datetime(df['call_end_datetime'])

# Removing erroneous entries where call end time is before start time
df = df[df['call_end_datetime'] > df['call_start_datetime']]
```

Exploratory Data Analysis

Data Transformation & Feature Engineering

- Datetime columns were transformed to enable accurate metric calculations. We calculated AHT by subtracting call_start_datetime from call_end_datetime.
- New features like the hour of the call and the day of the week were created to explore call volume patterns and time-based performance.
- These features helped us analyze how call times correlate with agent efficiency and customer satisfaction.

```
# Calculating AHT (in seconds)
df['AHT'] = (df['call_end_datetime'] - df['call_start_datetime']).dt.total_seconds()

# Creating new features: call hour and day of the week
df['call_hour'] = df['call_start_datetime'].dt.hour
df['call_day_of_week'] = df['call_start_datetime'].dt.dayofweek
```

Exploratory Data Analysis

Some of the SQL Snippets for Calculations and Analysis

```sql
-- Calculated total handle time per call
SELECT
    call_id,
    (strftime('%s', call_end_datetime) - strftime('%s', call_start_datetime)) AS total_handle_time
FROM calls;

-- Calculated overall AHT
SELECT
    SUM(strftime('%s', call_end_datetime) - strftime('%s', call_start_datetime)) / COUNT(call_id) AS AHT
FROM calls;

-- Calculated total waiting time per call
SELECT
    call_id,
    (strftime('%s', agent_assigned_datetime) - strftime('%s', call_start_datetime)) AS total_waiting_time
FROM calls
WHERE agent_assigned_datetime IS NOT NULL;

```

Exploratory Data Analysis

Some of the SQL Snippets for Calculations and Analysis

```sql
-- Calculated overall AST
SELECT
    SUM(strftime('%s', agent_assigned_datetime) - strftime('%s', call_start_datetime)) / COUNT(call_id) AS AST
FROM calls
WHERE agent_assigned_datetime IS NOT NULL;

-- Merged sentiment and call duration data
SELECT
    s.call_id,
    s.customer_tone,
    s.agent_tone,
    s.average_sentiment,
    (strftime('%s', c.call_end_datetime) - strftime('%s', c.call_start_datetime)) AS total_handle_time
FROM sentiment_statistics s
JOIN calls c ON s.call_id = c.call_id;

```

Exploratory Data Analysis

Some of the SQL Snippets for Calculations and Analysis

```sql
-- Checked correlation between sentiment and handle time
SELECT
    AVG((strftime('%s', call_end_datetime) - strftime('%s', call_start_datetime))) AS avg_handle_time,
    customer_tone, agent_tone
FROM sentiment_statistics s
JOIN calls c ON s.call_id = c.call_id
GROUP BY customer_tone, agent_tone;

-- Listed most frequent call reasons from the reason table
SELECT r.primary_call_reason, COUNT(c.call_id) AS frequency
FROM calls c
JOIN reason r ON c.call_id = r.call_id
GROUP BY r.primary_call_reason
ORDER BY frequency DESC;
```

Exploratory Data Analysis

Some of the SQL Snippets for Calculations and Analysis

```sql
-- Calculated the average handle time (AHT) for each primary call reason
WITH avg_aht AS (
    SELECT
        AVG(strftime('%s', c.call_end_datetime) - strftime('%s', c.call_start_datetime)) AS overall_avg_aht
    FROM calls c
)
SELECT
    r.primary_call_reason,
    AVG(strftime('%s', c.call_end_datetime) - strftime('%s', c.call_start_datetime)) AS avg_handle_time
FROM calls c
JOIN reason r ON c.call_id = r.call_id
GROUP BY r.primary_call_reason
HAVING avg_handle_time > (SELECT overall_avg_aht FROM avg_aht);

```

Key Findings from Analysis

Key Factors Impacting AHT

Tone Influence:

- Calm and polite tones significantly reduce AHT (avg: 615.79 sec), while angry or frustrated tones increase AHT (avg: 978.86 sec).
- Agent training in tone management and de-escalation could reduce AHT.

Complex Call Types:

- Complex call types like "Checkout" have the highest AHT (up to 2075 sec), while high-frequency calls like "IRROPS" are handled more efficiently (avg: 1146 sec).
- Process optimization or specialized agents can help manage these complex calls better.

Call Volume vs. Efficiency:

- High-volume calls like "Voluntary Change" and "Mileage Plus" have manageable AHT, suggesting they could be automated via self-service options to reduce agent workload.

Key Findings from Analysis

Patterns in Silence and Agent Performance

Impact of Silence:

- Calls with higher silence percentages are associated with longer AHT.
- Real-time monitoring could reduce silence by helping agents access information faster.

Agent Performance Gaps:

- Significant variability exists in agent performance, with some agents consistently having lower AHT than others.
- Sharing best practices from high-performing agents could reduce these gaps.
- Agents handling complex calls may need additional training or specialized tools to streamline their workflow.

Key Findings from Analysis

Time and Sentiment-Based Insights

Call Timing Patterns:

- Calls during peak hours (early morning, late afternoon) experience longer AHT due to agent overload.
- Staffing adjustments or incentives to encourage off-peak calling could improve efficiency during busy times.

Sentiment and Escalation:

- Negative customer sentiment leads to longer AHT and more frequent escalations, while positive sentiment correlates with faster resolutions.
- Sentiment-based alerts during calls could help agents manage conversations more effectively, reducing escalations and handling times.

Solution Overview

Proposed Solutions to Enhance Call Center Operations

To address the identified challenges in call center operations and improve key metrics like Average Handle Time (AHT) and Average Speed to Answer (AST), a multifaceted approach is proposed. The solutions focus on optimizing agent performance, enhancing customer experience through better tone management, and automating frequently occurring call types.

Key Components:

- Agent Training Programs: Implement comprehensive training programs focused on tone management, de-escalation techniques, and effective communication.
- Self-Service Options: Expand IVR capabilities to handle high-frequency call types, such as "Voluntary Change" and "Baggage," reducing the load on human agents.
- Real-Time Support Tools: Introduce tools that provide agents with quick access to information, minimizing silence during calls and improving response times.

Solution Overview

Enhancing Agent Performance through Training

- One of the primary factors affecting AHT is the performance of call center agents. By investing in targeted training programs, we can improve how agents manage customer interactions, particularly in maintaining positive tones during challenging conversations.

Training Elements:

- Tone Management Workshops: Focus on the importance of maintaining a calm and polite demeanor, even with frustrated customers.
- De-escalation Techniques: Equip agents with strategies to defuse tense situations and reduce call length.
- Continuous Feedback Mechanism: Implement regular performance evaluations and feedback sessions to help agents improve based on real call data.

Expected Impact:

- By enhancing agent skills, we anticipate a reduction in AHT, leading to improved customer satisfaction and retention.

Solution Overview

Automating High-Frequency Call Types

- To alleviate pressure on human agents and streamline customer service processes, we propose expanding self-service options within the IVR system. By automating routine inquiries, we can enhance efficiency and improve customer experience.

Self-Service Initiatives:

- IVR Enhancement: Redesign the IVR to handle common requests like Voluntary Changes, Baggage inquiries, and IRROPS, allowing customers to resolve issues without speaking to an agent.
- User-Friendly Interface: Ensure the IVR is intuitive and user-friendly, making it easy for customers to navigate options.
- Feedback Loop: Integrate customer feedback mechanisms within the IVR to continuously refine options based on user experience.

Expected Impact:

- Anticipated outcomes include reduced AHT for complex call types and decreased call volume for agents, leading to quicker response times for customers needing direct assistance.

Solution Overview

Implementing Real-Time Support for Agents

- To further enhance agent efficiency and reduce silence during calls, we propose the implementation of real-time support tools that give agents quick access to critical information.

Support Tools:

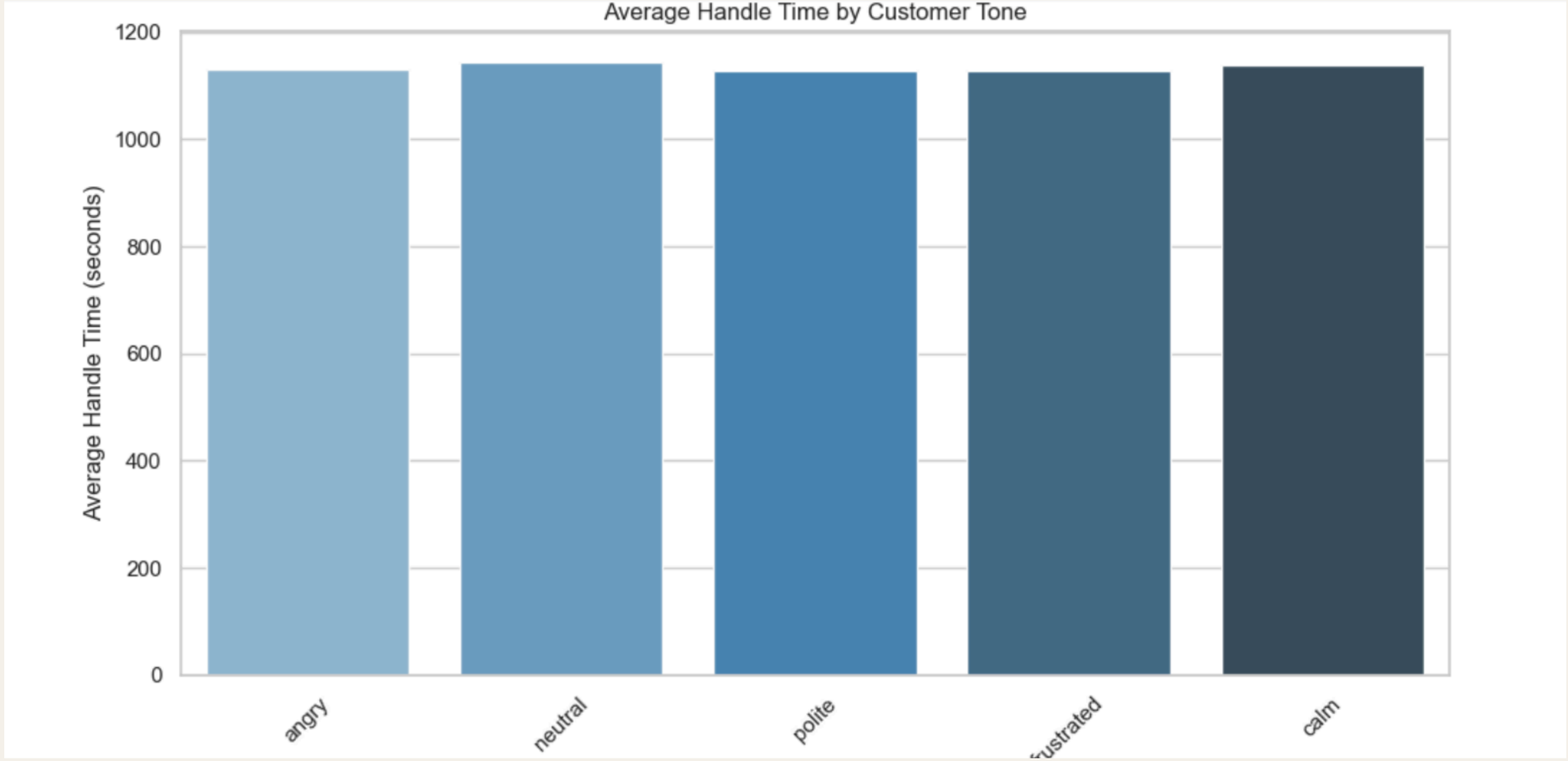
- Knowledge Base Integration: Create a centralized knowledge base that agents can access during calls to quickly find answers and solutions.
- Sentiment Analysis Tools: Utilize tools that provide real-time sentiment analysis of customer interactions, alerting agents to potential escalations or areas needing attention.
- Performance Dashboards: Equip agents with dashboards that show their current performance metrics in real-time, motivating them to improve AHT and customer satisfaction scores.

Expected Impact:

- The introduction of these tools is expected to minimize silence during calls, speed up resolution times, and ultimately lead to enhanced overall performance for agents and improved customer experiences.

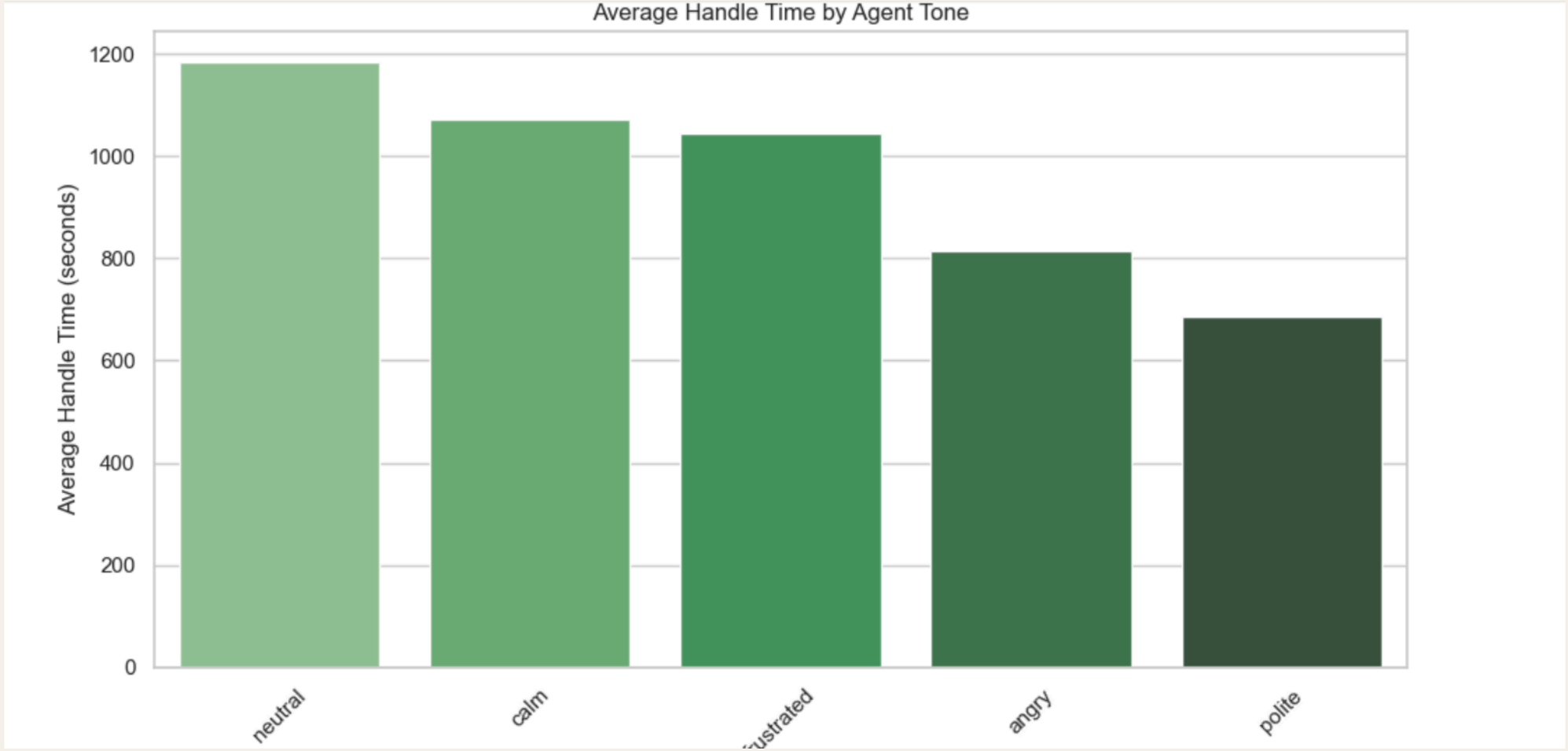
Insights

Average Handle Time by Customer Tone



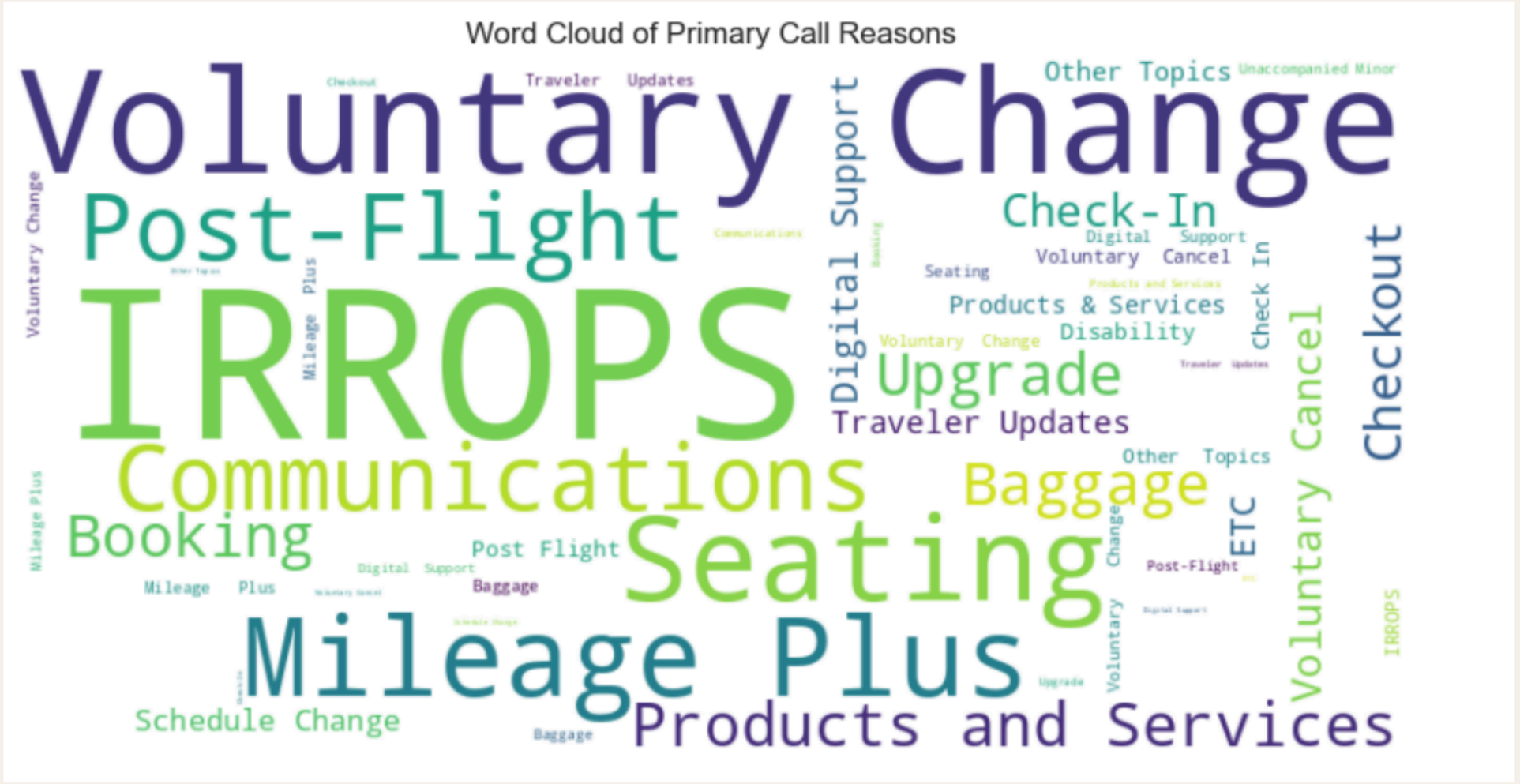
Insights

Average Handle Time by Agent Tone



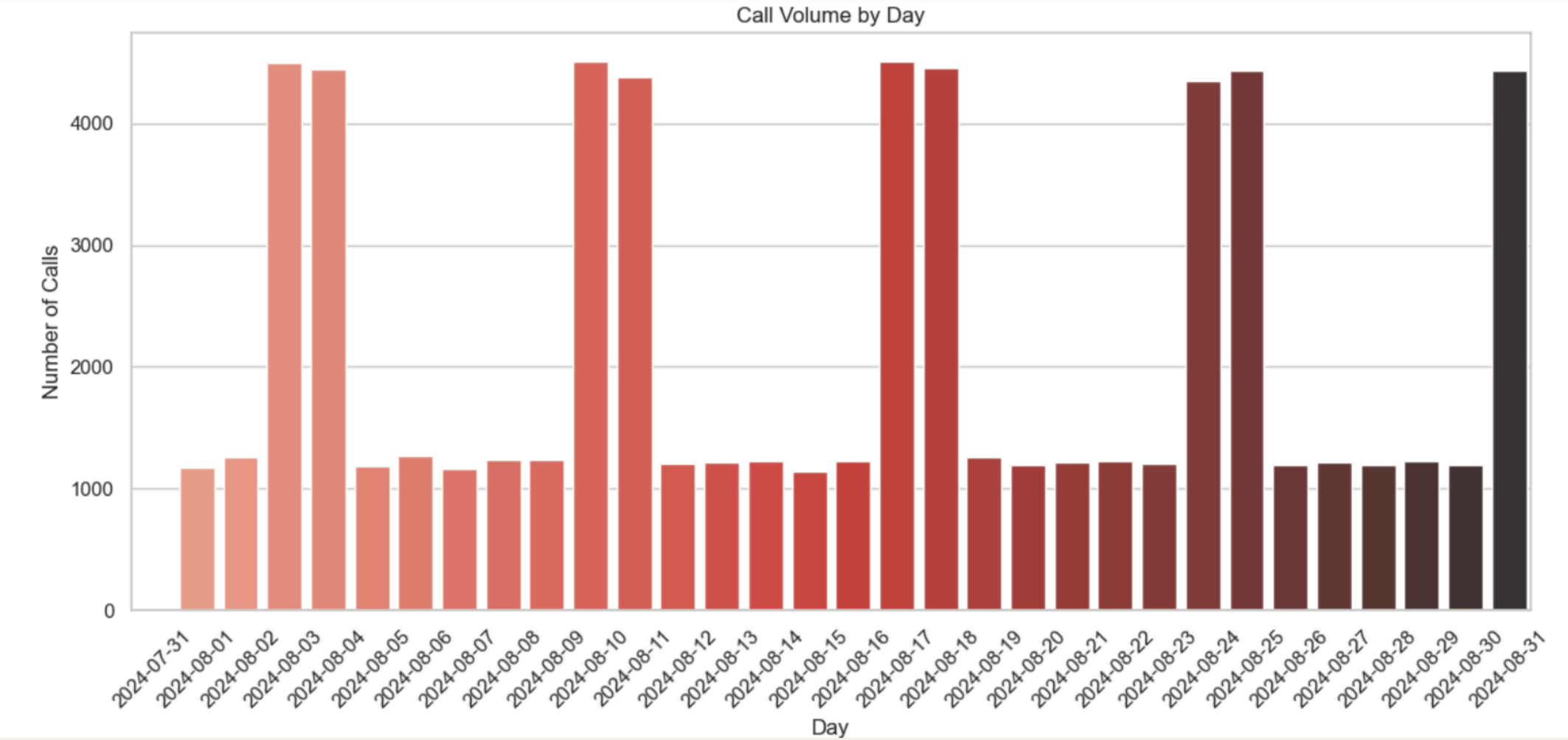
Insights

Word Cloud of Primary Call Reasons



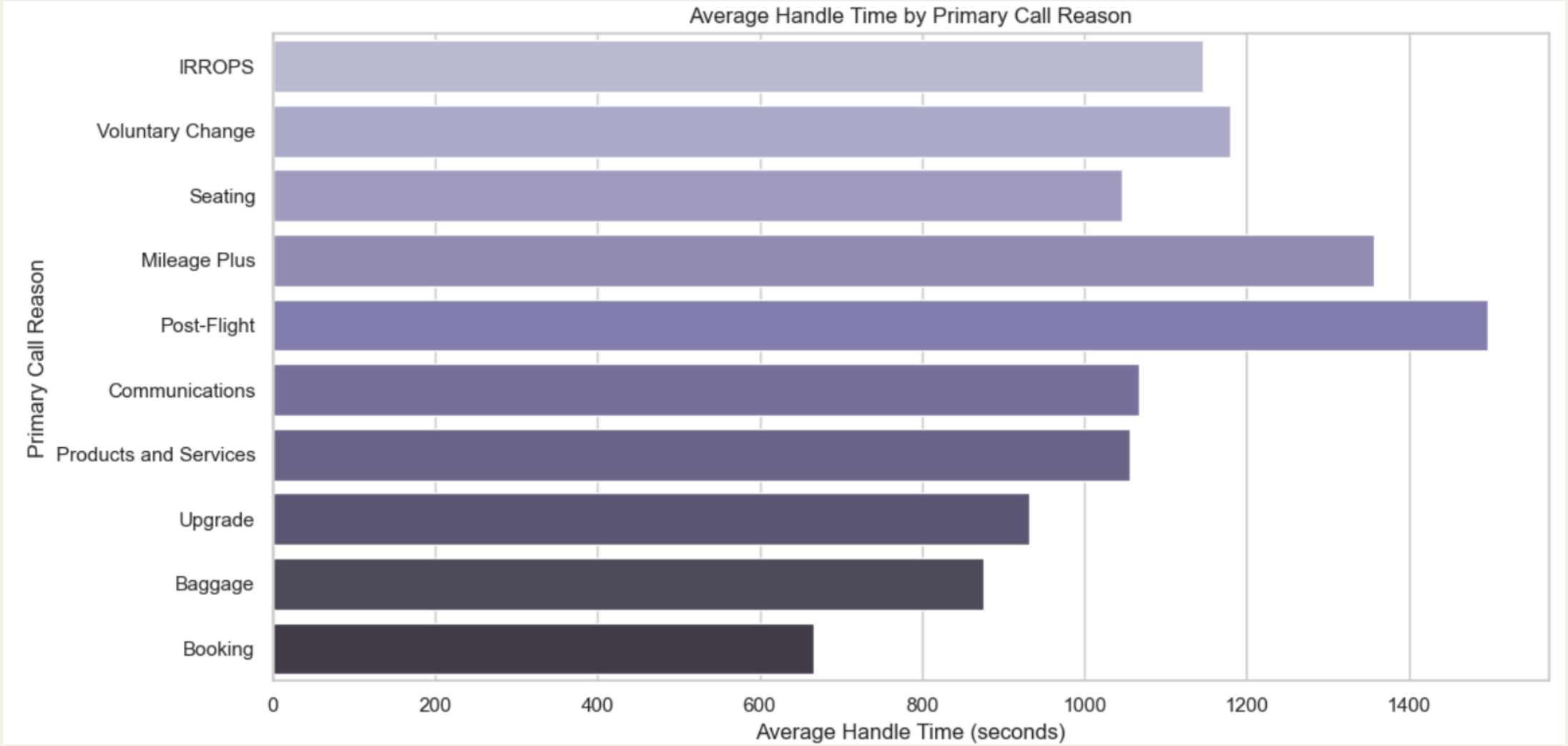
Insights

Call Volume by Day



Insights

Average Handling Time by Primary Call Reason



Recommendations

Enhance Agent Training and Development

- **Focus Area:** Introduce training programs that enhance agents' skills in tone management, de-escalation, and active listening.
- **Why It Matters:** Our analysis shows that when agents are calm and polite, AHT significantly decreases. Equipping agents with these skills will help them handle calls more effectively.

  Training Components:
- **Tone Management Workshops**: Help agents recognize and respond to emotional cues from customers.
- **De-escalation Techniques:** Teach agents how to calmly diffuse tense situations before they escalate.
- **Active Listening Skills:** Foster better engagement with customers to resolve issues swiftly.
- **Anticipated Results**: We expect to see a 10-15% reduction in AHT, which will lead to happier customers.

Recommendations

Expand Self-Service Options through IVR Improvements

- **What to Do:** Upgrade the IVR system to handle common requests like Voluntary Changes and Baggage Inquiries without needing an agent.
- **Reasoning:** By automating these frequent inquiries, we can ease the load on our agents, allowing them to focus on more complex issues.

Action Steps:

- **Revamp the IVR Menu:** Make it easier for customers to navigate and quickly find the answers they need.
- **Integrate FAQs:** Include quick answers to common questions within the IVR system.
- **Gather Customer Feedback:** Continuously refine the system based on what customers say about their experience.
- **Expected Impact:** We could see a 20-30% reduction in agent call volume, which would improve both AHT and AST.

Recommendations

Optimize Staffing Levels Based on Call Patterns

- **What We Recommend:** Analyze call data to align staffing levels with peak call times.
- **Why This Is Important:** By adjusting staff during busy periods, we can help keep AHT and AST in check.

Implementation Steps:

- **Analyze Call Data:** Identify when call volumes peak and adjust staffing accordingly.
- **Encourage Off-Peak Calling:** Offer incentives to customers who choose to call during quieter times.
- **Expected Outcomes:** By optimizing staffing, we can expect improved AST and AHT during peak hours, enhancing the overall customer experience.

Recommendations

Continuous Monitoring and Feedback Mechanism

- **Our Approach:** Set up a system for ongoing monitoring of performance metrics and customer feedback.
- **Why This Matters:** Regularly checking in on our data allows us to adapt quickly to customer needs and any operational challenges that arise.

Monitoring Components:

- **Real-Time Dashboards:** Keep track of key metrics like AHT and customer satisfaction continuously.
- **Automated Feedback:** Provide agents with immediate insights after each call to help them improve.
- **What We Expect:** With this approach, we aim for sustained improvements in AHT and AST through proactive management.