Affect Reflection Technology in Face-to-Face Service Encounters

by

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B.S., Korea Advanced Institute of Science and Technology (2007)

Submitted to the Program in Media Arts and Sciences,
School of Architecture and Planning,
in partial fulfillment of the requirements for the degree of

Master of Media Arts and Sciences

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

September, 2009

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Abstract

This thesis examines the role of facial expressions in dyadic interactions between a banking service provider and customer. We conduct experiments in which service providers manipulate their facial expressions while interacting with customers in one of three conditions: In the neutral condition the banker tried to maintain a neutral facial expression; in the smiling condition the banker tried to smile throughout the interaction; in the empathetic condition the banker tried to respond with the same or complementary facial expressions. Results show that the customers (n=46) were more satisfied with the interaction when they perceived the service provider was empathetic. More significantly, the service provider and customer shared synchronized facial expressions with many prolonged smiles, when customers said the service provider was empathetic. We suggested three different criteria to investigate customer satisfaction as follows; according to what the service provider tried to convey, what the customer perceived and what was actually detected in their interactions. According to the analysis of the interactions, smiling bankers who shared smiles were evaluated as the best while smiling bankers who did not share smiles with customers were appraised similar to non-smiling bankers.

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To my family
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Imagine you went out to a local restaurant for dinner. You would probably enjoy the dinner more if the waitress is friendly, kind and smiling rather than salty and disgruntled. Hochschild (1983) showed how service providers, especially flight attendants, have to manage their emotion and display positive affect when they interact with their passengers. This work is the first notable work in the emotional labor field of organization behavior area that has influenced other work thereafter such as exploring the inner feelings of service providers (Rafaeli and Sutton, 1989) and selecting a service provider who would get less psychologically stressed (Morris & Feldman, 1996). The methodology in their research focused on examining whether a smiling service provider affected the customer to feel better or whether smiles were contagious between the service provider and customer by looking at whether both of them smiled or not. In this thesis, we examine how nonverbal communication between a service provider and a customer affects the customers’ perceived satisfaction. Among nonverbal communication features such as facial expressions, eye contact, postures and body
gestures, we primarily analyze the dynamics of facial expressions between people in face-to-face conversations. Specifically, we look at both the service provider’s smiles and the customer’s smiles as well as customers’ reported feeling about the service. Previous studies have investigated behavioral mimicry in dyadic interaction by having human coders at the location of the experiment to check whether a certain behavior, such as smiling, happened over the entire interaction (Tsai, 2001). Other approaches have recorded the interactions and had human coders review the film and count the number of times a behavior occurred (Chartrand & Bargh, 1999; Barsade, 2002). We propose quantitatively more accurate ways of measuring mimicry behavior by measuring the number of times when it occurred and the percentage of time it takes up in the entire interaction. In addition, we explore empathetic communication not only through shared smile behavior but also with other complementary facial expressions such as “caring-upset” and “smile-interested”. Since emotion is subjective and emotions such as caring are hard to recognize, we also have people label their videos after the interaction and compare the labels of what they said they felt with the labels of what others perceive in their video. With regard to the analysis of smiles, we classify smiles into three different kinds depending on the intent and context in which the smile happened to elicit its authenticity. Grandey (2005) classified authentic and inauthentic smiles by their intensity and facial muscles, but we would rather take into account the intent and the context.

1.1 Background

During conversations people tend to mimic one another’s facial and body gestures, such as smiling together, nodding their heads in unison, or each putting their hand on their chin. Research has shown that synchronized nonverbal cues can influence face-to-face communication in a positive manner (Kendon, 1970). Many aspects of mimicry behavior have been studied by social scientists. In
Chartrand’s work, he demonstrated the chameleon effect, showing that those participants that interacted with a confederate who imitated the participant’s behavior, compared with the case in which the confederate did not imitate the participant, felt the interaction was more pleasing (Chartrand & Bargh, 1999). Other research has also investigated the positive influence of mimicry behavior in varying situations. In student-teacher interaction, the rapport between student and teacher was stronger when the students were copying the teacher's behavior (LaFrance, 1982). In counselor-client conversation clients preferred those counselors who mimicked the clients’ expressions to those who did not (Maurer & Tindall, 1983).

There are many arguments, and growing evidence, to account for human behavioral mimicry. According to the common-coding theory (Prinz, 1997; Knoblich & Flach, 2003), the representations of generated action are affected by the representations of perceived action and vice versa. Decety claims that people have similar representations of action (Decety J & Sommerville, 2003) and that people mimic the physical movements of one another because they are projecting the other person’s situation to their own (Decety, 2004). Empathy produces this "kinesthetic" imitation (Lipps, 1903), which induces people to think that they are sharing similar affective states and experiences with their conversation partners (Decety, 2004). The result is that people feel as if they “connect” with others, which influences the building and sustaining of relationships with others (Chartrand, 2005). As a result people create positive social and emotional qualities including affiliation and rapport by unconsciously mimicking the physical movements and expressions of one another when they interact (Chartrand, 2005).

Mimicry behavior can also be advantageous in establishing successful business relationships. In a study of facial mimicry between a service provider and a customer, at a coffee shop, there was a positive correlation between mutually similar facial expressions and positive customer evaluation (Barger, 2006). Moreover, a waitress received higher tips when she mimicked the customers by repeating the order that she was told (Baaren, 2003). In service-oriented businesses that
rely on face-to-face interaction, such as coffee shops, restaurants, banks or hotels, it is vital to establish and maintain good relationships with the customers. Although research in business management has shed light on the importance of employee-customer interactions, little has been done with respect to the analysis of dyadic interactions that focus on the behavior, and subsequent influences, of one person’s actions on the other. Notable examples by Pugh and Tsai demonstrate that positive affect, smiling, and engaging eye contact can positively influence the customer’s experience (Pugh 2001; Tsai 2001).

1.2 Overview

The remainder of this thesis is organized as follows: chapter two explains how the experiment is designed to have a banker interact with a customer altering his facial expression; chapter three elaborates on measures that we quantify to understand customer satisfaction and facial expressions; chapter four and chapter five emphasize the perspective differences between banker and customer; chapter six and chapter seven analyze customer satisfaction and dyadic communication; chapter eight is one of the most interesting parts of this thesis that investigates different kinds of smiles; In chapter nine, we conclude our findings.
Chapter 2

Experiment Design

2.1 General Description of the Experiment

The general design of the experimental interaction is that of a professional banker interacting with a customer interested in learning about financial services (Figure 2-1). The banker provides two kinds of financial services, which are similar to real world services provided at a retail branch. The first service is to cash a $5 voucher from the customer participant as compensation for participating in the study. This part is designed to simulate a cashing a check scenario. The participant was told up front that they would get $10 for compensation, but the banker told them they would have to fill out more paperwork after the study to get the rest of the money they were owed and could only get $5
This manipulation was made to instill a slightly negative state in the customer in order to approximate more accurately the situation where a customer might be going to a real bank assistant for help. After the experiment ended the participant received the rest of the money without additional paperwork. The second service is to explain one of the financial services that a customer chose to learn more about: Home Equity Line of Credit (HELOC), Individual Retirement Arrangement (IRA), Certificate of Deposit (CD), mortgages, credit card, or student financial plans (529 plans & CDs). This part is to simulate the situation in which bank customers ask questions and receive information about the financial product they are interested in. There were two male bankers and one of them interacted with forty-six participants, while the other interacted with forty-five participants. There is one banker and one customer in each experiment and the experiment was nonreciprocal one-with-many design (David, 2007) (Figure 2-1). The experiment was conducted in a room equipped with a desk, two chairs, bank service advertising pamphlets and two cameras to make the appearance alike to a personal banking service section at banks (Figure 2-2). One camera was used to record the banker's facial expressions and the other was used to record the participant's facial expressions.

![Figure 2-1. nonreciprocal one-with-many design](image-url)
2.2 Participants – Hired Bankers

We hired two professional personal bankers, each with over two years of career experience as a personal banker, to do what they usually do at work - explain financial services. During the hiring, we asked them if they would be willing and able to manipulate the type of facial expressions displayed during interaction with the customer. Each banker agreed to alter his facial expressions in three different ways, following these exact instructions:

Manipulation 1 – Neutral facial expressions: Please try to sustain neutral facial expressions regardless of the changes in the customer's facial expressions over the entire interaction.

Manipulation 2 – Always smiling: Please try to keep smiling regardless of the changes in the customer’s facial expressions over the entire interaction.
Manipulation 3 – Complementary facial expressions i.e., empathetic: Please try to understand the customer's feeling and respond to it appropriately by smiling when the customer seems to feel good, showing caring facial expressions when the customer expresses concern, showing neutral facial expressions when you need to express that you are listening to the customer sincerely and carefully, etc.

Throughout the experiment, the bankers interacted with the customer as they would normally do in a banking setting aside from the expression manipulation. This included greeting a customer, providing proper information, and thanking the customer for their time. The facial expressions of the bankers were unobtrusively videotaped and audio-recorded from the moment they met and greeted the customer to the end when the customer left the seat.

2.3 Participants – Customers

Thirty males and sixteen females (n=46) were recruited through flyers who were interested in receiving information about different financial services. Before the experiment started, they were told that their face and voice would be recorded as banks normally do for security reasons. However, they were not told that their facial expressions would be analyzed. This was to prevent them being aware of the purpose of the study. Afterward, they were told about the expressions and helped to label them.

2.4 Procedures

Prior to the participant entering the room the banker was told which expression manipulation to conduct. The participant was then allowed into the experiment room where they would interact with the banker and learn about specific financial services. At the end of the experimental interaction,
which took about 10 minutes, both the banker and participant filled out 9-point Likert scale surveys evaluating the quality of the service based on the most comprehensive and popular instrument SERVQUAL (Parasuraman, 1985 & 1988) and the attitude of the banker. While the banker and participant completed the surveys the experimenter transferred the video recorded experimental session to DVDs. After the banker and participant were finished with surveys they were asked to label the video data for their facial expressions and emotions. After labeling their own video information they labeled the videos containing the person they interacted with.

2.5 Facial Expressions Coding

In this study, the banker labeled his own video data and the participants also labeled their own data. Then, the banker labeled the participant's video data and the participants labeled the banker's video data. Lastly, human coders not involved in the study labeled both the bankers’ and the participants’ data. In the interface of the labeling software that the banker and the participant used, “VideoLAN-VLC media player” plays the DVD and the labeling software provides an entity to enter the time when a certain facial expression was observed and seven emotion labels to select (Figure 2-3). These seven labels are: smile, concerned, caring, confused, upset, sorry, and neutral. If there was no proper label to choose from, the user could press "Other" and enter another label that they think is appropriate for the expression. The labelers were instructed to stop playing the video and click on the label button when they saw a facial expression, and then to continue to play the video until they saw a change in the facial expression. On the right side of the user interface, there was a text box displaying the time and the labeling result and it was editable so that the user could annotate the reason for each facial expression, e.g. “smile – he made me laugh”. By providing the space to type the comment, we could learn more about the intent behind the facial expressions, especially the smiles, where we would later categorize them into “Greeting Smile,” “Social Smile,” and “Genuine
“Smile.” For example, when the annotation was “smiling to greet the customer”, it was classified as “Greeting Smile” and when the annotation was “smiling to be polite to the customer”, the smile was classified as “Social Smile”. “Genuine Smile” can be annotated as “hearing about getting the cash”, “glad to hear about tax deductions”, “the banker told me a funny joke”, etc. There were four human coders not involved in the actual experiments. These labelers used an online video annotation program, VidL, developed by the experimenters to label the video data (Figure 2-4). The interface contains nine labeling buttons for facial expressions, which are composed of smile, concerned, caring, confused, upset, neutral, satisfied, surprised and other and four labels for gestures including head nod, headshake, chin on hand, open arms. The last three buttons are to record the points when the participant started filling out a survey asking about a demographic profile at the very beginning of the interaction and the last scene of the interaction since we could not observe the participants face during this period.

Figure 2-3. Labeling interface used by banker and customer
Figure 2-4. Labeling interface used by four outside coders; The labels differ slightly here and these data turned out to not be used in this thesis.
Chapter 3

Measures

3.1 Facial Expression Measures

3.1.1 Percent synchrony time of the facial expressions

We measured the duration of each of the facial expressions studied for both the banker and participant. In total there are nineteen facial expressions that can be assigned by the human coder (Table 3-1). Initially, we provided eight facial expressions labels shown in Figure 2-3 and the human coders entered other emotion labels such as “Surprised”, “Interested”, “Annoyed” when they pressed the button “Other”. The labels in Table 1 include the seven labels provided in the labeling software as well as the labels that came out of the “Other” category. Therefore, there are 19*19 = 361 possible pairs of synchronized facial expressions between a banker and participant and each synchrony is
assigned a unique identification. For example, “Banker: Smile – Customer: Smile” is assigned to “Synchrony ID : 1” and “Banker: Concerned – Customer: Smile” is assigned to “Synchrony ID : 20”.

In this context, synchronization means a pair of facial expressions between the banker and the customer that overlaps in time. The percent synchrony time of the facial expressions is defined as the percentage of the time each synchrony takes up in the entire interaction; the length of the synchrony is divided by the entire interaction time length.

<table>
<thead>
<tr>
<th>ID</th>
<th>Facial Expressions</th>
<th>ID</th>
<th>Facial Expressions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Smile</td>
<td>11</td>
<td>Relieved</td>
</tr>
<tr>
<td>2</td>
<td>Concerned</td>
<td>12</td>
<td>Interested</td>
</tr>
<tr>
<td>3</td>
<td>Caring</td>
<td>13</td>
<td>Bored</td>
</tr>
<tr>
<td>4</td>
<td>Confused</td>
<td>14</td>
<td>Enthusiastic</td>
</tr>
<tr>
<td>5</td>
<td>Upset</td>
<td>15</td>
<td>Persuasive</td>
</tr>
<tr>
<td>6</td>
<td>Sorry</td>
<td>16</td>
<td>Annoyed</td>
</tr>
<tr>
<td>7</td>
<td>Neutral</td>
<td>17</td>
<td>Survey</td>
</tr>
<tr>
<td>8</td>
<td>Other</td>
<td>18</td>
<td>The end</td>
</tr>
<tr>
<td>9</td>
<td>Satisfied</td>
<td>19</td>
<td>Missing Label</td>
</tr>
<tr>
<td>10</td>
<td>Surprised</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3-1. Twenty-one labels for the facial expressions

3.1.2. Frequency of each facial expression

This measure counts how many times each facial expression happened over the entire interaction.

3.2 Customer Satisfaction Measures

3.2.1. Interaction satisfaction
The participants answered the question, “How satisfied are you with the interaction overall?”, with a 9-point Likert scale rating.

### 3.2.2. Information satisfaction

The participants also evaluated information satisfaction with the question, “How satisfied are you with the financial information provided?”, using a 9-point Likert scale rating.

### 3.2.3. Empathy of the bankers

A survey was given to ascertain the customer’s interpretation of the service provider’s empathetic attitude. The survey was based on the most commonly used instrument SERVQUAL (Parasuraman, 1985 & 1988) that investigates five aspects of the service; “Tangibles, Reliability, Responsiveness, Assurance, Empathy.” The four items in the “Empathy” section of SERVQUAL were adopted and the rating used a 9-point Likert scale.

### 3.2.4. Customer perception

The customers were asked to choose one of three attitudes for the banker: neutral, always smiling, and empathetic. We measured this to see whether customer perception did or did not agree with what the banker intended to convey.
Chapter 4

Banker Manipulation

4.1 Manipulation Checks

Figure 4-1 shows three labeled interactions illustrating interactions where the banker successfully performed the facial expressions for each condition. In Figure 4-1(a), “Neutral,” the banker is showing neutral facial expressions most of the time, visualized with light blue color, and other facial expressions such as smile and concerned are rarely observed. In Figure 4-1(b) “Always Smiling”, the banker is smiling throughout the interaction, which is visualized with orange bars. In Figure 4-1(c), “Complementary facial expressions”, we can see more dynamics in the banker’s facial expressions, i.e., transitions between different facial expressions, and we observe where the banker
and customer are smiling together. Additionally we see that the banker was responding with “caring” facial expressions when the customer was expressing “confused” or “other”.

Figure 4-1. Banker Manipulation Checks
We analyzed banker 2’s data which has forty-six pairs of interactions in this section as well as in the remainder of the thesis since banker 1’s data still needs to be cleaned up in a right format. Table 4-1 shows six quantitative measurements to distinguish three different manipulations. These six measurements are as follows:

1. **The percent of smiles** is defined as the time during which the banker was smiling during the entire interaction time. For example, in Figure 4-1 (c), the sum of each smile segment colored with yellow bar is 3 minutes and 14 seconds and the total interaction time is 19 minutes at 33 seconds. Therefore, the percent of smiles is \( \frac{3 \text{ minutes} 14 \text{ seconds}}{19 \text{ minutes} 33 \text{ seconds}} \times 100 = 16.5\% \). The first row in Table 4-1 summarizes the average of the percent of smile in 46 interactions for each manipulation.

2. **The percent of neutral facial expressions** is similar to the first measurement, the percent of smiles, except that this measurement calculates how much percentage the neutral facial expressions takes up in each interaction. The values in Table 4-1 are averaged over 46 interactions.

3. **The number of banker transitions** counts how many times the banker changed his facial expressions from one to another. For example, in Figure 4-1(b), the banker changes twice, smile(yellow bar) → concerned(red bar) → smile(yellow bar).

4. **The difference between banker’s transitions and customer’s transitions** is calculated by subtracting the number of customer’s facial expressions transitions from the number of banker transitions. For example, in Figure 4-1(b), the number of banker’s transitions is 3 and the number of customer’s transitions is 13. Therefore, the difference between the banker’s transitions and customer’s transitions is 3-13 = -10 in this case. The negative value means the customer had more transitions and was more dynamic. The positive value implies that the banker made more transitions. If this value is zero, both the banker and the customer made the same number of transitions.

5. **The number of smiles** counts how many times the banker smiled in the interaction. If a banker starts to smile and stops smiling and his facial expressions changes into another but smiling
then it is counted as one smile. For example, in Figure 4-1(b), the number of smiles is 2 and, in Figure 4-1(c), the number of smiles is 11.

6. The number of neutral facial expressions is similar to the number of smiles except that it counts how many times the banker showed neutral facial expressions.

As we can see from Table 4-1, the banker was smiling most of the time throughout the “always smiling” manipulation, which was 96.18% of the interaction time on average, while he was smiling only 1.01% of the interaction time in “neutral” manipulation. The banker was also successfully following the manipulation instruction by maintaining neutral facial expressions 98.75% of the interaction time.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Neutral Manipulation</th>
<th>Always Smiling Manipulation</th>
<th>Complementary Facial Expressions Manipulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The percent of smile</td>
<td>1.0%</td>
<td>96.2%</td>
<td>25.6%</td>
</tr>
<tr>
<td>The percent of Neutral Facial Expressions</td>
<td>98.8%</td>
<td>3.7%</td>
<td>68.0%</td>
</tr>
<tr>
<td>The number of banker transitions</td>
<td>0.8</td>
<td>0.9</td>
<td>13.4</td>
</tr>
<tr>
<td>The difference between banker’s transitions and customer’s transitions</td>
<td>-14.3</td>
<td>-12.9</td>
<td>-4.3</td>
</tr>
<tr>
<td>The number of smiles</td>
<td>0.5</td>
<td>1.4</td>
<td>6.6</td>
</tr>
<tr>
<td>The number of neutral facial expressions</td>
<td>1.3</td>
<td>0.4</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 4-1. Banker smiled most of the time in the “Always Smiling” manipulation, showed neutral facial expressions for 98.75% of the interaction time in “Neutral” manipulation and was more dynamic in “Complementary Facial Expressions” manipulation.

Figure 4-2 shows the histogram of these six measurements. From the histogram of Measurement 3, the number of banker transitions, we can see that the banker made more transitions during the complementary facial expressions manipulation averaging 13.4, which is much more dynamic than
the other two groups averaging close to 0.8. In addition, the dynamics between the banker and the customer tend to become similar in “Complementary Facial Expressions” manipulations. We can confirm this tendency from the histogram of Measurement 4, "The Difference Between Banker Transitions and Customer Transitions" since their difference was lower in “Complementary Facial Expressions” manipulations averaging -4.3 compared to the other two cases that were -14.3 and -12.9.
Figure 4-2. Histogram of Measurement 1. The percent of smile
Figure 4-3. Histogram of Measurement 2. The percent of neutral facial expressions.
(a) Neutral Manipulation

(b) Always Smiling Manipulation

(c) Empathetic Manipulation

Figure 4-4. Histogram of Measurement 3. The number of banker’s transitions.
Figure 4-5. Histogram of Measurement 4. The difference between banker’s transitions and customer’s transitions.
Measurements 5 and 6 can be observed more clearly when we combine these measures with the percentage measurements, i.e., measurement 1 and measurement 2 (Figure 4-6 & Figure 4-7). That is, there are a smaller number of smiles or neutral facial expressions in “always smiling” and “neutral
facial expressions” manipulations because the banker was told to keep the same facial expressions, while the percent is high because the banker was trying to keep the same facial expressions all the time. Meanwhile, in the “complementary facial expressions” manipulation, there are more smiles or neutral facial expressions, but the percentage is not the highest one among the groups. From this measurement, we can confirm there are three distinct forms of manipulations taking place.

4.2 Banker and Customer Perspective Differences

Interestingly, despite the differences between the three facial manipulations acted by the banker (Table 4-1), a customer’s perception of the banker’s attitude did not always agree with a banker’s manipulation.

<table>
<thead>
<tr>
<th>Customer Perception</th>
<th>Neutral</th>
<th>Always Smiling</th>
<th>Empathetic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Banker Manipulation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neutral</td>
<td>( \frac{7}{15} = 0.5 )</td>
<td>( \frac{6}{15} = 0.4 )</td>
<td>( \frac{2}{15} = 0.1 )</td>
</tr>
<tr>
<td>Always Smiling</td>
<td>( \frac{2}{16} = 0.1 )</td>
<td>( \frac{8}{16} = 0.5 )</td>
<td>( \frac{6}{16} = 0.4 )</td>
</tr>
<tr>
<td>Complementary Facial Expressions</td>
<td>( \frac{3}{15} = 0.2 )</td>
<td>( \frac{5}{15} = 0.3 )</td>
<td>( \frac{7}{15} = 0.5 )</td>
</tr>
</tbody>
</table>

Table 4-2. Banker manipulation vs. customer perception

Table 4-2 shows that when the banker tried to maintain a smile throughout the interaction, only half of sixteen customers reported that they thought the banker was always smiling, while two of sixteen customers thought the banker’s attitude was neutral. Surprisingly, six out of fifteen customers in the neutral manipulation sessions reported that they perceived the bankers attitude as
“Always Smiling”. This may be due to voice tone and the typical notion that bankers usually smile at their customers. Meanwhile, the probability that the customer would feel the banker was empathetic was highest when the banker was trying to respond with complementary facial expressions and the probability of the customer perception to be “Always Smiling” was highest when the banker intended to always smile. Since a customer’s perception does not always match a banker’s intent, we needed something more objective for our analysis. We therefore conducted three kinds of analysis, classifying the data into three conditions, i.e., neutral, always smiling, empathetic (complementary facial expressions), according to three different measures: the cognitively reported customer perception, a banker’s intent, and the measured synchrony labeled using their facial expressions. We present these three analyses in chapter six and chapter seven after discussing the differences in perspective in chapter five.
Chapter 5

First Perspective Labeling and Second Perspective Labeling

After filling out the survey asking about their interaction satisfaction, both the banker and the customer reviewed their own video data recorded during their interaction. Firstly, they labeled their own facial expressions from the DVD that recorded them. Then the experimenter switched DVDs so that the banker could label the customer’s facial expressions and the customer could label the banker’s facial expressions. The first perspective labeling refers to the facial expressions labeling that was done while each person was watching their own DVD and the second perspective labeling corresponds to the facial expressions labeling that was done while they were watching their partner’s DVD. In sections 5.1 and 5.2, we compare these two different perspectives to observe the facial
expressions and list which facial expressions tend to have relatively more agreement between these two perspectives and which facial expressions are ambiguous.

5.1 Data Format

Since both the banker and the customer reviewed their own DVD and their partner’s DVD, there were four labeling files in each experiment; banker’s labeling of his own DVD, banker’s labeling of the customer’s DVD, customer’s labeling of his/her own DVD and customer’s labeling of the banker’s DVD. Figure 5-1, Figure 5-2, Figure 5-3 and Figure 5-4 show one data sample with these four labeling results. Figure 5-1 is the banker’s labeling of his own DVD. The first line starts with the time when the banker meets and greets the customer and the last line is the time when the banker finishes the conversation and the customer leaves the room. In this sample, the banker labeled that he was smiling when he was greeting to meet the customer and recapitulating his explanation session. The first line and the last line have to be the same in all four files, which means their interaction time is equal. In Figure 5-2, Figure 5-3 and Figure 5-4, the time of the first line is the same as the one in Figure 5-1, yet the label is “Missing Label”, which means the coder did not start labeling at that point. In addition, the coders annotated the reason why they were making a certain facial expression at that moment. We make use of these comments to understand the intent and context of the facial expressions and classify smiles into three categories in chapter eight. By comparing the banker’s labeling in Figure 5-1 with the customer’s labeling of banker’s DVD in Figure 5-2, we notice that there exists some agreement in smile labeling and there exists some disagreements in “Neutral” and “Caring” facial expressions. In the following section, we calculate the agreement between banker’s labeling and customer’s labeling for each facial expression.
6:46:42 Smile customer is entering the room
6:46:47 Smile Greeting the customer
6:47:11 Smile explaining there is not enough money
6:47:25 Smile explaining the survey
6:47:32 Smile customer is filling out survey
6:47:52 Smile customer is asking a question
6:48:05 Smile answering his question
6:48:26 Smile interacting with customer regarding the survey
6:49:15 Smile explaining what a 529 plan is
6:50:19 Smile addressing customer's question regarding who benefits from these plans
6:50:33 Smile customer is telling me he has heard of those plans but didn't realize they were called 529's
6:51:23 Smile client is joking about the high cost of an education
6:51:30 Smile listening to his question about CD's
6:51:59 Smile pausing after summarizing
6:52:05 the end of the interaction

Figure 5-1. Banker’s Labeling of Banker’s DVD

6:46:42 Missing Label. Start of interaction
6:46:44 Smile Introduction
6:46:55 Smile Being polite
6:47:07 Caring Trying to be empathetic
6:47:22 Smile Being polite
6:47:27 Smile Thinks I don't want to hear it
6:47:44 Neutral Waiting
6:47:52 Concerned Getting ready to answer my question
6:47:57 Smile Answering my question
6:48:24 Smile Mistake
6:48:34 Concerned Waiting for me to finish
6:48:40 Smile Being polite
6:48:46 Neutral Getting down to business
6:48:49 Smile Starting explanation
6:48:55 Concerned Making sure I understand
6:49:15 Smile Sees that I understand what he's saying
6:49:23 Concerned Continuing explanation
6:49:29 Smile Understand each other
6:49:44 Caring Continuing his story
6:50:17 Smile Answering my question
6:50:24 Caring More details
6:50:34 Smile Mutual understanding
6:50:40 Caring
6:51:08 Smile Being polite
6:51:12 Caring More details
6:51:25 Smile Agreeing with me
6:51:34 Caring Continuing
6:52:00 Smile Being polite
6:52:05 End of interaction

Figure 5-2. Customer’s Labeling of Banker’s DVD
Figure 5-3. Customer’s Labeling of Customer’s DVD

Figure 5-4. Banker’s Labeling of Customer’s DVD

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5.2 Agreement between First and Second Perspective Labeling

We have used three measurements to compare first and second perspective labeling. In all three measurements, the numerator is the length of the time during which the banker’s labeling and the customer labeling agree. The difference between these three measurements is that measurement 1 compares the agreement between the banker and the customer with banker’s labeling, measurement 2 compares it with customer’s labeling, and measurement 3 compares it with the length of the interaction. To explain these three measurements specifically, let’s take an example with the data shown in Figure 5-1, Figure 5-2, Figure 5-3 and Figure 5-4 of section 5.1 above.

<table>
<thead>
<tr>
<th>Banker’s Labeling</th>
<th>Duration</th>
<th>Customer’s Labeling</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:46:42 Smile</td>
<td>5 seconds</td>
<td>6:46:42 Missing Label</td>
<td>2 seconds</td>
</tr>
<tr>
<td>6:47:11 Smile</td>
<td>14 seconds</td>
<td>6:46:55 Smile</td>
<td>12 seconds</td>
</tr>
<tr>
<td>6:47:25 Smile</td>
<td>7 seconds</td>
<td>6:47:07 Caring</td>
<td>15 seconds</td>
</tr>
<tr>
<td>6:47:32 Smile</td>
<td>20 seconds</td>
<td>6:47:22 Smile</td>
<td>5 seconds</td>
</tr>
<tr>
<td>6:47:52 Smile</td>
<td>11 seconds</td>
<td>6:47:27 Smile</td>
<td>17 seconds</td>
</tr>
<tr>
<td>6:48:03 Smile</td>
<td>23 seconds</td>
<td>6:47:44 Neutral</td>
<td>8 seconds</td>
</tr>
<tr>
<td>6:48:26 Smile</td>
<td>49 seconds</td>
<td>6:47:52 Concerned</td>
<td>5 seconds</td>
</tr>
<tr>
<td>6:49:15 Smile</td>
<td>1 minutes 4 seconds</td>
<td>6:47:57 Smile</td>
<td>27 seconds</td>
</tr>
<tr>
<td>6:50:19 Smile</td>
<td>14 seconds</td>
<td>6:48:24 Smile</td>
<td>10 seconds</td>
</tr>
<tr>
<td>6:50:33 Smile</td>
<td>50 seconds</td>
<td>6:48:34 Concerned</td>
<td>6 seconds</td>
</tr>
<tr>
<td>6:51:23 Smile</td>
<td>7 seconds</td>
<td>6:48:40 Smile</td>
<td>6 seconds</td>
</tr>
<tr>
<td>6:51:30 Smile</td>
<td>29 seconds</td>
<td>6:48:46 Neutral</td>
<td>3 seconds</td>
</tr>
<tr>
<td>6:51:59 Smile</td>
<td>6 seconds</td>
<td>6:48:49 Smile</td>
<td>6 seconds</td>
</tr>
<tr>
<td>6:52:05 End of the interaction</td>
<td>6 seconds</td>
<td>6:48:55 Concerned</td>
<td>20 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6:49:15 Smile</td>
<td>8 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6:49:23 Concerned</td>
<td>6 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6:49:29 Smile</td>
<td>15 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6:49:44 Caring</td>
<td>33 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6:50:17 Smile</td>
<td>7 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6:50:24 Caring</td>
<td>10 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6:50:34 Smile</td>
<td>6 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6:50:40 Caring</td>
<td>28 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6:51:08 Smile</td>
<td>4 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6:51:12 Caring</td>
<td>13 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6:51:25 Smile</td>
<td>9 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6:51:34 Caring</td>
<td>26 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6:52:00 Smile</td>
<td>5 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6:52:05 End of interaction</td>
<td>5 seconds</td>
</tr>
</tbody>
</table>

Figure 5-5. Banker’s Labeling of Banker’s DVD and Customer’s Labeling of Banker’s DVD
Figure 5-5 compares the banker’s labeling of the banker’s DVD, which is the same as Figure 5-1, with the customer’s labeling of the banker’s DVD, which is the same as Figure 5-2. As we can see on the left side of Figure 5-5, according to the banker’s self labeling the banker was smiling during the entire interaction time, 5 minutes 23 seconds. Meanwhile, according to the customer’s labeling the banker was smiling only 2 minutes and 23 seconds, which is the summation of all of the smiling segments (11 + 12 + 5 + 17 + 27 + 10 + 6 + 6 + 8 + 15 + 7 + 6 + 4 + 9 seconds = 143 seconds = 2 minutes and 23 seconds). In this case, the value of measurement 1 of smiles is 0.443, which can be calculated like the following:

\[
\frac{\text{The duration of banker and customer labeling agreement of smile}}{\text{The duration of banker’s labeling of smile}} = \frac{2 \text{ minutes 23 seconds}}{5 \text{ minutes 23 seconds}} = \frac{143 \text{ seconds}}{313 \text{ seconds}} = 0.443
\]

Therefore, measurement 1 is the ratio between the banker and customer labeling agreement and banker’s labeling. Measurement 2 can be calculated similar to measurement 1 except that the denominator is the duration of the customer’s labeling of smile this time. Measurement 2 can be calculated like the following:

\[
\frac{\text{The duration of banker and customer labeling agreement of smile}}{\text{The duration of customer’s labeling of smile}} = \frac{2 \text{ minutes 23 seconds}}{2 \text{ minutes 23 seconds}} = \frac{143 \text{ seconds}}{143 \text{ seconds}} = 1.000
\]

Measurement 3 is used to calculate how much ratio the banker and customer labeling agreement of smile takes up during the entire interaction time.

\[
\frac{\text{The duration of banker and customer labeling agreement of smile}}{\text{The Interaction Time}} = \frac{2 \text{ minutes 23 seconds}}{5 \text{ minutes 23 seconds}} = \frac{143 \text{ seconds}}{313 \text{ seconds}} = 0.443
\]

Table 5-1 shows these three measurements for all the facial expressions IDs, from ID 1, smile, to ID 19, missing label. The values listed here are the average of forty-six data of banker2 in the experiment. For example, if we calculate measurement 1 for facial expressions ID 2= concerned = with the data provided in Figure 5-5, the value was ignored when the average was calculated since
the duration of the banker’s labeling of concerned is zero in this data. Table 5-1 shows the comparison between the banker’s self labeling of the banker’s DVD and the customer’s labeling of the banker’s DVD, which means the banker’s labeling is the first person perspective labeling and the customer’s labeling is the second person perspective labeling. As we can see from Table 5-1, “Facial Expressions ID 1: Smile” made a fairly high ratio of agreement between first person and second person perspectives labeling, which takes up 45.2% among the banker’s smile labeling and 43.4% among the customer’s labeling. “Facial Expressions ID 7: Neutral” was also relatively higher than others, which was 43.3% among the banker’s labeling and 67.6% of the customer’s labeling.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Banker’s Labeling</td>
<td>Customer’s Labeling</td>
<td>Interaction Time</td>
</tr>
<tr>
<td>1: Smile</td>
<td>0.452</td>
<td>0.434</td>
<td>0.152</td>
</tr>
<tr>
<td>2: Concerned</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3: Caring</td>
<td>0.222</td>
<td>0.011</td>
<td>0.003</td>
</tr>
<tr>
<td>4: Confused</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5: Upset</td>
<td>Not Applicable</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6: Sorry</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7: Neutral</td>
<td>0.433</td>
<td>0.676</td>
<td>0.282</td>
</tr>
<tr>
<td>8: Other</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9: Satisfied</td>
<td>Not Applicable</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10: Surprised</td>
<td>Not Applicable</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11: Relieved</td>
<td>Not Applicable</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12: Interested</td>
<td>Not Applicable</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>13: Bored</td>
<td>Not Applicable</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>14: Enthusiastic</td>
<td>Not Applicable</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>15: Persuasive, Convincing</td>
<td>Not Applicable</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16: Annoyed</td>
<td>Not Applicable</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>17: Survey</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>18: The end of interaction</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>19: Missing Label</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 5-1. Comparison between banker self labeling and the customer’s labeling of banker’s DVD for each facial expression ID; banker’s self labeling is the first person perspective labeling and customer’s labeling is the second person perspective labeling.
Table 5-2 shows the same three measurements for the customer’s self labeling of the customer’s DVD and the banker’s labeling of customer’s DVD. Since the customer’s labeling is the first person perspective labeling and the banker’s labeling is the second person perspective labeling in this case, the denominator of measurement 1 is the duration of the customer’s labeling of each facial expression and the denominator of measurement 2 is the duration of the banker’s labeling of each facial expression. As is shown in Table 5-2, “Facial Expressions ID 7: Neutral” had the highest agreement, which agreed with 89.9% of customer’s self labeling and 52.7% of the banker’s labeling of customer’s facial expressions.

<table>
<thead>
<tr>
<th>Facial Expressions ID</th>
<th>Measurement 1: Banker and Customer agreement</th>
<th>Measurement 2: Banker and Customer agreement</th>
<th>Measurement 3: Banker and Customer agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Customer’s Labeling</td>
<td>Banker’s Labeling</td>
<td>Interaction Time</td>
</tr>
<tr>
<td>1: Smile</td>
<td>0.311</td>
<td>0.510</td>
<td>0.038</td>
</tr>
<tr>
<td>2: Concerned</td>
<td>0.014</td>
<td>0.199</td>
<td>0.003</td>
</tr>
<tr>
<td>3: Caring</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4: Confused</td>
<td>0.033</td>
<td>0.172</td>
<td>0.001</td>
</tr>
<tr>
<td>5: Upset</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6: Sorry</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7: Neutral</td>
<td>0.899</td>
<td>0.527</td>
<td>0.410</td>
</tr>
<tr>
<td>8: Other</td>
<td>0.064</td>
<td>0.286</td>
<td>0.001</td>
</tr>
<tr>
<td>9: Satisfied</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>10: Surprised</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11: Relieved</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12: Interested</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>13: Bored</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>14: Enthusiastic</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>15: Persuasive, Convincing</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16: Annoyed</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>17: Survey</td>
<td>0.8592</td>
<td>0.765</td>
<td>0.098</td>
</tr>
<tr>
<td>18: The end of interaction</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>19: Missing Label</td>
<td>0.3366</td>
<td>0.643</td>
<td>0.005</td>
</tr>
</tbody>
</table>

Table 5-2. Comparison between customer self labeling and the banker’s labeling of customer’s DVD for each facial expression ID; the customer’s self labeling is the first person perspective labeling and the banker’s labeling is the second person perspective labeling
“Facial Expressions ID 1: Smile” also showed more than 50% agreement in the banker’s labeling and 31.1% of customer’s labeling. We can conclude from the results in Table 5-1 and Table 5-2, smiles and neutral facial expressions were quite obviously recognizable between different coders, while caring, concerned, and confused were less obvious in comparison. More interestingly, other facial expressions except for these ones i.e., smile, neutral, caring, concerned and confused, were very dependent on the coder’s perspective. Therefore, to analyze and understand dyadic communication not only through shared smiles but also with other complementary facial expressions pairs such as “Smile-Satisfied”, “Caring-Upset”, and “Caring-Bored”, we adopt both the first person perspective labeling and the second person perspective labeling in chapters six and seven.
Chapter 6

Customer Satisfaction Data Analyses

6.1 Hypotheses

H1. Customers are more satisfied with the interaction and the information when a customer feels the service provider is empathetic or always smiling.

H2. There are three distinctive and valuable ways to investigate customer satisfaction and these are what the service provider is trying to do, what the customer perceives and what actually happens in their interaction.
The remainder of this chapter analyzes the customer satisfaction data according to cognitively reported customer perception, banker manipulation and affectively measured synchronized facial expressions.

6.2 Analysis 1. Cognitively Reported Customer Perception

Interaction satisfaction and information satisfaction were highest in the "Empathetic" group and SERVQUAL empathy score of a service provider measured with surveys was highest in the "Always Smiling" group, yet these two groups showed similar mean of ratings in all of these three measurements (Figure 6-1). An ANOVA was run on each of Interaction Satisfaction, Information Satisfaction and SERVQUAL empathy score. In each ANOVA, “Interaction Satisfaction” (F = 12.855, p = 0.000042) and “Information Satisfaction” (F = 7.036, p = 0.0023) and “Empathy Score” (F = 8.672, p = 0.0007) were significantly lower in the “Neutral” group than “Empathetic” and “Always Smiling” group.

![Figure 6-1. Interaction Satisfaction, Information Satisfaction and Empathy Score](image-url)
6.3 Analysis 2. Banker Manipulation

While there are obvious differences among the three measures, Interaction Satisfaction, Information Satisfaction, and SERVQUAL Empathy Score, when the data is classified according to customer perception, these measures are similar when we classify the data according to the banker’s manipulation. As it is shown in Figure 6-2, Interaction Satisfaction, Information Satisfaction and Empathy Score scored highest in “Always Smiling” group (when the banker tried to always smile) and scored lowest in “Neutral” group (when the banker appeared neutral). However, all of the $P$-values, $p$(Interaction, Information, Empathy Score) = (0.126, 0.287, 0.424), are higher than 0.05 in ANOVA, which indicates that the difference is not statistically significant.

![Figure 6-2. Interaction Satisfaction, Information Satisfaction, Empathy Score](image-url)
6.4 Analysis 3. Affectively Measured Synchronized Facial Expressions

We classified the data into three groups by directly measuring the synchronized facial expressions: If there were more than 10% of shared smiles in the interaction, then the data was placed into the “Empathetic” group. We also classified not only smile pairs but also other complementary facial expressions pairs in which the banker was expressing “caring” and the customer was “upset”, the banker was smiling while the customer was satisfied or interested as part of the “Empathetic” group. With regard to the “Banker: caring – Customer: upset” pair, “Banker: Smile – Customer: Satisfied” pair, and “Banker: Smile – Customer: Interested” pair, if the percent of one of these pairs is more than 0%; then the data was classified as part of the “Empathetic” category. These criteria were chosen by looking at the quantitatively measured percentage of each synchrony pair and comparing this measurement among the data set. As we can see from Figure 6-6, there is a distinct boundary at 10% in “Banker: smile – Customer: smile” synchrony, which means the data with 10% or more shared smiles have a relatively large percentage of shared smiles compared to other data in this data set. If there were fewer than 10% of shared smiles throughout the interaction and more than 40% of the time the banker smiled, then the data were classified into the “Always Smiling” group. There are more rules to classify the data into three groups: neutral, always smiling and empathetic. These rules are explained in Figure 6-3 below.
Figures 6-4 to 6-6 plot the distribution of each synchrony. In these figures, the x-axis corresponds to the 361 facial expressions synchrony IDs listed in Appendix A and the y-axis indicates the percentage of each synchrony in each interaction. Therefore, Figure 6-5 shows the distribution of 361 facial expressions synchrony IDs of the forty-six pairs of interactions of Banker 2. The decision boundaries in the classification rules above (Figure 6-3) were chosen by hand based on the distribution of these facial expressions synchronies. We can see a lot of data at the range from Synchrony ID 1 to Synchrony ID 50 and at the range from Synchrony ID 100 to Synchrony ID 150 in Figure 6-4. To observe this region in detail, the range from Synchrony ID 1 to Synchrony ID 19 is plotted in Figure 6-5. Synchrony ID 1 is the smile pair i.e., Banker: Smile – Customer: Smile and it is less than 40% in general. Therefore, we scaled down the y-axis to take a look at the data closely, which is redrawn in Figure 6-6. The red line in Figure 6-6 indicates there is a gap between the data.
above the red line and the data below the red line, which means the red line could possibly be a
boundary to divide the data into two groups. That is how the first classification rule is taken in Figure
6-3. There is another red line on Synchrony ID 12 (Banker: Smile – Customer: Interested) in Figure
6-3. This synchrony is chosen to classify the data into the empathetic group if the data does not meet
the criteria to belong to the always smiling group, which has more than 40% of banker’s smiles
without customer’s shared smiles. Synchrony ID 12 can also be the banker’s one-sided smile but it is
different from others in such that this synchrony is a positive one whereas others such as Synchrony
ID 2 (Banker: Smile – Customer: Concerned), Synchrony ID 4 (Banker: Smile – Customer: Confused) or Synchrony ID 5 (Banker: Smile – Customer: Upset) can be considered as a negative
pair and a lack of empathy. There is one more positive pair which is the not shared smile pair and it
is Synchrony 9 (Banker: smile - Customer - satisfied). However, as is shown in Figure 6-6, this pair
was not found among the dyadic data so that criterion was not chosen to select the empathetic group.
There were rarely found data between Synchrony ID 20 (Banker: concerned - Customer: smile) and
Synchrony ID 38 (Banker: concerned - Customer: missing label) having only two points (Figure 6-7).
Figure 6-4. Distribution of Facial Expressions Synchrony IDs from ID 1 to ID 361

Figure 6-5. Distribution of Facial Expressions Synchrony IDs from ID 1 to ID 19 (Y-axis: from 0 to 1)
Figure 6-6. Distribution of Facial Expressions Synchrony IDs from ID 1 to ID 19 (Y-axis: from 0 to 0.2)

Figure 6-7. Distribution of Facial Expressions Synchrony IDs from ID 20 to ID 38
Figure 6-8. Distribution of Facial Expressions Synchrony IDs from ID 39 to ID 57

Figure 6-9. Distribution of Facial Expressions Synchrony IDs from ID 97 to ID 115
Figure 6-10. Distribution of the Sum of Facial Expressions Synchrony IDs from ID 1 to ID 19

Figure 6-11. Distribution of the Sum of Facial Expressions Synchrony IDs from ID 115 to ID 133
Synchrony ID 43 (Banker : Caring – Customer : Upset) was also chosen to place the data into the empathetic category as it is a complementary facial expression pair. The boundary value of this synchrony is marked as 0% in Figure 6-3. There were seldom data between facial expressions synchrony ID 96 and ID 115 (Figure 6-4). The x-axes in Figure 6-5 and Figure 6-6 have different meanings from the ones in Figures 5-1, 5-2, 5-3, 5-4 and 6-3. Figure 6-5 plots the sum of banker-only smiles without the customer returning a smile. The x-axis in Figure 6-5 means the synchrony ID takes up the most portion of the sum. For example, if the sum is 0.44 and Synchrony ID 7 takes up 0.38 and the sum of other Synchrony IDs between Synchrony ID 2 and Synchrony ID 19 accounts for the remaining 0.06%, then Synchrony ID 7 is the x-coordinate of the data and their sum 0.44 is the y-coordinate of the data. The x-axis and y-axis in Figure 6-6 also have the same concept except that neutral facial expressions are counted in this case. When we classified the data into neutral, always smiling and empathetic groups following the classification rules in Figure 6-3, the number of data in each group was quite evenly distributed, assigning fifteen to neutral, sixteen to empathetic and fifteen to the always smiling group. Figure 6-12 shows the customer satisfaction analysis results when the data was classified along with these affectively observed rules. The major difference between Analysis 1 and Analysis 3 is that the Empathy Score is the highest in “Empathetic” group in Analysis 3 i.e., affectively measured classification, whereas the Empathy Score is the highest in “Always Smiling” group in Analysis 1 i.e., cognitively reported classification. In addition, in terms of interaction satisfaction, the mean of the ratings of “Always Smiling” was close to the mean of the “Empathetic” group in Analysis 1 yet, the mean of the ratings of “Always Smiling” was close to the mean of the “Neutral” group in Analysis 3. Meanwhile, the “Empathetic” group scored highest in “Information Satisfaction” in both analyses. However, in Analysis 3 the significance is not enough to make strong differences between the three groups, which have p-values larger than 0.05 in ANOVA. As is the result in this section, since there is a difference between the cognitively reported way to investigate customer satisfaction and the affectively observed way, we need to analyze the customer
satisfaction data with both methods. Moreover, there might be more than one way to classify the data according to the affectively measured method depending on how we describe the criteria. For example, Synchrony ID 42 (Banker: Caring – Customer: Confused) could have been another criterion to classify the data into empathetic group. Therefore more ways to select those criteria need to be explored.

![Figure 6-12. Interaction Satisfaction, Information Satisfaction and Empathy Score](image)

### 6.5 Summary

From the result in Analysis 1, we could confirm hypothesis 1 that claims the customer satisfaction is the best when the customer think the service provider is empathetic. This is a typical and traditional way to investigate customer satisfaction. We suggested two more ways to analyze customer satisfaction and these are to classify the data according to what the service provider tried to convey and what actually happened in their nonverbal communication. When the data were classified according to the banker’s manipulation the customer satisfaction scored highest in the “Always Smiling” manipulation in Analysis 2 and when the data were classified according to their detected
facial expressions in Analysis 3 the customer satisfaction was the highest in the empathetic group, while in the other two groups i.e., Neutral and Always Smiling groups, the ratings were similar. This result agrees with the result mentioned in Chapter 4 that people’s intent and perception is subjective. Therefore, these three methods are valuable, and should be further investigated and kept individually to complement each other.
Chapter 7

Dyadic Communication Data Analyses

7.1 Hypotheses

H3. The banker and the customer share smiles for a longer period of time when the customer perceives the banker is empathetic.

H4. The banker and the customer share smiles more often when the customer perceives the banker is empathetic.

As we classified the data into neutral, always smiling and empathetic category according to three different criteria i.e., cognitively reported customer perception, banker manipulation and affectively measured facial expressions synchrony in chapter six, we analyze the dyadic communication with the same way in the following section 7.2, 7.3 and 7.4.
7.2 Analysis 1. Cognitively Reported Customer Perception

We collected forty-six sets of interaction data and in each pair the customer appraised whether the banker’s attitude was neutral, always smiling or empathetic. This section examines when the data are grouped into these three categories based on using the customer’s perceptions of the banker. Figure 7-1 illustrates the ten kinds of facial expression synchrony between the banker and the customer that took up the longest duration among 361 synchrony pairs in each group. The x-axis indicates the synchrony ID and the y-axis indicates the fraction of the synchronized facial expressions. The fraction of each synchrony is computed across the participants in each condition. In the perceived as "Neutral" condition, the "neutral-caring" pair (ID = 117) occurred most of the time, taking up 45.1% of the entire interaction time on average. In the perceived as "Always Smiling" condition, we found more than 50% of one-sided smiles from the banker i.e., 30.8% of the pair "smile–neutral" (ID = 7), 12.6% of the pair "smile–other" (ID = 8), 11.9% of the pair "smile–concerned" (ID = 2) and 11.7% of the “smile-surprised” (ID = 10). In these banker-only smiles, the customer was showing neutral facial expressions rather than smiling, which may be inferred as the customer not enjoying the interaction. The most frequently occurring synchrony pairs are shown in Figure 7-2. The x-axis indicates the synchrony ID and the y-axis indicates the number of the synchronized facial expressions. In the perceived as "Neutral" group, the banker was expressing neutral facial expressions most of the time, regardless of the customer’s facial expressions. And "neutral-neutral" pair (ID = 121) was the most frequent pair. In “Empathetic”, the "neutral-neutral" pair (ID = 121) occurred 5.6 times on average, which was higher than the value of this pair in the “Neutral” group, which was 5. "Smile-smile" pair (ID = 1) was also much more frequent, scoring 6 compared to the other two groups (“Neutral” = 2.8, “Always Smiling” = 3.5). This result implies that the “Empathetic” group is more dynamic than the other two groups. Therefore, we can conclude that
when the customer perceived the banker as empathetic, they smiled together genuinely more often and for longer.
Figure 7-1. Ten Synchronized Facial Expressions that take up the largest percentage in the entire interaction in each group
Figure 7-2. Ten most frequent synchronized facial expressions in each group
7.3 Analysis 2. Banker Manipulation

This section examines when the data are grouped into these three conditions based on using the banker’s manipulation and what he was trying to convey.

Figure 7-3 illustrates the ten kinds of facial expression synchrony between the banker and the customer that took up the longest duration among 361 synchrony pairs in each group. The x-axis indicates the synchrony ID and the y-axis indicates the fraction of the synchronized facial expressions. The fraction of each synchrony is computed across the participants in each condition. In the "Neutral" condition, all of the ten longest synchronies were paired with the banker’s neutral facial expressions. The pair "smile–smile" (ID = 1) happened longer in the "Always Smiling" condition taking up 16.8% than in “Empathetic” condition, 8.2%. The shared smile pair of “Always Smiling” condition was observed nearly twice as long as that of “Empathetic” condition. This result can be accounted for with the facts found in chapter four that explain the difference between what the banker was trying to do and what the customer was responding with and thinking. In the “Always Smiling” group, there are more than 50% “smile-neutral” pairs along with other banker-only smile pairs such as “smile-other”(ID=8), “smile-concerned”(ID=2), “smile-confused”(ID=4), and “smile-upset”(ID=5). In Figure 7-4, “Empathetic” group shows more diversity in banker’s facial expressions including neutral, smile and sorry. The other two groups do not have “sorry” in banker’s facial expressions, which implies the banker is trying to respond to customer’s concerns. Moreover, the values of the pairs “neutral-neutral”(ID=121), “smile-neutral”(ID=7) and “smile-smile”(ID=1) seem to be similar between groups; the pair “neutral-neutral”(ID=121) in the “Empathetic” group is 5.2 and in the “Neutral” group is 4.9; the pair “smile-neutral”(ID=7) is 5.4 in the “Always Smiling” group and 4.9 in the “Empathetic” group; the pair “smile-neutral”(ID=1) is 4.7 in the “Always Smiling” group and 4.5 in the “Empathetic” group.
Figure 7-3. Ten Synchronized Facial Expressions that take up the largest percentage of the entire interaction in each group
Figure 7-4. Ten most frequent synchronized facial expressions in each group
7.4 Analysis 3. Affectively Measured Synchronized Facial Expressions

This section examines when the data are grouped into these three conditions based on what was really observed in their dyadic communication through facial expressions. The classification rules are described in section 6.4.

Figure 7-5 illustrates the ten kinds of facial expression synchrony between the banker and the customer that took up the longest duration among 361 synchrony pairs in each group. The x-axis indicates the synchrony ID and the y-axis indicates the fraction of the synchronized facial expressions. The fraction of each synchrony is computed across the participants in each condition. In the "Neutral" condition, except for the "smile-surprised" pair (ID = 10), most of the pairs are banker’s neutral facial expressions. In the “Empathetic” group, the smile pair (ID =1) at 20.2% appeared the longest compared to the other two groups; there is no shared smile in “the Neutral” group or in the “Always Smiling” group. In the “Always Smiling” group there is more than 50% of banker-only smiles, combining 29.0% of “smile-neutral”(ID=7) and 14.0% of “smile-other”(ID=8). This value is smaller than the total of banker-only smiles in the “Empathetic” group, adding up 27.5% of “smile-neutral”(ID=7), 18.8% of “smile-other”(ID=8), 13.9% of “smile-surprised”(ID=10), 12.6% of “smile-concerned”(ID=2) and 8.5% of “smile-confused”(ID=4), yet there is no shared smile that appears among the ten longest pairs in “Always Smiling”. The pair “smile-smile”(ID = 1) is most frequent in the “Empathetic” group compared to other two groups (Figure 7-6).
Figure 7-5. Ten Synchronized Facial Expressions that take up largest percentage in the entire interaction in each group
Figure 7-6. Ten most frequent synchronized facial expressions in each group

Neutral (N=15)

Always Smile (N=15)

Empathetic (N=16)
7.5 Summary

We measured the percent of each facial expression synchrony pair as well as the number of each facial expression synchrony pair. Both measures of the smile-smile pair appeared highest when the customer perceived the banker was empathetic, which confirms the hypotheses three and four. Note that the shared smile pairs were more distinctively found when the data were classified according to what actually happened in the interaction compared to the analyses done by customer perception and banker manipulation. In the next chapter, chapter eight, we suggest a more novel way to understand smiles by their context and intent and classify them into four kinds of smiles.
Chapter 8

Specific Classification and Analysis of Smiles

8.1 Smiles with Context

As is explained in section 5.1, the data gathered for each participant includes the time, facial expressions and a short comment about the facial expressions. From these comments we can infer whether the person was smiling just for greeting, laughing at a joke, satisfied with the information or trying to be polite. Therefore we classified the smile labeling into three groups; social, genuine, and greeting smile. Here are some examples of the comments that can be classified into these three kinds of smile (Figure 6-4). Interestingly, there are positive reasons for genuine smiles but also negative
reasons for genuine smiles such that the customer smiled when he disagreed with the banker, probably politely, or when he encountered an unexpected situation where did not get the full amount of compensation for the study, probably to make the banker feel it is okay.

8.2 Validation of Social, Genuine and Greeting Smiles

Three undergraduate students labeled three kinds of smiles as explained in section 8.1. Three of them sat down together until they were trained to get agreement between these three kinds of examples and
then they were separated and labeled the smiles of the full set of data. There are forty-six interactions and four labeled files for each interaction. There are 46*4 = 184 labeled files in total and 60 of them did not have any smiles labeled in them. Therefore there were 124 smile labeled files and three coders labeled these files with social, genuine and greeting smiles. Figure 8-2 shows the inter-coder agreement using Cohen’s Kappa coefficient. Cohen’s Kappa coefficient is a commonly used measure in social science analysis to take into account the effect that human coders can show agreement by chance when there are two coders (Cohen, 1960; Fleiss, 1971; Galton, 1892; Gwet, 2001; Landis, 1977). From this result, 67 files among 124 smile labeling files got 0.81~1.00 of Cohen’s Kappa coefficient, which means the three coders labeling was pretty much in agreement.

![Figure 8-2. Cohen’s Kappa Coefficient among three coders](image-url)
Chapter 9

Conclusions and Future Work

9.1 Summary

“Service with a smile” (Pugh, 2001 & Grandey, 2005) is a common motto in the service provider industries. It is assumed that a smiling employee is the best representative for customer interaction. We examined the effects that a service provider’s facial expression manipulation during customer interaction had on customer satisfaction. We measured interaction satisfaction, information satisfaction, and the perceived empathetic attitude of the service provider, to estimate customer satisfaction. The results show that customer satisfaction was not significantly affected by the banker’s intent to portray a particular quality of interaction. Rather, customer satisfaction was
dependent on how the customer perceived the service provider’s attitude. When the customer perceived the service provider as empathetic, customer satisfaction was greater than the cases in which the customer thought the service provider was neutral or always smiling. We looked more specifically at the data when the customer felt the service provider was empathetic, and measured that they shared smiles together more often and for a longer time. In contrast to the common notion of “Service with a Smile”, the “Always Smiling” attitude of the service provider was not effective in making the service provider or experience more enjoyable. Based on measuring smiles, the important aspect of smiles in service appears to be when conditions are such that both the service provider and the customer smile, together, and genuinely. This principle also applies to other complementary facial expressions.

9.2 Suggested Future Work

Dyadic analysis of forty-six face-to-face customer service encounters reveals that affective social signals through facial expressions have a significant influence on how customers perceive the service. We obtained this result using the facial expression labels provided by the experimental participants. However, the labeling depends on the labeler’s perspective. To improve the reliability of the data labeling, we could compare the three different labelings done by the participants themselves, their interaction partners and four independent outside coders. In addition, we classified the smiles into three kinds of smiles; specifically it becomes four kinds when the genuine smile is divided into positive and negative ones, in chapter eight and we suggest to analyze customer satisfaction and dyadic communication with these labeled data.

The current state of computer vision technology suggests that computers can be trained to recognize a number of human facial expressions automatically (el Kaliouby, 2005 & Zaman, 2006).
We visualized the dyadic pattern of facial expressions between a service provider and a customer by assigning each facial expression to a specific color. A future application might provide real-time feedback (e.g., Kim et al., 2008) about affective information during a service interaction. With regard to data analysis, other measures such as the duration of each facial expression and the number of transitions of between expressions, may be useful. In addition, for more complete understanding, voice analysis can be combined with facial analysis to explain such topics as why a customer perceives a service provider was smiling even when the service provider intended to be neutral.

While sharing genuine smiles appears to be very important to interaction, the way to best achieve this sharing is more challenging than simply asking the banker to act empathetically.
Appendix A: 361 Banker and Customer

Facial Expressions Synchrony IDs

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Bibliography


