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The Facial Feedback Hypothesis: Does it Apply to People with Schizophrenia?

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THE FACIAL FEEDBACK HYPOTHESIS:

DOES IT APPLY TO PEOPLE WITH SCHIZOPHRENIA?

by

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Abstract

The Facial Feedback Hypothesis (FFH) states that emotions are induced or enhanced by one's own facial expression. Lack of accurate empathy, deficits in the ability to read facial expressions, and anhedonia are all symptoms found in schizophrenia. These symptoms have a dramatic impact on schizophrenia patients; the levels of those symptoms often determining functional outcome. Few studies exist on facial feedback in schizophrenia and those that do are conflicting in their views as to whether or not FFH applies to people with schizophrenia. This study measured level of positive affect and how it is affected by facial expression. Controls assigned to the smile condition demonstrated a trend toward higher immediate positive affect than did controls who did not smile. However, there was no trend toward happiness for the schizophrenia group assigned to the smile condition. This study also found that time spent smiling does not appear to be correlated higher or more intense positive affect for any group. Future research directions are discussed.

Introduction

The facial feedback hypothesis (FFH) is the idea that, in addition to being affected *by* emotion, facial expressions actually affect emotion (Hess & Thibault, 2009). For instance, smiling has the power to make the person happy, whether they felt happy in the first place or not. While the veracity of FFH in the general population has been called into question for a lack of supporting evidence (e.g., Buck, 1980), several more recent studies testing the idea of facial feedback support it (e.g., Alam, 2008; Dimberg, 2000; Dimberg and Soderkvist, 2011; Strack, Martin, & Stepper, 1988).

FFH has been shown to enhance emotional empathy (Dimberg, Andréasson, & Thunberg, 2011). People have a tendency to mimic the facial expressions of people they observe, even if their mimicry is very subtle. That facial expression then induces the corresponding emotion in the observer, who is able to more accurately empathize with the target person (See Figure 1). For example, person X looks happy and person Y observes his smiling facial expression. Mirror neurons in the brain of person Y reflect that expression, and he too smiles, even if the facial movement is very slight – too slight to notice. Person Y then experiences a happy feeling and can better understand the feelings of Person X.

One of the symptoms of schizophrenia is a deficit in accurate empathy (Derntl et. al., 2009; Penn, Sanna, & Roberts, 2008). At what point in the process of empathy does

that deficit occur? It is possible that people with schizophrenia do not experience facial feedback the way that controls do.

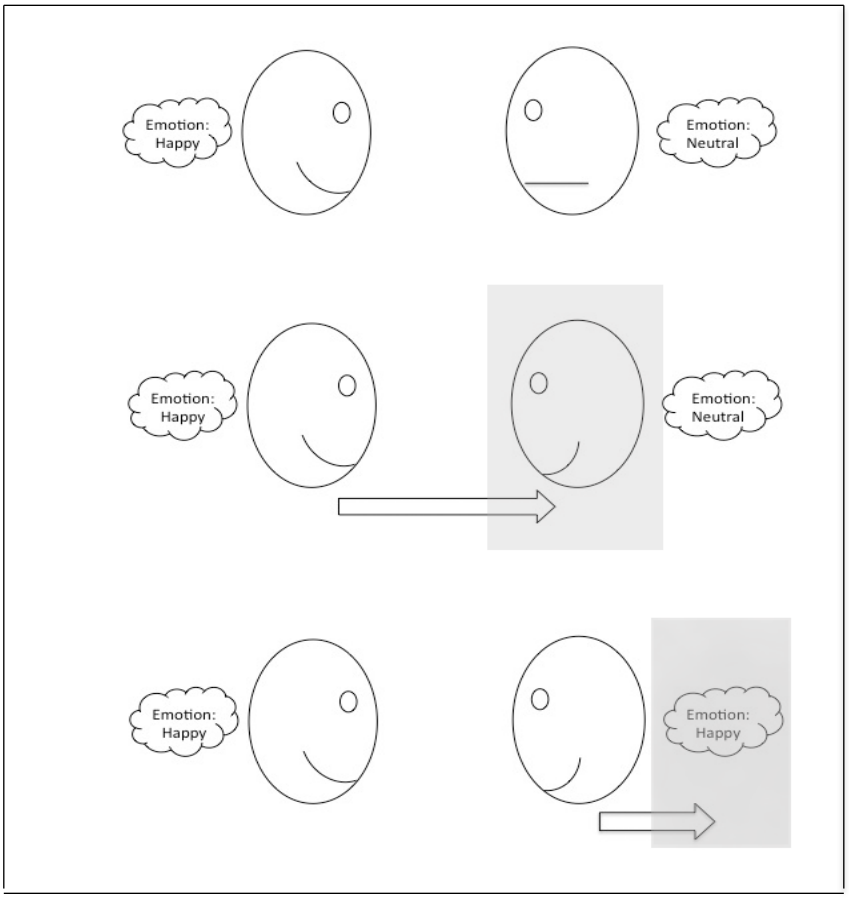

Figure 1. Empathy enhanced by facial feedback. A) Mirror neurons reflect the facial expressions of others. B) That facial expression then induces the corresponding emotion in the observer, who is then able to more accurately empathize with the target person.

People with schizophrenia have several negative symptoms besides a deficit in empathic ability. The negative symptoms of schizophrenia are not alleviated by current medications (Kring & Earnst, 1999) and include anhedonia (the inability to experience pleasure), deficits in facial affect recognition, and deficits in showing facial affect. Anhedonia consists of a lack of both consummatory, or in-the-moment pleasure, as well as anticipatory, or future-oriented pleasure. However, studies have repeatedly shown that

people with schizophrenia do experience consummatory pleasure (Gard, Kring, Gard, Horan, & Green, 2007). They report intensity of consummatory pleasure at the same or greater intensity than non-clinical controls. In other words, people with schizophrenia are feeling the same level of pleasure in-the-moment as anyone without schizophrenia, but they still aren't showing pleasure in their facial expressions. This suggests a disconnect between movement and emotion in the schizophrenia population.

Several studies have proposed that negative symptoms are directly tied to functional outcome in people with schizophrenia (e.g. Statucka & Walder, 2013). The inability to effectively read faces or make facial expressions inhibits interpersonal communication and often leads to a lack of social relationships. Many people with schizophrenia are unable to keep a job due to interpersonal problems. The lack of anticipatory pleasure in anhedonia means that people with schizophrenia are unable to associate a future event with a pleasurable feeling, which leads to lack of motivation, and even lower functional outcome.

There are some relatively successful social cognition remediation programs currently being used to improve negative symptoms of schizophrenia, two of which use tactics based on FFH, and their success suggests that FFH does apply to people with schizophrenia. The social cognition and interaction training (SCIT) and the social cognitive skills training (SCST) programs both utilize mimicry of a facial expression that the patient sees on a screen (e.g. Statucka & Walder, 2013). This tactic is based on FFH (e.g. Penn & Combs, 2000). The hypothesis is that mimicking the facial expression the person sees will evoke the corresponding emotion within them and they will be better able to identify the emotion that is depicted in the picture. Both of these programs have

shown promising results in improving social cognition in schizophrenia (Statucka & Walder, 2013). However, there are some limitations to the tactic of mimicry. For instance, people with schizophrenia are less accurate at imitating faces than are controls (Schwartz, Mastropaolo, Rosse, Mathis, & Deutsch, 2006). In other words, the face they make may not match the one they are supposed to mimic. Also, several steps are involved in creating emotions through mimicry. Focusing on the two-dimensional face, recognizing the manipulations that have created such an expression, and changing his or her own expression all need to occur before FFH applies. FFH is merely the interaction between the facial affect and emotion. Mimicry provides extra room for error.

However, there is divided evidence on whether FFH can be applied to people with schizophrenia at all. Besides SCIT and SCST trials, few studies have directly tested FFH in people with schizophrenia. Those that do exist offer conflicting conclusions. Penn and Combs (2000) even mention the need for further research in this area.

The strongest evidence available that supports the veracity of FFH in schizophrenia is the strong correlation between mimicry and emotion recognition. Despite the aforementioned complication added to FFH by mimicry, one study concludes that imitation is a reliable way to improve emotion recognition in people with schizophrenia (Mazza et. al., 2010). Other studies show that inhibition of expression in non-clinical subjects also decreases emotion. That is, a frown may induce a sad feeling, but inhibition of the ability to frown reduces the sad feeling (Davis, Senghas, & Ochsner, 2009; Alam, 2008). This can be applied to people with schizophrenia because they show less-intense facial expression than non-clinical subjects. The reduced expressiveness of people with schizophrenia may explain any discrepancy between faces they view and

emotions they feel. However, only a small change in facial expression is needed to affect emotion in controls. That means that people with schizophrenia would have to make no facial expression changes at all for this principle to apply.

Other studies oppose the veracity of FFH in schizophrenia. The strongest utilized fMRI and demonstrated that empathic accuracy uses different parts of the brain in people with schizophrenia than it does in controls (Harvey, Zaki, Lee, Ochsner, & Green, 2013). However, this is the only study of its kind, contained only 30 participants, and studied empathy - a related but higher-level function than facial feedback. Another study found amygdala abnormalities in people with schizophrenia (Aleman & Kahn, 2007). The amygdala is thought to be involved in facial feedback in controls. While this points to a deficit in a key part of the brain, the amygdala is responsible for many functions in the brain and it cannot be concluded that the abnormalities found in this study are directly related to facial feedback.

It is clear that facial feedback can significantly impact functional outcome in people with schizophrenia. The implications of FFH in empathy are particularly important to the improvement of social cognition in this population. Knowing whether or not FFH applies to people with schizophrenia may lead to improvement in the efficiency of social cognitive remediation programs, which may dramatically improve the functional outcome of people with schizophrenia. Here, we aim to test FFH in people with schizophrenia.

This study was modeled after the Strack (1988) study about facial feedback hypothesis in a non-clinical sample. Rather than simply comparing emotion between different types of facial expressions, this study seeks to also compare the effects of one

facial expression over two different groups: those with, and those without a diagnosis of schizophrenia or schizoaffective disorder. The deficit in showing facial expressions, despite reporting the same intensity of in-the-moment emotions as non-clinical controls, leads us to believe that there may be an underlying neurological problem that weakens the link between facial expression and emotion. Such a deficit may result in a loss of efficiency in getting signals from neurons to the facial muscles, but also from the facial muscles to neurons. Additionally, we believe that emotional intensity will increase as time spent with a certain facial expression increases. This is based on the observation that there exists a continuum of happiness for each person in non-clinical populations; that people do not instantly increase happiness from the minimum to the maximum level. We reason that the more stimulation someone is exposed to, the higher the level of the corresponding emotion. To the best of our knowledge, no research exists on the time necessary to induce FFH and whether or not longer exposure corresponds to more intense emotion.

It is hypothesized that:

1) Control participants who experience the smile condition will report a significantly higher "funniness rating" of the videos than will any other group. No difference is expected for schizophrenia participants regardless of condition. This is an interaction effect for controls by condition (teeth) where the independent variables are group and condition and the dependent variable is funniness rating.

2) Participants in the non-clinical, smile condition will rate the last video as being significantly 'funnier' than the first video. This will

demonstrate that the more time controls demonstrate a certain facial expression, the stronger the corresponding emotion becomes. (Positive correlation between time and emotion) People with a diagnosis of schizophrenia will rate the first and last videos in each condition as being equally funny, as facial expression will not affect emotion (i.e. no correlation between time and emotion). The independent variables will be group and condition, while the dependent variable is difference between first and fourth video funniness rating.

Methods

Participants and Recruitment

Experimental participants were outpatients at the Andrew's Center for Behavioral Health with a diagnosis of schizophrenia or schizoaffective disorder (n=19). They were each in a stable condition, each being treated by a psychiatrist, and their diagnoses were confirmed through chart review. The experimental group was recruited via flyers and case management staff at the Andrews Center. They were each given a $10 gift card from Walmart for participation. Control participants were recruited from math courses at the University of Texas at Tyler in exchange for extra credit in said courses. Recruitment of the experimental group was done via flyers and case management staff at the Andrews Center for Behavioral Health in Tyler, Texas. They were each given a $10 gift card from Walmart for participation. The study was run at the University of Texas at Tyler for controls and at the Andrews Center for the experimental group. Ethics committees at both locations approved this study and participation was completely voluntary. Demographic and diagnostic information is listed in Table 1.

Table 1

Demographic and clinical data

Measure	Control group Smile condition	Control group Neutral condition	Experimental group Smile condition	Experimental group Neutral condition
Number of participants (*n*)	13	12	10	10
Age				
Mean	23.62	26.75	42.8	37
SD	(5.32)	(10.8)	(18.49)	(9.13)
Gender (*n*)				
Male	5	4	4	3
Female	8	8	6	7
Psychiatric diagnosis (*n*)				
Schizophrenia	0	0	6	3
Schizoaffective disorder	0	0	4	7

Measures

Demographic Questionnaire

This questionnaire is a self-report and asked participants to list their age, gender, race, highest level of education, any history of psychiatric illness, and whether or not they are employed. Psychiatric diagnosis, age at the time of diagnosis, number of times hospitalized for that condition and medications being taken were also included in the experimental group questionnaire.

Oxford Happiness Questionnaire (OHQ)

This 29-item self-report questionnaire is a shorter version of the well-known Oxford Happiness Inventory (OHI), and is used to determine overall life satisfaction. The average score of the 29 questions was calculated for each participant. This questionnaire is reported to have high construct validity (Hills and Argyle, 2002). However, interpretation between subjects is somewhat difficult, as there is no standard

score information published. Rather, this information is used to compare happiness between participants.

Motivation and Pleasure Scale – Self Report (MAP-SR)

The MAP-SR is a 15-question survey designed to explore the motivation and pleasure domains of negative symptoms. The MAP-SR seeks to determine severity of negative symptoms common to schizophrenia and is reported to have high validity and reliability (Llerena et. al., 2013).

Questionnaire Regarding Beliefs About Physical Disabilities

This self-report, created by the principal investigator, was used only to increase face validity of the study. It consisted of seven True/False questions about the participant's feelings toward people with physical disabilities.

Positive and Negative Affect Scale (PANAS)

This questionnaire consists of a list of 27 emotions and a Likert rating scale consisting of numbers from 1 (very slightly or not at all) to 6 (extremely). Participants were instructed to rate how strongly they feel each of those emotions at the moment that they are filling out the questionnaire. In order to measure change in affect due to the experimental section of this study, the PANAS was given to participants directly before and directly after they participated in the pen-holding activity.

Self-Assessment Manikin (SAM)

This measure consists of pictorial representations of people feeling nine levels of pleasure and nine levels of arousal. It has received good validity scores and was used as an extra measure of change in feelings immediately after rating each video.

Procedure

This study was given to up to four participants at a time. There was an alcohol swab, a Pentel Rolling Writer pen, and a clipboard with several sheets of paper on it at each desk. A large, cardboard privacy board was set up between participants to decrease influence by, or self-conscious about, the presence of the other participants.

Step 1

It is important that the participant be unaware of the true purpose of the study, as bringing the participant's attention to their own facial expression may influence feelings they report. For that reason, the following explanation was given to participants at the beginning of the study:

The study you are participating in has to do with coordination and movement. We are interested in people's ability to perform tasks with parts of their body that they would normally not use for such tasks. You may have seen pictures of physically impaired people who use their mouth to write or use the telephone. Obviously, the ability to do the same task with different parts of their body has important implications for these people. For them, the quality of their future life is greatly dependent on whether they can continue to exercise control over their environment by being able to perform basic tasks by themselves. This is confounded if they have other conditions to contend with already. The tasks we would like you to perform are actually part of a pilot study for a more complicated experiment we are planning to do next semester to better understand this substitution process. The tasks we plan to test involve a variety of everyday functions like reading a book or operating a computer.

Step 2

Participants were asked to fill out the demographic questionnaire, the OHQ, MAP-SR, the questionnaire about people with physical disabilities, and the PANAS. All participants were asked whether or not they understood the directions and any confusion was then clarified.

Step 3.1

Participants were asked to disinfect the provided pen with the alcohol swab. They were then asked to hold the pen in their mouth in a manner demonstrated by the researcher. The two possible pen positions were described as follows: (1) Across the teeth, so that the ends of the pen point towards the left and right of the participant. Participants were asked not let the pen touch their lips. This position is designed to make the participant smile contract his or her zygomaticus major and risorius muscles, which are involved in smiling. We later refer to this as the 'smile' condition. (2) With the writing end protruding straight out from the mouth, with the lips closed around it. This position was designed to inhibit contraction of the zygomaticus major and risorius muscles, so that the participant was unable to smile. We later refer to this as the 'neutral' position. Half of the participants from the control group and half of the participants from the experimental group were randomly selected to hold the pen in the smile position, while the other half will hold the pen in the neutral position. However, in order to limit confusion, participants taking part in the study at the same time were assigned to the same pen condition. The researcher checked to make sure participants were holding the pen in the correct position each time they were instructed to do so.

Step 3.2

The participants were then asked to connect five dots on a graph while holding the pen in the designated position. While continuing to hold the pen in the designated position, participants were be asked to rate the difficulty of the dot-connecting task on a Likert scale (0-9). They did this by writing the standard Arabic numeral that corresponded to their chosen rating in an 'answer box' on a provided answer sheet. This step is designed to increase face-validity of the test, but was also used to gauge difficulty or other negative feelings that the participant associated with the task. The participants were then asked to circle the picture that best described their current pleasure and arousal feelings (SAM scale). The SAM scale was given at this point in order to be sure that participants understood the directions of the task before actually rating the videos as well as to gauge feelings after completing the connect-the-dots task.

Step 3.3

Next, participants watched one of four "vine" videos (V1) that each lasted between six and 13 seconds. After the video, participants were asked to rate the video's "funniness", on a scale of 0-9, in the answer box labeled 'video 1' with the pen in the previously designated position (smile condition or neutral condition). They were then asked to circle the picture that best described their feelings of pleasure or arousal, as done for the practice task (SAM scale). The researcher looked to ensure that each participant was holding and writing with the pen in the correct position.

Steps 3.4, 3.5, and 3.6

Videos 2, 3, and 4 were then shown to participants, giving time between each video for participants to rate the funniness of the video and circle the SAM pictures that corresponded to their feelings, always using the provided pen in the designated position. Each participant was shown the same four videos, but the order in which the videos were shown was randomly selected for that administration of the study. However, everyone participating in the study at the same time (up to 4 participants) viewed the videos in the same order. The four selected videos depict animals with human characteristics and are humorous in nature. These videos were selected because they are comparable to the ones used in Strack's (1988) study. The four videos were deemed to be similar in humor quality, as each one received at least 12 online 'likes' for each one 'dislike'. Participants were not required to hold the pen in their mouths between times they needed to use it to write. However, there was only a short period of time that the participants could take the pen out of their mouths once the video task began, as each video only lasted several seconds.

Step 4

After participants rated and completed the SAM for Video 4, they were asked to complete another copy of the PANAS, corresponding to their feelings at that moment. Participants were allowed to use their hands to fill out this survey.

Results

Hypothesis 1

In order to test hypothesis 1, a two-by-two analysis of variance (ANOVA) was used to determine if the funniness ratings given by the control participants under the smile condition (CS) were significantly higher than that of any of the other three groups (i.e. Control participants, neutral condition (CN), experimental participants, smile condition (ES), experimental participants, neutral condition (EN)). Results indicated a trend toward that prediction. However, no significant difference in happiness was detected between the groups [$F(3,42)= 2.425$, $p= 0.079$].

As a follow up, the post-study PANAS was compared among the four groups. The positive measures on the PANAS scale were used because this study seeks to calculate increase or decrease in positive affect, but not increase or decrease in negative affect. There was no significant difference between groups on positive post-study PANAS scores [$F(3,42)= 0.9866$, $p= 0.3276$].

Hypothesis 2

In order to test hypothesis 2, an ANOVA was used to compare the four groups based on increase or decrease (slope) of funniness perceived by each person in relation to time. Results showed that there was not a significant difference between change in affect rating among the four groups [$F(3,43)= 0.644$, $p= 0.427$]. In order to further test this hypothesis, the mean change between positive pre-study and positive post-study PANAS

scores between groups was explored using an ANOVA. The positive measures on the PANAS scale were utilized because this study seeks to calculate increase or decrease in positive affect, but not increase or decrease in negative affect. Results to this test also showed that there was no significant difference between groups based on change in affect over time [$F(3,43)=3.784$, $p=0.058$].

It should be noted that none of the demographic questions and no data from the OHQ, MAP-SR, or the SAM appeared to have an effect on the outcome of this study. There was also no significant difference between groups on difficulty rating of the task.

Discussion

The primary purpose of this study was to determine whether or not the Facial Feedback Hypothesis applies to people with schizophrenia and whether it is feasible to rely on this principle when developing social cognitive remediation programs for this population. As hypothesized, this study did not demonstrate a significant difference between happiness ratings of the smile and neutral conditions in the schizophrenia group. However, such information must be considered in light of another factor: this study also showed that there was not a significant difference (but merely a trend) between the smile and neutral conditions in the control group. As this was something that was meant to replicate what previous studies have found, we must consider the possibility that this study was not effective in measuring the difference between smile and neutral conditions, no matter which population was involved. The second hypothesis was not supported by this study. The amount of time participants displayed a smiling facial expression did not appear to influence emotion.

One possible explanation for why this study merely showed a trend between smile and neutral facial expressions in the control group is that there were not enough participants. Subtle differences in affect may not have appeared to be significant in this size of a sample. We suggest that future studies of this nature use a larger sample for both the control and experimental (schizophrenia) groups. The reason that the post-study PANAS score did not differ among groups may have had to do with the fact that it was

the participants' last page in their answer packets. They knew that they were almost finished with their participation and could soon receive their compensation and leave. It is possible that this rushed participants and they did not think about the instructions to describe the way they felt in that very moment, but rather quickly chose answers that normally relate to them.

There are several possible explanations for the outcome demonstrated in hypothesis 2. Emotions induced or enhanced by facial expressions may merely last several seconds after the facial expression is demonstrated. This would mean that the effects of the smile expression may have dissipated by the time participants filled out the post-study PANAS. Another possible explanation is that the change in facial expression did not affect participants at all, thus the smile condition participants felt no happier at the end of the study than they did at the beginning. There is also a possibility that participants remembered which ratings they wrote down for each of the emotions on the pre-study PANAS and it was simply easier to rewrite those responses. In fact, it may have seemed more practical to participants to assume that their affect did not change between the first and second times that they filled out the PANAS. We suggest that future studies change the order and style of the second PANAS copy, so that they do not appear to be identical to the participant.

More research is needed to further clarify whether or not FFH applies to people with schizophrenia. The possibility of becoming better versed in the traits of people with schizophrenia, particularly when it comes to social factors, has the potential to greatly affect the social programs we have in place for that population. More well-defined knowledge of social traits in people with schizophrenia may also lead to better understanding of the neurological side of the disorder. Thus, we encourage future research in this area.

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