Stress Reactivity of Participants in Response to Same vs. Opposite Gender of Experimenters

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Abstract

Beginning in childhood, males and females tend to be more comfortable with individuals of their own gender. This effect tends to be more pronounced in males compared to females. Being in an uncomfortable situation can lead to a stress response in an individual, causing increased heart rate, blood pressure, and electrodermal skin conductance. In addition, males and females have been shown to have different responses to stress. The purpose of this study was to examine gender differences in stress response when the same or opposite gender was present. Participants were asked a series of questions designed to induce stress by either a same or opposite gender experimenter. Blood pressure, heart rate, and electrodermal skin conductance were measured before and during the questioning sessions. It was found that a same or opposite gender experimenter did not have an effect on the stress response of participants. Despite previous research indicating that individuals are more comfortable with members of the same sex, and that there are differences in stress response between genders, this study demonstrates that the gender of others does not affect stress response in individuals.

Introduction

Without consciously realizing it, the majority of people are the most comfortable with and choose to spend the most time with people of the same gender (DiDonato and Strough, 2013). Gender segregation, an unconscious bias towards members of the same gender, begins in childhood and peaks in early adolescence (Zimmer-Gembeck et al., 2010). Gender segregation is generally thought of as a term applied to children, but it has been shown that adults demonstrate similar patterns. DiDonato and Strough (2013) found that college students self-reported that they had more same-gender friends. However, this preference was less pronounced among women,
indicating that women tend to befriend more opposite-gender peers relative to men (DiDonato and Strough, 2013).

In addition to preferring association with same gender individuals, men and women respond to stress differently, especially during interpersonal interactions (Chaplin et al., 2008). Glynn et al. (1999) examined the difference in stress reactivity, measured via changes in blood pressure and heart rate, in men and women giving a short speech. This speech was given to a male or a female observer who was either supportive or non-supportive. Both male and female participants had a small increase in blood pressure, but not heart rate, when observed by a supportive woman (Glynn et al., 1999). An unsupportive female observer, however, as well as a supportive and unsupportive male observer, produced larger increases in blood pressure in the participants. Glynn et al. (1999) explained their findings through an expectancy effect, where individuals expect females to be more friendly and responsive, and when this expectation is violated, they become confused and stressed. Glynn et al. (1999) shows the effects that preconceived notions have on interacting with people of different genders, as well as how individuals’ stress reactions can differ based on another’s gender. Despite Glynn et al. (1999)’s investigation, few other studies have looked at how another's gender influences individual stress responses.

The current study aims to determine whether a stranger of the same or opposite sex evokes more physiological arousal in participants during a stressful social encounter. Specifically, the study seeks to understand whether the experimenter's sex (male versus female) will affect stress reactivity in both male and female participants. The chosen paradigm is a verbal question-answer session, where both a female and a male experimenter will each ask participants questions. This format is believed to be more representative of a normal social interaction, and
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will include both innocuous and uncomfortable questions (see Appendix 1). By incorporating uncomfortable questions into the survey, it is hoped that the discrepancy in individual's stress reactivity between experimenters will be augmented, as stress makes gender differences more salient (Glynn et al., 1999). Additionally, people have been shown to edit their answers to survey questions based on whom asked the question, which takes subconscious effort and is therefore detectable via physiological measures (Tourangeau et al., 2007). Control groups consisted of a male participant with two male experimenters or a female participant with two female experimenters. These groups control for switching experimenters during the experiment. Finally, a pilot study was used as a positive control to ensure that uncomfortable questions cause increased stress reactivity relative to innocuous questions.

Method

Participants

This study was conducted with students enrolled in the Spring 2016 Physiology 435 class at the University of Wisconsin-Madison, ages 20-23. A total of fifteen males and fifteen females were used for the experiment. Each group (female control trial, male control trial, female with a male experimenter first, female with a female experimenter first, male with a male experimenter first, and male with a female experimenter first) consisted of five participants each. For further clarification of the groups, see Table 1. The experiment was conducted in room 2340E and room 2340B of Medical Sciences Center. Prior to participation, subjects signed a consent form.
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<table>
<thead>
<tr>
<th>First Experimenter</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Experimental design regarding experimenter and participant sex.

Procedure

Physiological measurements (blood pressure, heart rate, and skin conductance) were obtained through BIOPAC software (MP36, #MP36E1204002758, BIOPAC systems, Inc., Goleta, CA, USA). Equipment included an OMRON Automatic Blood Pressure cuff (BP791IT, #20141004280LG, Omron Healthcare Company, Ltd., Lake Forest, IL, USA), a Nonin pulse oximeter (#9843, Nonin Medical, Inc., Plymouth, MN, USA), and BIOPAC electrodermal electrodes (MP36, #13013874, BIOPAC systems, Inc., Goleta, CA, USA).

After a brief introduction between the first experimenter and the subject, the subject was connected to the skin conductance machine, pulse oximeter, and blood pressure cuff. Recording of skin conductance was started, and after one minute the initial blood pressure and heart rate were documented. Reading of the skin conductance continued during the entire experiment. After questions 3, 6, 9, 12 and 14, both the time and current heart rate were recorded. A second blood pressure measure was documented after question 14.

The second experimenter replaced the first experimenter after question 14 (the halfway point of the verbal question-answer session). The experimenter recorded the blood pressure and heart rate readings again after one minute, prior to starting the second half of the survey. The second baseline blood pressure and heart rate readings were noted at the end of a one minute
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period. After questions 17, 20, 23, 26 and 28, both the time and current heart rate were recorded. Blood pressure was measured and documented again after question 28. See Figure 1 for a description of the experimental procedure.

![Figure 1. Experimental procedure.](image)

**Data Analysis**

The data was divided into four sections, which consist of the baseline of the first experimenter, the portion of time where the participant is answering questions in response to the first experimenter, the baseline of the second experimenter, and the portion of time where the participant is answering the questions from the second experimenter. The skin conductance and heart rate data were averaged across these intervals of time. Using two-sample t-tests with Bonferroni correction, the differences of means for skin conductance, blood pressure, and heart rate were calculated. Comparisons were made between female control participants and female
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experimental participants and between male control participants and male experimental participants.

Results

Results were analyzed with the help of a statistician (Alan Sayler) who used R to run statistical tests. There was no effect of order (male or female experimenter, first or second) on either baseline or experimental measurements. Additionally, there was no difference between control and experimental conditions for any of the three physiological measurements (blood pressure, heart rate, and electrodermal activity).

Blood Pressure

No significant results were found regarding mean arterial blood pressure, systolic, or diastolic blood pressures. Male and female participants (for each, control N = 5, experimental N = 10) failed to show any difference in their blood pressure regardless of being interviewed by either sex, $p > 0.05$. In addition, systolic versus diastolic blood pressures were compared. No differences were found in systolic and diastolic pressures between males and females. Male systolic data can be found in Figure 2, and male diastolic data can be found in Figure 3. Female systolic data can be found in Figure 4, and female diastolic data can be found in Figure 5.

Heart Rate

No significant results were found regarding heart rate. Male participants (control N = 5, experimental N = 10) did not show any difference in heart rate, regardless of if they were being questioned by a male or female experimenter, $p > 0.05$. Similarly, female participants (control N = 5, experimental N = 10) did not show any difference in heart rate, regardless of if they were being questioned by a male or a female experimenter, $p > 0.05$. Table 2 contains mean and standard deviation values for male participants. See Table 3 for mean and standard deviation...
values for female participants. A graph of the male participant data can be seen in Figure 6, while the female participant data can be seen in Figure 7.

*Electrodermal Activity*

There was no significant change in the electrodermal activity. Male participants (control N = 4, experimental N = 10) did not show statistically significant differences between the control and experimental groups, $p > 0.05$. Similarly, female participants (control N = 5, experimental N = 10) did not show differences between the control and experimental groups, $p > 0.05$. See Table 4, which contains mean and standard deviation values for males. Table 5 contains this same information for females. A graph of the male participant data can be seen in Figure 8, while female participant data can be seen in Figure 9.

<table>
<thead>
<tr>
<th>Male Participant Heart Rate</th>
<th>Baseline 1 Average Heart Rate (Standard Deviation)</th>
<th>Question Set 1 Average Heart Rate (Standard Deviation)</th>
<th>Baseline 2 Average Heart Rate (Standard Deviation)</th>
<th>Question Set 2 Average Heart Rate (Standard Deviation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (Two male interviewers)</td>
<td>66.6 (12.54)</td>
<td>76.52 (11.75)</td>
<td>70.2 (13.55)</td>
<td>75.88 (11.16)</td>
</tr>
<tr>
<td>Female Interviewer First</td>
<td>75.8 (12.54)</td>
<td>89.52 (16.04)</td>
<td>87.2 (18.58)</td>
<td>84.96 (17.93)</td>
</tr>
<tr>
<td>Female Interviewer Second</td>
<td>65.2 (6.38)</td>
<td>67.4 (7.85)</td>
<td>63.2 (5.12)</td>
<td>67.52 (7.02)</td>
</tr>
</tbody>
</table>

Table 2. Means and standard deviations for male participant heart rate measurements.
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<table>
<thead>
<tr>
<th>Female Participant Heart Rate</th>
<th>Baseline 1 Average Heart Rate (Standard Deviation)</th>
<th>Question Set 1 Average Heart Rate (Standard Deviation)</th>
<th>Baseline 2 Average Heart Rate (Standard Deviation)</th>
<th>Question Set 2 Average Heart Rate (Standard Deviation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (Two female interviewers)</td>
<td>77.4 (14.17)</td>
<td>85.32 (13.66)</td>
<td>73.4 (11.59)</td>
<td>82.16 (8.74)</td>
</tr>
<tr>
<td>Female Interviewer First</td>
<td>63.6 (6.43)</td>
<td>70.92 (7.06)</td>
<td>72.6 (8.88)</td>
<td>76.68 (10.48)</td>
</tr>
<tr>
<td>Female Interviewer Second</td>
<td>73.8 (9.86)</td>
<td>77.44 (9.51)</td>
<td>70.4 (7.64)</td>
<td>74.88 (8.25)</td>
</tr>
</tbody>
</table>

Table 3. Means and standard deviations for female participant heart rate measurements.

<table>
<thead>
<tr>
<th>Male Participant EDR</th>
<th>Baseline 1 Average EDR (Standard Deviation)</th>
<th>Question Set 1 Average EDR (Standard Deviation)</th>
<th>Baseline 2 Average EDR (Standard Deviation)</th>
<th>Question Set 2 Average EDR (Standard Deviation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>3.453256 (7.721765)</td>
<td>3.65005 (8.16176)</td>
<td>3.734591 (8.3508)</td>
<td>3.880618 (8.677325)</td>
</tr>
<tr>
<td>Male Interviewer First</td>
<td>3.879598 (8.675044)</td>
<td>4.259801 (9.525204)</td>
<td>5.530629 (12.36686)</td>
<td>5.937727 (13.27716)</td>
</tr>
<tr>
<td>Female Interviewer First</td>
<td>1.557719 (3.894297)</td>
<td>1.567898 (3.919745)</td>
<td>2.357248 (5.893119)</td>
<td>2.393059 (5.982648)</td>
</tr>
</tbody>
</table>

Table 4. Means and standard deviations for male participant electrodermal measurements.
Table 5. Means and standard deviations for female participant electrodermal measurements.

<table>
<thead>
<tr>
<th>Female Participant EDR</th>
<th>Baseline 1 Average EDR (Standard Deviation)</th>
<th>Question Set 1 Average EDR (Standard Deviation)</th>
<th>Baseline 2 Average EDR (Standard Deviation)</th>
<th>Question Set 2 Average EDR (Standard Deviation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (Two male interviewers)</td>
<td>2.081469325 (4.65)</td>
<td>2.953373996 (6.60)</td>
<td>3.024333083 (6.76)</td>
<td>3.13203594 (7.00)</td>
</tr>
<tr>
<td>Female Interviewer First</td>
<td>3.782196756 (8.46)</td>
<td>3.706261588 (8.29)</td>
<td>3.264028 (8.05)</td>
<td>4.121257716 (9.22)</td>
</tr>
<tr>
<td>Female Interviewer Second</td>
<td>4.881462539 (10.92)</td>
<td>5.598563634 (12.52)</td>
<td>4.925921653 (11.01)</td>
<td>5.068576998 (11.33)</td>
</tr>
</tbody>
</table>

Figure 2. Systolic blood pressure measurements for male participants.
Figure 3. Diastolic blood pressure measurements for male participants.

Figure 4. Systolic blood pressure measurements for female participants.
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**Figure 5.** Diastolic blood pressure measurements for female participants.

**Figure 6.** Heart rate measurements for male participants.
Figure 7. Heart rate measurements for female participants.

Figure 8. Electrodermal measurements for male participants.
**Figure 9.** Electrodermal measurements for female participants.

**Discussion**

The hypothesis that there would be differences in stress reactivity between male and female participants in response to a same- or opposite-gender experimenter was rejected. Overall, the three physiological parameters assessing stress reactivity - heart rate, blood pressure, and skin conductance - reflected no statistically significant differences for male and female participants when same- or opposite-gender experimenters verbally questioned them. This result does not concur with the initial hypothesis, and it may be due to the limitations in the experimental design.

There were several possible problems regarding subject recruitment. Due to limited time and resources available, the sample size may have been too small to draw meaningful and significant conclusions. Additionally, the subjects were drawn via a convenient sampling from
the Spring 2016 Physiology 435 class. As all participants were of similar age and life experience, they may respond to stressors in a more similar manner than the larger population, or may have not been adequately stressed by the experimental paradigm. This biased sample distribution composed of undergraduate college students could have led to skewed results, and the results may change as the diversity of the sample pool increases.

Additionally, there has been prior research indicating that in some instances, there is no difference in stress reactivity between genders. Billings and Moos (1981) found that while the gender-based differences in coping were statistically significant, the actual differences were very small. Their results indicate that while there can be differences in stress reactivity between genders, these differences may not have any actual physiological relevance. Furthermore, a review on gender differences in pain response (pain is a physiological stressor) has shown that while results are not entirely conclusive, the trend is that there are no differences in measured pain response between genders (Fillingim and Maixner, 1995). Similarly, Felston (1998) reported that the stress response and coping strategy does not differ between male and female college students. A standardized stress inventory was used to present a stressful situation to participants, and their scores on a Coping Strategy Indicator (CSI) were recorded. Felston (1998) concluded that there was no difference in CSI between genders, and similar patterns in coping, stress, and depression were observed for both males and females. Finally, Wang et al. (2007) found no gender differences in stress reactivity as measured by heart rate or salivary cortisol in response to a serial subtraction test. When taken together, these studies indicate that coping responses to a stressor appear to be similar in males and females. Additionally, gender differences in stress response, while existing, either may not have physiological relevance, or the difference may or may not exist depending on the particular stressor.
Another source of bias could have been introduced via body language cues of the interviewers. Studies have shown that interviewers give unconscious bodily cues during question-answer sessions due to the implicit biases and personal opinions of the interviewers (Meadors and Murray, 2014). In the current study, interviewers asked participants a range of questions, including some regarding social, religious, and political issues. Most people have strong opinions regarding religion and politics in particular; so hearing an opinion that clashes with their own views could cause body language changes that may affect the participant’s physiological responses. As several different interviewers were used within this current study, differing opinions of the interviewers (and thus differences in body language responses) could have skewed the stress response of the participants.

The results could also be due to equipment operating issues. The electrodermal recordings were especially problematic, with some recordings showing very little activity. This may have been due to different amounts of Gel 101 (the provided conductive gel) used or how tight the band attaching the equipment to the participant was. Additionally, one male participant did not have an electrodermal recording, and was not included in the analysis. Finally, different machines were used (all the same make and model) on different days. It is possible, albeit unlikely, that a machine(s) could have introduced a systematic bias for some of the data.

Despite the results of our positive control, our paradigm did not result in a consistent stress response. While there were several individuals who did exhibit a stress response during the experiment, not all participants were stressed by the verbal question-answer session. In the future, a paradigm similar to Kirschbaum et al. (1995) could be used. Kirschbaum et al. (1995) required participants to present a speech, rather than answer a verbal survey, and participants exhibited a consistent stress response. There were also significant gender differences in the stress
response as measured by cortisol levels. A limitation, however, is that this paradigm can be considered to be less reflective of normal social interactions.

In order to improve control groups in future studies, a gender neutral computer program could be used to give the survey. This gender neutral survey could potentially eliminate social desirability bias as no one would be in the room with the participant (Couper et al., 2001). This would eliminate all potential gender variables during the survey; however, someone would still have to help set up the equipment. Ideally there would be an experimental paradigm that would prevent the participant from having any interaction with the experimenters, but this would be difficult to achieve. A gender neutral survey would also eliminate the transition period between experimenters. Without the transition period the participant may experience less stress as the survey would not be interrupted by a new interviewer.

In conclusion, while there are several possible sources of error in this study, the results show that there are no significant differences in stress response (as measured by blood pressure, heart rate, and skin conductance) among participants due to the gender of the experimenter or gender of the individual.
References

Billings, A. G. and Moos, R., H. The Role of Coping Responses and Social Resources in Attenuating the Stress of Life Events. Journal of Behavioral Medicine, 4(2) 139-157.


Appendix 1. Survey Questions

First Experimenter
1. Do you play any sports?
2. How many one night stands have you had?
3. Are you a virgin?
4. How much weight have you gained in the past 6 months?
5. Do you support homosexual marriage?
6. Do you live in a dorm?
7. How old are you?
8. Are you pro- or anti-gun control?
9. What is your major?
10. How many languages do you speak?
11. How many credits are you taking?
12. Do black lives matter or all lives matter?
13. How many siblings do you have?
14. Do you believe in God?

Second Experimenter
15. What size shoe do you wear?
16. How many roommates do you have?
17. What color are your eyes?
18. Are you pro-choice or pro-life?
19. What is your name?
20. Where are you from?
21. Have you ever cheated on a significant other?
22. Do you think one person could believe in multiple religions?
23. Do you have a pet?
24. Can more than one religion be right?
25. Are your pro- or anti-death penalty?
26. Have you ever done illegal drugs?
27. Have you viewed pornography?
28. What grade level are you?