

An Experimental Study of Perceived Event Uncertainty on Stress

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The definition of stress, as provided by the American Psychological Association, is the physiological or psychological response to internal or external stressors (APA, n.d.). Stress manifests itself in many ways, including but not limited to sweating, faster heart rate, fidgeting, etc. (APA, n.d.). The study of stress and possible causes of it is crucial to understanding how stress develops and how best to prevent stress from manifesting. Given that stress is a part of daily life for most, if not all, people, understanding and limiting the stressors may not only provide a better quality of life but may even save lives. One causal theory is that a lack of perceived certainty leads to higher levels of stress. More specifically, those that are on the brink of a major life change or are embarking on something new and perceive high uncertainty should demonstrate higher levels of stress than those that are not. The literature seems to support this theory. For example, one study performed in 1984 showed that there was a positive correlation between patients' perceived uncertainty towards a future surgery and their levels of stress (Mishel, 1984). This study highlighted the importance of perceived uncertainty vs. actual uncertainty, given that the actual uncertainty of a situation may not necessarily match with a subject's perception. A more recent paper discussed findings on uncertainty due to the COVID-19 pandemic as it affected stress and found similar results (Freeston et al., 2020). It also differentiated uncertainty from threat, noting that they are not at all the same thing (Freeston et al., 2020). Further, an experimental study discovered that knowing a certain event would take place but not knowing when (temporal uncertainty) actually had a stronger effect on stress than knowing when an event would take place but not how uncertain it would be (event uncertainty) (Monat et al., 1972). This finding suggests that not all perceived uncertainties are equal, as temporal uncertainty seems to be more stressful than event uncertainty. Interestingly, uncertainty

may be the strongest factor that leads to stress for college students, as demonstrated by a nationwide study in China (Wu et al., 2020). The study found that uncertainty based stress accounted for more of the development of mental disorders than study or life based stress, even when controlling for university level (Wu et al., 2020). On a related note, it appears trait neuroticism affects an individual's level of stress response to uncertainty, as demonstrated by an experimental study (Hirsh & Inzlicht, 2008). This indicates that even perceived uncertainty may not produce consistent and reliable results in stress between individuals, meaning any experiments must control for neuroticism. The literature also suggests that coping competence, that is how well an individual can cope with negative factors, has an effect on stress. An experiment conducted on police officers in which they were given a wellness program that promoted coping strategies found that the wellness program led to higher levels of coping competence and subsequently lower levels of perceived stress (Anshel, Umscheid, & Brinthaup, 2013). The perceived event uncertainty of their jobs and their subsequent stress was mediated in part by coping competence. Given all the literature on this particular topic, a fine tuned research question can be established: How does perceived event uncertainty affect stress levels for college students, and does coping competence mediate the relationship between the two? Thus, the independent variable will be perceived event uncertainty, the dependent variable will be stress, and the mediating variable will be coping competence. The mediation model for this experiment is shown on page 21 (see Figure 1). This mediator model will help assess for a three-way causal relationship, that is whether or not perceived event uncertainty influences coping competence which influences stress. In order to conduct an experimental study to answer the research question, perceived event uncertainty will be manipulated through a vignette. Participants in the experimental group will be given a vignette meant to prime perceived event uncertainty whereas

participants in the control group will be given a normal story. Coping competence will be operationalized through the Coping Competence Questionnaire (Schroder & Ollis, 2013) and stress will be operationalized through the Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983). The hypotheses for this experiment are as follows: priming thoughts of perceived event uncertainty in the group given the uncertain vignette will cause higher Coping Competence Questionnaire scores, which will cause higher Perceived Stress Scale scores than in the group given the normal vignette.

Methods

Participants

There were 29 participants who participated in this study ($N = 29$), all of whom are University of Maryland undergraduate psychology students. The majority of the participants are female, the majority of participants are juniors, and the majority of the participants are white. All of the participants are enrolled in PSYC300: Research Methods in Psychology. The participants were selected using convenience sampling. An experiment link was sent out to students of two different discussion sections to fill out. As an incentive, after completion of the survey each student would be rewarded with credit for PSYC300 based on their full UID entry. The randomization of participants into either the experimental group or the control group was done through the last digit of their phone number. If the last digit was even, they would be placed in the experimental group. If the last digit was odd, they would be placed in the control group.

Measures/Materials

Independent Variable Manipulation

The independent variable, perceived event uncertainty, was manipulated using a vignette. The vignettes for both conditions were similar in nature, in that they both described the same

setting of talking with an academic advisor and planning out next semester's schedule. This was done to limit the effects of different vignettes and to remove confounds. For those in the experimental group, the vignette stated that the academic advisor told the participant that they could graduate early at the end of the semester. It further stated that the participant did not plan for this and has nothing lined up after graduating (see Appendix A). This is meant to prime feelings of event uncertainty. On the other hand, the vignette for the control group simply stated that the academic advisor told the participant that all is well (see Appendix B).

Subject Variable Measure

The subject variable, gender, was measured through a simple questionnaire. Gender was then coded as either male, female, or nonbinary/other (see Appendix D).

Coping Competence Questionnaire

The mediator variable, coping competence, was measured using the Coping Competence Questionnaire (Schroder & Ollis, 2013). This variable is meant to explain the relationship between the independent variable, perceived event uncertainty, and the dependent variable, stress, in a more informative way. Specifically, it is meant to measure the effect of coping competence on the relationship between perceived event uncertainty and stress. Four of the questions on the CCQ were used for this study. A sample question is as follows: How often have you become easily discouraged by failures (see Appendix E for full list)? The Coping Competence Questionnaire has been tested for validity and reliability with a sample size of 261, and it has a Chi-squared of 123.98 and an internal reliability coefficient of 0.89 (Akin et al., 2014). Therefore, the reliability and validity of the CCQ are high. The scale is coded from a range of 0 to 100, with 0 being never, 25 being almost never, 50 being sometimes, 75 being fairly often, and 100 being very often. The individual scores for each question is noted and the average

of all the scores is calculated as the composite score of the scale. A lower score means higher coping competency.

Perceived Stress Scale

The dependent variable, stress, was measured using the Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983). 10 of the questions on the PSS were used for this study. A sample question is as follows: In the last month, how often have you felt that you were unable to control the important things in your life (see Appendix C for full list)? The Perceived Stress Scale was developed and tested on three diverse samples with consistent results, therefore the reliability is high (Cohen, Kamarck, & Mermelstein, 1983). Chi-squared by degrees of freedom was calculated to be 10.69, therefore the validity is also high (Dias et al., 2015). PSS is also unidimensional. The scale is coded from a range of 0 to 100, with 0 being never, 25 being almost never, 50 being sometimes, 75 being fairly often, and 100 being very often. Questions 4, 5, 6, 7, 9, and 10 are reverse coded, given that they reflect the lack of stress. The individual scores for each question is noted, the appropriate scores are reverse coded, and finally the average of all the scores is calculated as the composite score of the scale.

Procedure

A sample template given by the TA for the Qualtrics survey was used as a baseline, already containing the gender measure, Coping Competence Questionnaire, and Perceived Stress Scale. In the section for Condition 1, the experimental group, the manipulating vignette was added. In the section for Condition 2, the control group, the control vignette was added. The survey was then published and the link was sent to the TA for distribution. The TA distributed the survey link to two other discussion classes. After a participant clicked on the survey link, they would be taken to the informed consent block. If they consented and moved on to the next

block, they would see a question asking for the last digit of their phone number. If the last digit was even, they would be sent to read the manipulation. If the last digit was odd, they would be sent to read the control. After reading the vignette, the participant would then be taken to the gender measure to be completed. After completion of the gender measure, the participant would then complete the Coping Competence Questionnaire. The survey would then move on to the Perceived Stress Scale. After finishing the scale, the participant would then enter their UID. Finally, the contact block would be displayed in which the researcher's email would be given for future contact, and the survey would end on the next button click.

Design

A 2x3 combined design was utilized in this research to study the effects of perceived event uncertainty and gender on stress. Combined designs measure the relationship of two or more variables on a dependent variable. Unlike correlational studies, combined designs can assess causation and allow control for extraneous variables through manipulation and statistical analysis. It provides a higher level of control and allows for the use of a manipulation check to assess the effectiveness of the manipulation. For a study that is interested in the causal relationship between perceived event uncertainty and stress, and how gender interacts with both, a 2x3 combined design is perfect. The independent variable is perceived event uncertainty, the dependent variable is stress, and the subject variable is gender.

Results

All survey entries by participants were clean and completed fully, therefore there was no need to throw any of the data out. The sample size is 29. Most of the participants are female, juniors, and white. All participants are enrolled in PSYC300 and attend University of Maryland, College Park. As a reminder, the original hypotheses are that priming thoughts of perceived event

uncertainty in the group given the uncertain vignette will cause higher Coping Competence Questionnaire scores, which will cause higher Perceived Stress Scale scores than in the group given the normal vignette. The factorial analysis used in this study was the Baron Kenny model of mediation analysis. Given that the experiment is measuring a three-way causal relationship and that the Baron Kenny model allows for testing individual causal relationships as well as doing multiple regressions, the Baron Kenny model of mediation analysis is the best analysis to use. To test the hypothesis that coping competence would mediate the relationship between perceived event uncertainty and stress, several regressions were run in order to test the various model pathways. With further analysis of the Baron Kenny mediation analysis, the regression coefficient of perceived event uncertainty on stress is -9.221, the regression coefficient of perceived event uncertainty on coping competence is -8.418, the regression coefficient of coping competence on stress is 0.56594, and the regression coefficient of perceived event uncertainty on stress when controlling for coping competence is -4.45684 (see Figure 1). The results of the Baron Kenny mediation analysis is as follows: Perceived event uncertainty was not found to significantly predict stress, $b = -9.221$, $t = -1.6$, $p = 0.121$. Additionally, perceived event uncertainty was not found to significantly predict coping competence, $b = -8.418$, $t = -0.94$, $p = 0.355$. A multiple regression found that coping competence was a significant predictor of stress, $b = 0.56594$, $t = 9.412$, $p = 7.73 * 10^{-9}$. However, within this model, perceived event uncertainty was not a significant predictor of stress when coping competence was taken into account, $b = -4.45684$, $t = -1.568$, $p = 0.129$ (see Table 1). Given that only the effect of coping competence on stress was significant, the overall findings show no mediation and therefore do not show support for coping competence mediating the relationship between perceived event uncertainty and stress. Therefore, the null hypothesis cannot be rejected.

Discussion

Before the study, it was hypothesized that priming thoughts of perceived event uncertainty in the group given the uncertain vignette will cause higher Coping Competence Questionnaire scores, which will cause higher Perceived Stress Scale scores than in the group given the normal vignette. More specifically, it was expected that the effect of perceived event uncertainty on coping competence would be significant, the effect of coping competence on stress would be significant, and the effect of perceived event uncertainty on stress when controlling for coping competence would be not significant, as per the mediation model (see Figure 1). However, the findings seem to indicate that there is no mediation of coping competence between perceived event uncertainty and stress, that is only the effect of coping competence on stress was significant. These findings directly oppose the hypotheses and mediation model and therefore do not support it. Given that the findings do not reject the null hypothesis, no conclusion can be made regarding the study. Though the hypotheses were not supported in the end, there are still strengths in this current research. The use of a well established scale for measuring stress and coping competence, the Perceived Stress Scale and Coping Competence Questionnaire, respectively, significantly increased the validity of the study, at least for stress measurement and coping competence measurement. Given the research was experimental, causation could be concluded. Previous studies could only conclude correlation, whereas this study can conclude a direct cause of perceived event uncertainty on stress. Also, the current experimental design allows for the assessment of multiple factors on stress, as can be seen by the assessment of perceived event uncertainty and coping competence in unison. On the other hand, the weaknesses in this research are plenty. A major problem was the fact that participants were gathered through convenience sampling. Though a valid sampling method, it is

vulnerable to major participant bias. It could be that the only students who bothered to complete the survey had an external incentive and perhaps were more stressed about their grades than others, thus tilting the stress scores to higher than usual. Another problem was the manipulation of the independent variable through Qualtrics. Without a proper lab setting, experimental control was lacking, and even more so manipulation of the independent variable may not have worked through Qualtrics. In the future, research can control for potential extraneous variables, such as current workload or social pressure. These variables are both possible influences on an individual's stress level, therefore if they are not controlled they can impact the outcome variable and skew the results. For example, an individual who has low event uncertainty but high social pressure may indicate high levels of stress, which would tarnish the data. In relation to meditation, the current design cannot assess the temporal landscape, such as perceived event uncertainty caused coping competence which caused stress. Future research can also gather larger and more diverse samples. This could be done by sending the survey link through multiple widespread channels, such as through social media or advertising, to get as many participants as possible. This would significantly increase and diversify the sample size, meaning the p-value would be much lower and therefore the findings can be statistically significant. It would also increase external validity and generalizability as a more diverse sample was used. Adding on, further research can conduct the study in a lab setting rather than through Qualtrics. Though this would lower the reach of the sample, it would allow for greater experimental control and stronger manipulation. A lab setting would also allow for different measures of the dependent variable stress, such as measuring heart rate and cortisol levels. Finally, future research can experiment with conducting different analyses on the data, such as moderation. For example, it

may be that personality moderates the strength of the effect of perceived event uncertainty on stress.

References

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Appendix A**Condition 1 (Manipulation) Vignette**

You are planning your classes for next semester and you go to your academic advisor. She tells you that it turns out that you have the ability to graduate early, in fact you can graduate at the end of this semester! This comes as a shock to you, and after thinking for a bit you decide to take the offer and graduate early. Of course, you had not planned for this possibility at all and are now feeling uncertain about what will happen when you graduate in just a couple months. Graduating early is nice, but you do not have a job or any plans lined up.

Appendix B

Condition 2 (Control) Vignette

You are planning your classes for next semester and you go to your academic advisor. She looks over your proposed class schedule and likes what she sees. After discussing your future for a couple minutes you both agree that you are on track to graduating on time. Everything is as you planned and there are no foreseeable surprises in the future waiting for you.

Appendix C

Perceived Stress Scale (Cohen et al., 1983)

1. In the last month, how often have you been upset because of something that happened unexpectedly?
2. In the last month, how often have you felt that you were unable to control the important things in your life?
3. In the last month, how often have you felt nervous and "stressed"?
4. In the last month, how often have you dealt successfully with irritating life hassles?
5. In the last month, how often have you felt that you were effectively coping with important changes that were occurring in your life?
6. In the last month, how often have you felt confident about your ability to handle your personal problems?
7. In the last month, how often have you felt that things were going your way?
8. In the last month, how often have you found that you could not cope with all the things that you had to do?
9. In the last month, how often have you been able to control irritations in your life?
10. In the last month, how often have you felt that you were on top of things?

Appendix D

Subject Variable Question

Please select what gender you identify as

- ☐ Male
- ☐ Female
- ☐ Nonbinary/Other

Appendix E

Coping Competence Questionnaire (Schroder & Ollis, 2013)

1. How often have you become easily discouraged by failures?
2. How often have you questioned your own abilities?
3. How often have you allowed failures to shake your self-confidence for a long time?
4. How often have you given up after failing at something?

Table 1*Baron Kenny model of mediation analysis*

Baron & Kenny Step 1:

```

```{r}
step1 <- lm(Avg_PSS~Condition, data=mediation.dat)
summary(step1)

Condition2 coefficient = -9.221
Condition2 t-statistic = -1.6
Condition2 p-value = 0.121
not significant
```

```

Call:

```
lm(formula = Avg_PSS ~ Condition, data = mediation.dat)
```

Residuals:

| Min | 1Q | Median | 3Q | Max |
|---------|---------|--------|-------|--------|
| -35.537 | -10.485 | 1.969 | 9.012 | 27.886 |

Coefficients:

| | Estimate | Std. Error | t value | Pr(> t) |
|-------------|----------|------------|---------|--------------|
| (Intercept) | 58.692 | 4.145 | 14.16 | 5.14e-14 *** |
| Condition2 | -9.221 | 5.763 | -1.60 | 0.121 |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 15.51 on 27 degrees of freedom

(2 observations deleted due to missingness)

Multiple R-squared: 0.08661, Adjusted R-squared: 0.05278

F-statistic: 2.56 on 1 and 27 DF, p-value: 0.1212

Baron & Kenny Step 2:

```

```{r}
step2 <- lm(Avg_CCQ~Condition, data=mediation.dat)
summary(step2)

Condition2 coefficient = -8.418
Condition2 t-statistic = -0.94
Condition2 p-value = 0.355
not significant
```

```

Call:

```
lm(formula = Avg_CCQ ~ Condition, data = mediation.dat)
```

Residuals:

| Min | 1Q | Median | 3Q | Max |
|---------|---------|--------|--------|--------|
| -46.485 | -19.862 | 3.587 | 20.910 | 34.728 |

Coefficients:

| | Estimate | Std. Error | t value | Pr(> t) |
|-------------|----------|------------|---------|--------------|
| (Intercept) | 52.962 | 6.439 | 8.225 | 7.85e-09 *** |
| Condition2 | -8.418 | 8.953 | -0.940 | 0.355 |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 24.09 on 27 degrees of freedom

(2 observations deleted due to missingness)

Multiple R-squared: 0.0317, Adjusted R-squared: -0.004162

F-statistic: 0.8839 on 1 and 27 DF, p-value: 0.3555

Baron & Kenny Step 3 and Step 4:

```

```{r}
step34 <- lm(Avg_PSS~Condition + Avg_CCQ, data=mediation.dat)
summary(step34)

Condition2 coefficient = -4.45684
Condition2 t-statistic = -1.568
Condition2 p-value = 0.129
not significant

Avg_CCQ coefficient = 0.56594
Avg_CCQ t-statistic = 9.412
Avg_CCQ p-value = 0.00000000737
significant
```

```

Call:

```
lm(formula = Avg_PSS ~ Condition + Avg_CCQ, data = mediation.dat)
```

Residuals:

| Min | 1Q | Median | 3Q | Max |
|---------|--------|--------|-------|--------|
| -11.608 | -5.621 | -1.225 | 3.167 | 16.052 |

Coefficients:

| | Estimate | Std. Error | t value | Pr(> t) |
|-------------|----------|------------|---------|--------------|
| (Intercept) | 28.71840 | 3.76671 | 7.624 | 4.31e-08 *** |
| Condition2 | -4.45684 | 2.84267 | -1.568 | 0.129 |
| Avg_CCQ | 0.56594 | 0.06013 | 9.412 | 7.37e-10 *** |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 7.527 on 26 degrees of freedom
(2 observations deleted due to missingness)

Multiple R-squared: 0.7928, Adjusted R-squared: 0.7768

F-statistic: 49.73 on 2 and 26 DF, p-value: 1.301e-09

Note: Baron Kenny mediation analysis of participants' scores. Effect of perceived event

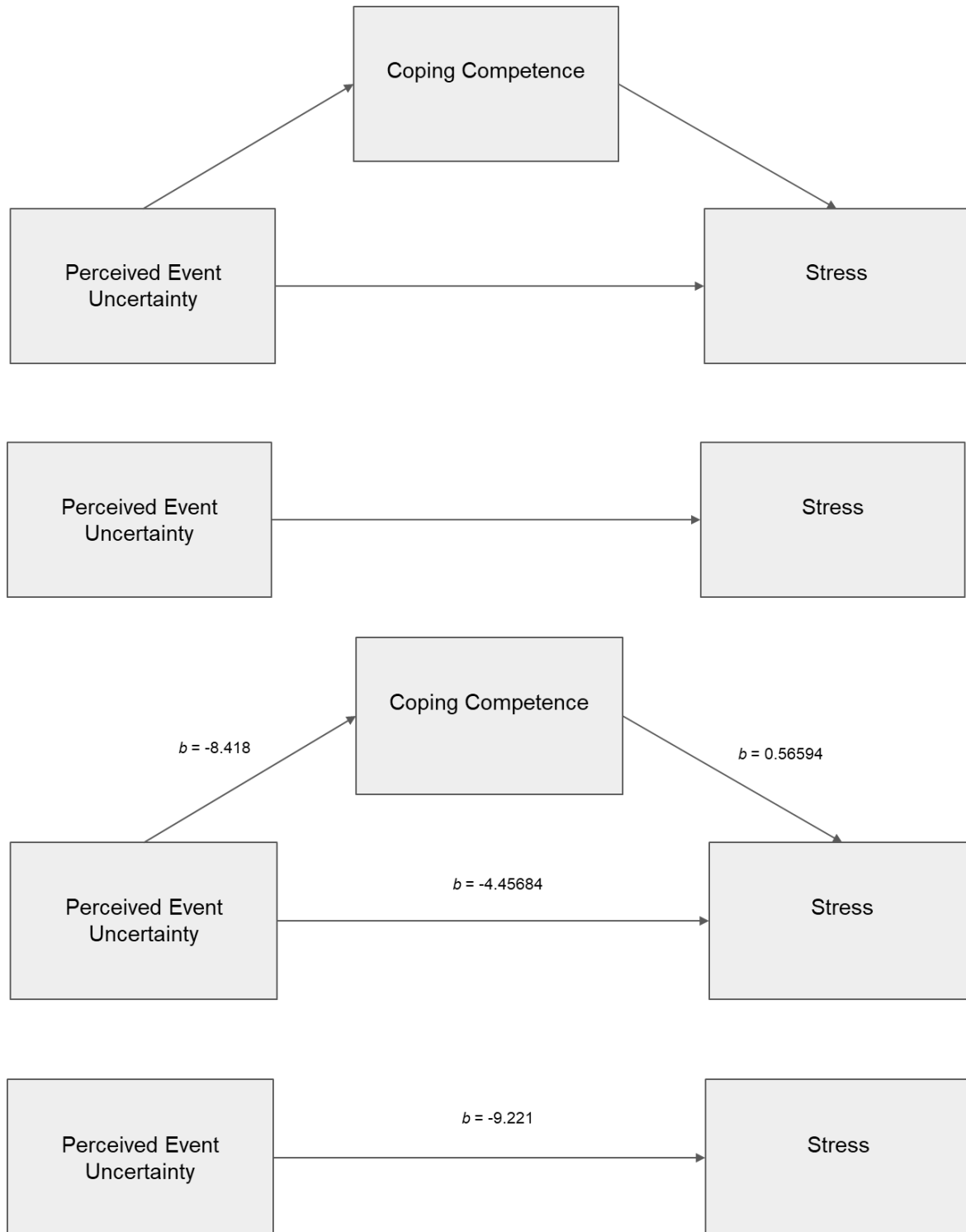
uncertainty on stress, perceived event uncertainty on coping competence, coping competence on

stress, and perceived event uncertainty on stress when controlling for coping competence were

measured.

Figure 1

Mediation Model of Perceived Event Uncertainty, Coping Competence, and Stress with and without coefficients



Note: Mediation model of the relationship between perceived event uncertainty, coping competence, and stress. Bottom model includes regression coefficients on each path of the model.