

Belief in afterlife appears to modulate alpha-amylase reactivity
to mortality salience

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Abstract

Terror Management Theory (TMT), a widely popular psychological research topic, suggests people use culture, more specifically religion, as a buffer against fearing death; however, no physiological data has ever been given to support this claim. The goal of this study was to test TMT against physiological data, namely salivary cortisol and alpha-amylase levels, two known stress hormones. Participants spoke about either dental pain (the control condition) or their own death (the experimental condition) for approximately five minutes. Belief in afterlife was measured via self-report questionnaire prior to this. Three saliva samples were taken during the study, and then analyzed for cortisol and alpha-amylase using Salimetrics® enzyme-linked immunosorbent assays. Fifteen minutes after speaking, alpha-amylase levels were lowest for those who were high in belief in afterlife and highest for those who had low belief in afterlife, with a roughly linear distribution between the two ends of the spectrum ($p < 0.01$), suggesting that belief in an afterlife minimizes the acute stress caused by the salience of one's impending death. These results are consistent with what TMT literature predicts, and suggest belief in afterlife could be evolutionarily adaptive.

Introduction

Philosophers have attempted to develop frameworks of thought to make sense of the human condition for centuries. Many of these frameworks of thought are impossible to test using the traditional scientific method. Over the last century and a half, psychologists have undertaken the monumental task of explaining the human condition using experiments and data. While psychology has provided many published papers and numbers, it remains difficult to say with certainty exactly what those numbers mean, as many measures, especially self-report measures, are admittedly subjective and not fit for analysis using ratio statistics. Due to the subjective

nature of the human condition, the self-report and subjectivity of psychological research is by and large here to stay; however, due to the advent of non-invasive biomarkers, there are some areas of psychology, particularly research measuring stress, immune function, and genetic bases of behavior, that can escape subjectivity for at least one axis of measurement. For example, cortisol and α -amylase are two hormones produced by the body in response to stress, and are readily measurable in saliva via a straightforward assay. This gives researchers the ability to objectively quantify stress, making it possible to scientifically study stress, its function, and its reactivity in humans. These products have been developed, tested, and optimized by Salimetrics®, and mechanistically functions as an enzyme-linked immunoabsorbent assay (Raff, Homar, & Skoner, 2003).

Cortisol is a stress hormone produced by the endocrine system's hypothalamic-pituitary-adrenal axis (HPA-axis) (Honour, 1994; Figure 1). Because of the trophic nature of cortisol and the fact that cortisol is a steroid hormone, changes in cortisol levels are not measurable in the blood or saliva until approximately 15 minutes after the stressful stimulus. The concentration of active cortisol increases in response to both physical and psychosocial stress, and this increase in active cortisol occurs in the same magnitude, regardless if the stressor is perceived or real (Magariños, McEwen, Flügge, & Fuchs, 1996). Cortisol is also the key hormone in the stress response, and it is highly conserved across vertebrates, conveying the evolutionary importance of the hormone (Love & Williams, 2008). Cortisol levels rise and fall in a diurnal pattern, meaning cortisol levels peak in the morning, then decline through the day (Edwards, Evans, Hucklebridge & Clow, 2001). Alpha-amylase is a hormone secreted from the salivary glands that has been shown to indicate sympathetic nervous system activity, and it rises in concentration in response to stress (Rohleder, Nater, Wolf, Ehlert, & Kirschbaum, 2004; Nater & Rohleder, 2009). The

alpha-amylase secretory pathway is less understood than the pathway leading to cortisol release. Alpha-amylase levels respond immediately to a stressful stimulus, as opposed to the lag in response observed in cortisol.

These robust tools are at the figurative doorstep of those who study behavior, yet they are not often used. One particular field that would benefit immensely from the use of physiological biomarkers is Terror Management Theory (TMT). Terror Management Theory is an extremely active area in psychological research, and research on the topic has produced hundreds of publications. The theory suggests humans manage terror by using different world beliefs and personal beliefs as a buffer (Greenberg et al., 1990). The theory, in its mortality salience hypothesis, posits religion is important because it serves as a way for humans to cope with their eventual mortality; in other words, individuals use religion as a buffer against fearing their own deaths (Jonas and Fisher, 2006). Terror Management Theory has been around for decades, spawned hundreds of publications, and been widely accepted as true, yet no one has stringently tested the hypothesis that religion serves as a buffer against mortality salience against a physiological backdrop; all previous studies have been based upon subjective testing methods, such as self-report questionnaires, or interviews.

In light of this inexplicable gap in the literature, the present study aims to test the mortality salience hypothesis of Terror Management Theory against the physiological biomarkers, cortisol and alpha-amylase. We seek to answer the research question: Do people with different beliefs have systematically different physiological responses to mortality salience? We hypothesize those with higher levels of religiosity will have a lower physiological stress response to mortality salience.

Methods

This study was performed in full compliance with Oklahoma State University's Institutional Review Board. The full Institutional Review Board application can be found in this document's appendix.

Recruitment and Location of Study

Each participant was sent an email reminder about the study 24 hours prior to participation. This email was designed to ensure that each participant is properly reminded of the activities that must be avoided prior to coming to the lab. The email was sent to the email address that is listed in the Sona system for the participant. Each participant reported to North Murray Hall room 308 for the study on the assigned day.

Random Assignment

Each subject was assigned to a randomly drawn prime to determine whether that participant will participate in mortality salience prime version A or mortality salience prime version B (the experimental conditions; see below for description of the difference between the versions), or dental pain prime version A or dental pain prime version B (the control conditions).

Primes Used

Subjects experienced version A or B of one of the two primes, all of which took place in North Murray 310. There were two versions of each prime, as we suspect the current standard mortality salience prime is not the most effective way to elicit mortality salience. Version A of the mortality salience prime asked participants to write for 5 minutes to the following prompts: "Please briefly describe the emotions that the thought of your own death arouses in you. Please describe, as specifically as you can, what you think will happen to you as you physically die and once you are physically dead." Version A of the dental pain prime asked participants to write for

5 minutes to the following prompts: “Please describe the emotions that the thought of experiencing dental pain arouses in you. Please describe, as specifically as you can, what you think will happen to you as you experience dental pain and once you are experiencing dental pain.” This was the standard, most often used, versions of these primes. There was a research assistant who entered the room twice over the five minute period to instruct the participants to keep writing if they had stop before the five minutes is over. Version B of the mortality salience prime consisted of asking participants to orally reflect on their own death (with a research assistant) for five minutes. Version B of the dental pain prime consisted of asking participants to orally reflect on dental pain (with a research assistant) for five minutes. Research assistants were instructed to ensure the questioning lasted for at least four minutes.

Informed Consent

After reporting to the location, each participant was properly given an informed consent and asked to sign the consent if they wished to participate. Furthermore, each participant was given a copy of the informed consent.

Procedure

After participants signed up to participate in the study, the participant received a link to complete a series of questionnaires, which ask the participant’s views on sex, national identity, humans’ place in the animal kingdom, parenting, religiosity, temperament and afterlife. When the participant visited the link, there was a short informed consent for to read. By clicking “next,” they signed the informed consent. The subject was to complete the seven questionnaires listed previously. The questionnaires were to be finished at least one day before the participant arrived in the lab. It was not allowed for a student to complete the questionnaire in lab, as this could serve as an accidental religious prime. When the participants arrived in the lab, North

Murray 308, they were read, and then signed the informed consent and were asked to fill out a series of questionnaires on their demographics, general health, self-esteem and personality. The purpose of the questionnaires was to gather information, but also to allow them to habituate to the lab setting. After all participants had completed the questionnaires (approx. 15 minutes), a baseline saliva sample was taken. Participants gave a saliva sample via passive drool. They held a sterile straw to their mouths with their heads tilted forward, to let gravity pool the saliva in the front of the mouth. The saliva then traveled through the straw into a sterile cryovial.

Approximately 1.0 milliliters of saliva were used for the sample. The cryovial was labeled only with an identification number, and was then placed in a freezer to be later analyzed for cortisol and alpha-amylase. Next, the participants completed either a mortality salience prime or a dental pain prime in North Murray 310. If a participant was in version B (the oral reflection condition), his or her response was recorded, for coding purposes. Recording was discreet as to not add an extra dimension of stress, but the participant did know about the possibility of being recorded upon consent. As soon as each participant completed the prime, he or she was asked to give another saliva sample, using the same protocol as previously listed. After this, the participant was asked to sit quietly for 13 minutes. After 13 minutes, the participants was given a final set of questionnaires which showed their desire to affiliate with those they have a close relationship with and their level of distress (on a 5 point scale) upon completion of the study. In the unlikely event that a subject indicated that she or he was feeling extremely distressed or anxious (rating 4 or above on a 5 point scale), they were asked at the conclusion of the debriefing if they would like a research assistant to accompany them to the Psychological Services Clinic. At this point, 15 minutes should have elapsed since the collection of the last saliva sample. If 15 minutes had not passed, the participant sat quietly until 15 minutes had been reached. The purpose of this

strict time frame was to allow cortisol levels to reach their peaks. After 15 minutes had passed, the subject gave the final saliva sample, using the protocol outlined above. The participants were debriefed, given a copy of both the debriefing form and counseling form and then dismissed. Saliva samples were analyzed for cortisol and alpha-amylase in Life Sciences West at Oklahoma State University – Stillwater, with Salimetrics® enzyme-linked immunosorbant assays, in accordance with specified protocols.

Statistical Analyses

Correlation and linear regression analyses were run to determine the relationship between salivary alpha-amylase and belief in afterlife; these tests were also run to determine the relationship between salivary cortisol and belief in afterlife. These analyses were completed for all prime groups (dental pain A and B; mortality salience A and B) for each of the three time points at which saliva samples were taken. An alpha level of 0.05 was used for this study. Analyses were completed using SPSS Statistics, produced by IBM.

Results

Linear regression analyses to determine the strength of the relationship between salivary cortisol and belief in afterlife at the three different time points for both prime groups were all non-significant ($p > 0.05$). Linear regression analyses showed there to be a highly significant relationship ($p < 0.01$) between salivary alpha-amylase and belief in afterlife at the third saliva sample, for the mortality salience, oral reflection group (Figure 2). Approximately 40 percent of the variation in salivary alpha amylase levels was shown to be attributable to a person's belief in afterlife ($r^2 = 0.39903$; $r = - 0.63$). There was also a significant relationship ($p = 0.48$) between belief in afterlife and salivary alpha-amylase levels at the third time point for those who completed the written version of the mortality salience prime, although the direction of this

relationship was opposite that of the aforementioned result.

Analyses for time points one and two showed a non-significant relationship between alpha-amylase and belief in afterlife for all versions of the prime. Those who completed the oral reflection version of the mortality salience prime showed no relationship between belief in afterlife and salivary alpha-amylase levels at time points one and two, although a significant difference did arise at time point three (Figure 1, 2 and 3).

Discussion

Overall, the results of this study are consistent with what previous studies on Terror Management have predicted. We hypothesized those with higher levels of religiosity would have a lower physiological stress response to mortality salience. This hypothesis was resoundingly supported by our results from the mortality salience, oral reflection condition, which showed a highly significant ($p < 0.01$) relationship between belief in afterlife and salivary alpha-amylase, which is a stress biomarker, at the third time point, which was 15 minutes after the participant spoke about his or her own death. These results further suggest participants with belief in afterlife either consciously or subconsciously use these views as a buffer against having a physiological stress response to their own death, thus modulating alpha-amylase reactivity to mortality salience.

The first hormone measurement, which occurred before the prime took place, was taken as an internal control mechanism, to ensure the difference in alpha-amylase levels was not present before the independent variable manipulation, as Terror Management Theory does not speak to latent differences in stress; these differences manifest themselves only after a person's life or worldview is threatened. The second hormone measurement could have hypothetically yielded a difference in alpha-amylase concentration based on differences in belief in afterlife,

due to it being after the prime, but we did not see a difference at this measurement. We suggest this is likely due to the nature of giving speeches. Impromptu oral speeches cause people's stress levels to increase or decrease in a way that is independent of belief in afterlife; however, 15 minutes after the speech is over, participants have likely recovered from whatever physiological effect the speech had on them, whether that be negative or positive, and they have had time to silently and solitarily reflect on the question asked they were asked in the interview, which was, "Please briefly describe the emotions that the thought of your own death arouses in you. Please describe, as specifically as you can, what you think will happen to you as you physically die and once you are physically dead." At this time sample, we see our linear result form, where the participants who were high in belief in afterlife have low alpha-amylase levels, and participants with low belief in afterlife levels have high alpha-amylase levels, suggesting it is belief in afterlife that causes a difference in alpha-amylase reactivity to mortality salience. There were no significant results found in our control primes, which were the oral and written dental pain primes, further adding to the internal validity of the present study.

At this time, we must examine the results from the third saliva sample of the participants who completed the mortality salience, written condition. These results were statistically significant, although they were in the opposite direction of what was predicted with the present study's hypothesis. We speculate these results are not reliable, and should be dismissed under the grounds of a flawed method. In previous studies conducted in the Psychobiology Research Lab, research assistants have frequently observed participants refusing to fully engage in written primes, thus confounding the results of these studies. In other words, participants who are not comfortable with the prompt on the paper frequently do not answer the question, or if they do, it is rarely more than a one-sentence response, that takes them very little time to write. This means

participants in the written version of the prime are not fully or consistently experiencing the prime, causing unreliable data. The oral reflection condition is much more robust, because it ensures all participants fully reflect on the question, and it also ensures participants reflect on the question for the correct amount of time. To our knowledge, we report the unreliability of a written prime compared to an oral prime for the first time. We further suggest the written prime may confound data when used in subsequent studies. Additionally, some studies use the mortality salience prime as a general stressor. We show this is an imperfect application of this prime, because it causes unequal amounts of stress in individuals, depending on their belief in afterlife.

Critics of the current study may be leery of the results, because they were found in alpha-amylase levels, but were not replicated in salivary cortisol levels. This is due to the lagging nature of the HPA-axis. Recall from the introduction to the present study that changes in cortisol levels take approximately 15 minutes to occur in response to a stressor. Since the significant difference was found in the last saliva sample, this means the result would show up in cortisol levels approximately 15 minutes later. Since we did not have a subsequent saliva sample collection, the potential mirror in cortisol levels was not measured.

There are several limitations to the current study. The first is that we did not have a saliva sample 15 minutes after the significant effect was found in alpha-amylase, meaning we cannot verify the result with cortisol levels. Additionally, due to the social mores associated with the geographic region in which the study was conducted, the present study had relatively few participants who were low in religiosity. A future study should be run with more people who are low in religiosity to see if the effect persists. The last limitation to the present study is that afterlife is not suitable to be measured as a continuum. In planning the study, we made sure to

use a robust measure, but even though we took this precaution, the trait is inherently likely not fit for statistics that use ratio measures. Editors and reviewers largely overlook this limitation, but we report it here in an attempt to change how people use statistics and think about measurements.

In conclusion, we report for the first time that belief in afterlife appears to modulate alpha-amylase reactivity to mortality salience. This result supports the mortality salience hypothesis of Terror Management Theory, yet there are many more hypotheses of this theory that should be tested against physiological measures. Additionally, this study models how psychology and physiology can be successfully integrated to come to a succinct conclusion; this approach could be widely adapted to add validity to a wide range of studies. Also, our results show belief in afterlife may help us maintain homeostasis by buffering the stress response. The HPA-axis is known to have deleterious effects when chronically stimulated (Sapolsky, 1998), and maintaining homeostasis is beneficial to one's health and reproductive ability, leading us to suggest belief in afterlife could be evolutionarily adaptive. Studies lacking physiological data have previously suggested this (Pyysiäinen, & Hauser, 2010; Bering, 2006); the present data supports these claims and adds to them by providing the mechanism by which belief in afterlife may be adaptive. Broadly, these data show that the way we think can actually change the way we function at the molecular level, furthering the link between physiology and psychology.

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Figures

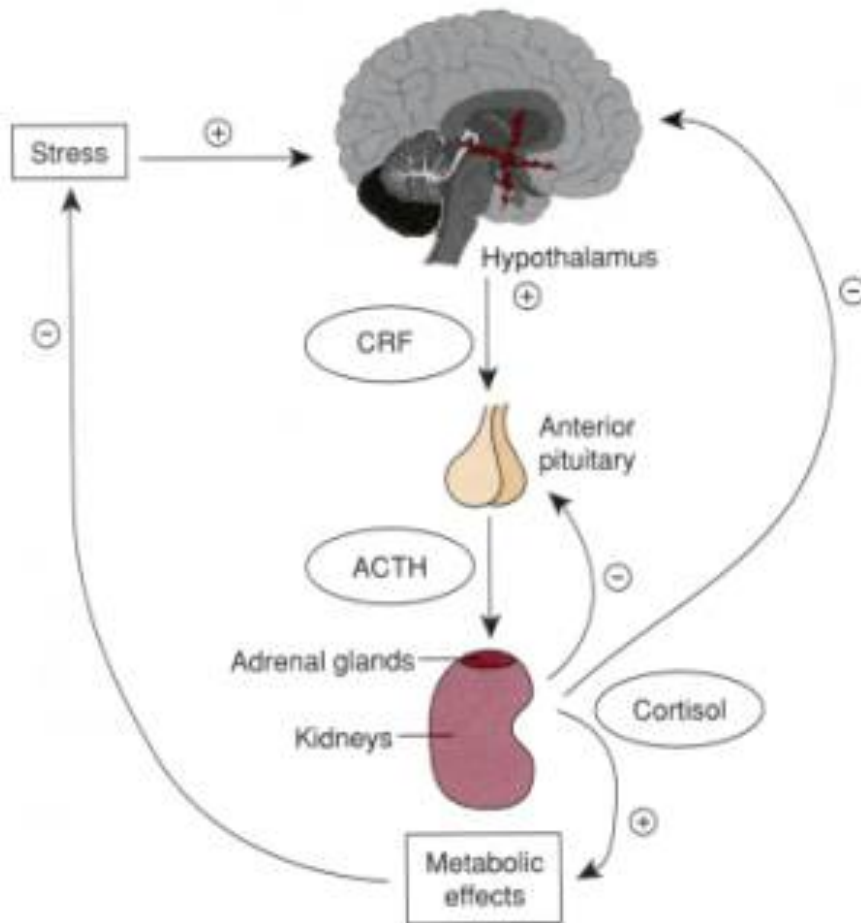


Figure 1: Cortisol is produced as the end result of a multistep endocrine cascade. The stressor, whether real or imagined, causes the hypothalamus to release corticotropin-releasing hormone (CRH); corticotropin-releasing hormone acts on the anterior pituitary, which releases adrenocorticotropic hormone (ACTH); adrenocorticotropic hormone acts on the adrenal gland, and leads to cortisol being released into the blood stream.

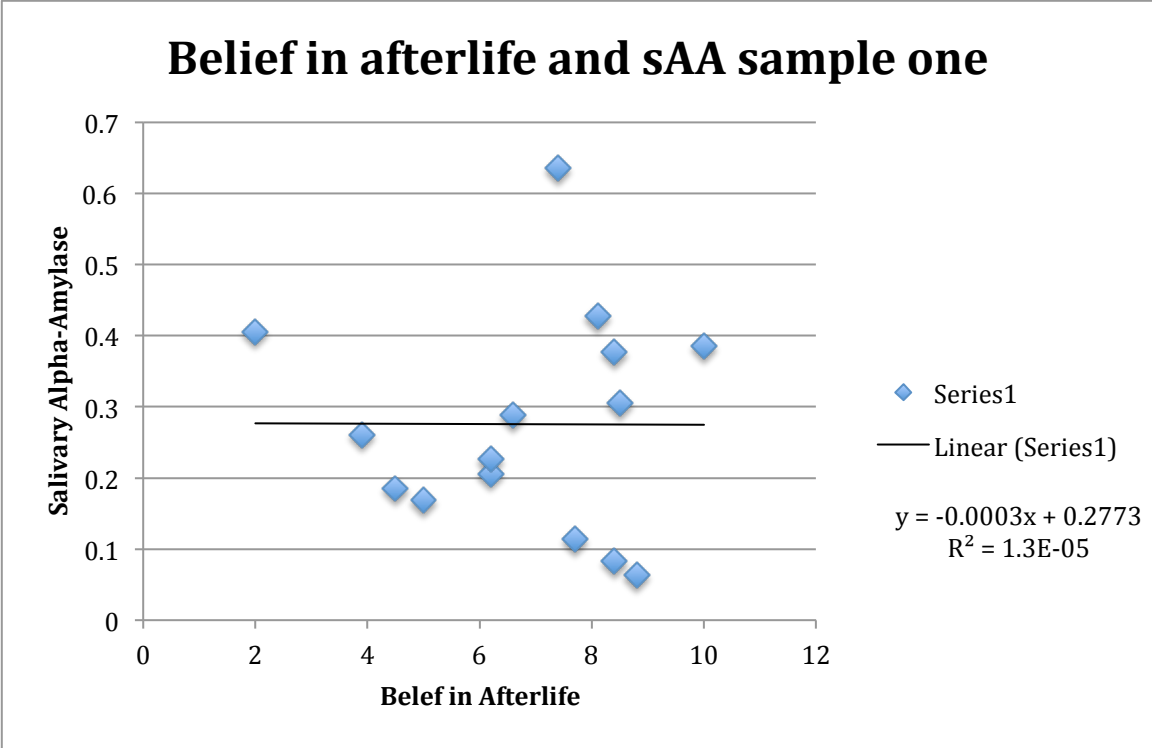


Figure 2: This figure shows participants who completed the oral reflection condition of the mortality salience prime at the first time point, which was 15 minutes after arrival to the lab, before the prime took place. The figure compares belief in afterlife and salivary alpha-amylase levels, which indicate stress. As one can see, there was no relationship between belief in afterlife and salivary alpha-amylase levels before the prime occurred.

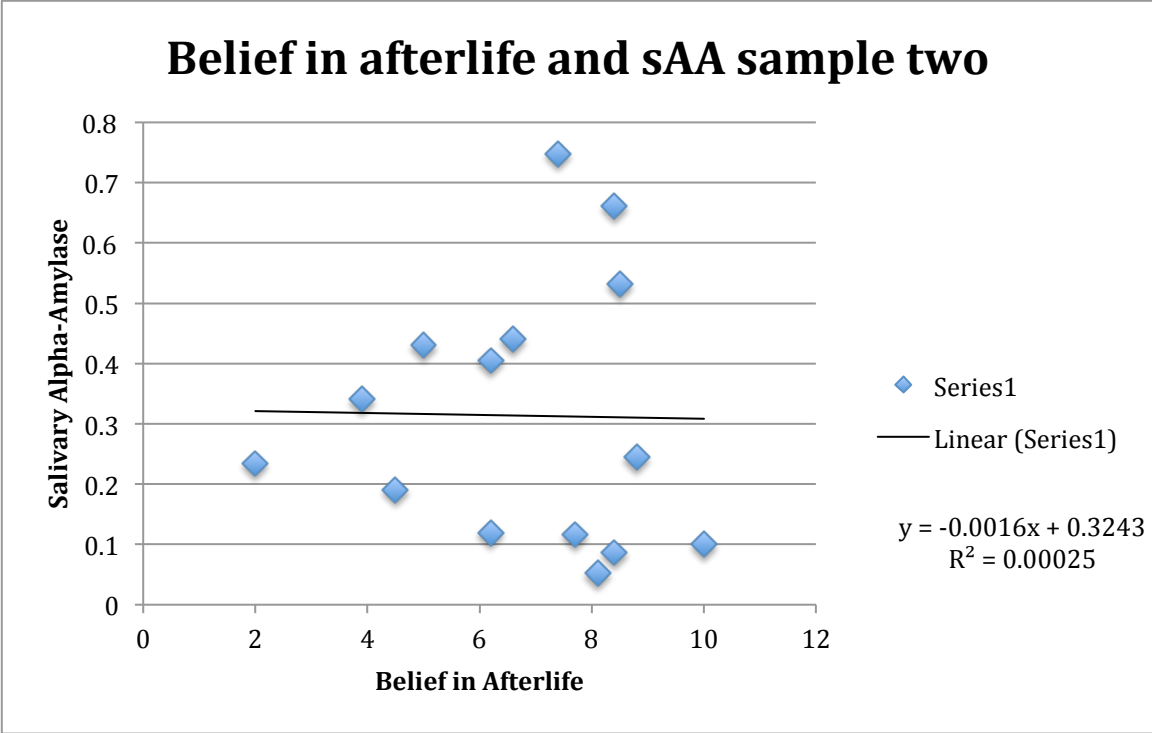


Figure 3: This figure shows participants who completed the oral reflection condition of the mortality salience prime at the second time point, which was 15 minutes after the first time point, and immediately after the prime where the participant spoke about his or her own death. The figure compares belief in afterlife and salivary alpha-amylase levels, which indicate stress, and shows that there was no significant relationship between the two immediately following the prime.

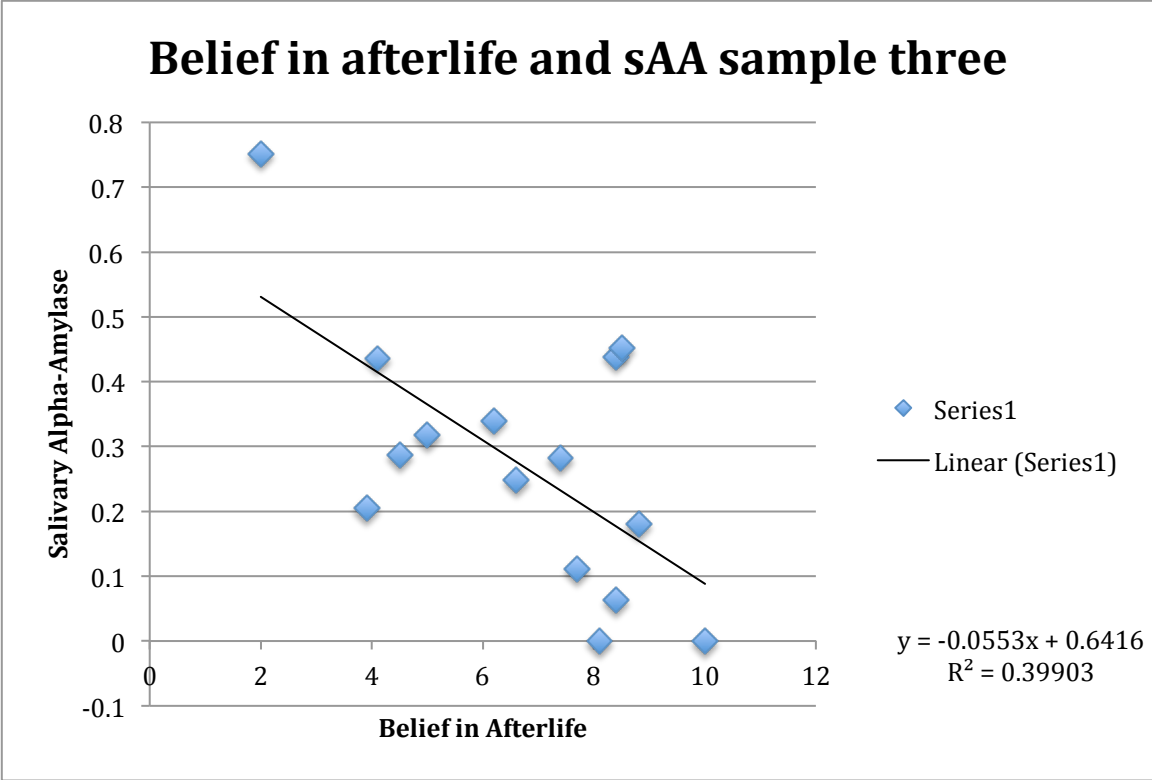


Figure 4: This figure shows participants who completed the oral reflection condition of the mortality salience prime at the third time point, which was 15 minutes after the second time point, meaning it was 15 minutes after the prime where the participant spoke about his or her own death. The figure compares belief in afterlife and salivary alpha-amylase levels, which indicate stress. This figure shows a highly significant relationship between these two variables.

Appendix

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HANDWRITTEN FORMS WILL NOT BE ACCEPTED
APPLICATION MUST BE SINGLE SIDED

APPLICATION FOR REVIEW OF HUMAN SUBJECTS RESEARCH SUBMITTED TO THE OKLAHOMA STATE UNIVERSITY INSTITUTIONAL REVIEW BOARD Pursuant to 45 CFR 46	_____ IRB Number FOR OFFICE USE ONLY
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Title of Project: Physiological Effects of Mortality Salience

Is the Project externally funded? Yes No If yes, complete the following: Private State Federal

Agency: _____ Grant No: _____ OSU Routing No: _____

Type of Review Requested: Exempt Expedited Full Board

Principal Investigator(s): *I acknowledge that this represents an accurate and complete description of my research. If there are additional PIs, provide information on the additional PIs form.*

Jennifer Byrd-Craven		
Name of Primary PI (typed)	Signature of PI	Date
Psychology	Arts & Sciences	
Department	College	
116 North Murray	(405) 744-2914	jennifer.byrd.craven@okstate.edu
PI's Address	Phone	E-Mail
Required IRB Training Complete: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No (Training must be completed before application can be reviewed)		

Brandon Hubbard		
Name of Co-PI (typed)	Signature of Co-PI	Date
	Arts & Sciences	
Department	College	
305 S. Monroe St.	(405) 408-8173	Brandon.t.hubbard@okstate.edu
PI's Address	Phone	E-Mail
Required IRB Training Complete: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No (Training must be completed before application can be reviewed)		

Adviser (complete if PI is a student): *I agree to provide the proper surveillance of this project to ensure that the rights and welfare of the human subjects are properly protected.*

Adviser's Name (typed)	Signature of Adviser	Date
Psychology		
Department	College	
Adviser's Address	Phone	E-Mail

[Required IRB Training Complete:](#)

Yes No

(Training must be completed before application can be reviewed)

NOTE: If sufficient space is not provided below for a complete answer in sufficient detail for the reviewer to fully understand what is being proposed, please use additional pages as necessary.

1. Describe the purpose and the research problem in the proposed study. *Your response in this section will enable the reviewers to determine whether the project meets the criteria of research with human participants and also the extent to which the research may produce new generalizable knowledge that may benefit the participants and/or society.*

The purpose of this study is to investigate differences in physiological response to mortality salience (thinking about one's own death) and to investigate how the desire to affiliate after experiencing a stressor varies across gender. Terror Management Theory (TMT) states that people use culture, more specifically religion, as a buffer against fearing their own deaths. Also, people with high self-esteem are reported to show less fear towards death; however, no physiological data has been given to support either of these claims. In this study, participants would answer questionnaires to determine the participant's self-esteem and religiosity. Next, participants will either receive a mortality salience prime or a control (dental pain) prime. Three saliva samples will be taken, and two biomarkers (cortisol and alpha-amylase) will be analyzed from samples. The levels of both biomarkers are known to rise in response to stress.

Our hypotheses are that those who experienced the mortality salience prime will have a higher stress response than those who received the control prime. Also, we expect that those with higher levels of religiosity will be less physiologically stressed by the mortality salience prime than those with lower levels of religiosity. Additionally, we expect there to be little to no difference in physiological stress response to the control dental pain primer between participants with high or low religiosity. Furthermore, we expect there to be little to no difference in physiological stress response to either of the primes between people with high or low self-esteem. Lastly, at the conclusion of the study, we expect women in the experimental group will have a higher desire to affiliate with close friends than men in the experimental group; we do not expect to find this sex difference in the control group.

2. (a) Describe the subjects of this study:

- 1) [Describe the sampling population](#): Undergraduate students 18 years or older enrolled in courses granting research credit through the Psychology Department's SONA system.
- 2) Describe the subject selection methodology(i.e. random, snowball, etc.): Random
- 3) Describe the [procedures to be used to recruit subjects](#). Include copies of scripts, flyers, advertisements, posters or letters to be used. **If recruitment procedures will require access to OSU System email addresses you will need to include [Appendix A](#) of this application:**⁷
Subjects will be recruited through the study description on SONA's website.
- 4) How many subjects are expected to participate? 225
- 5) What is the expected duration of participation for each segment of the sampling population? If there is more than one session, please specify the duration of each session: Online segment: 60 minutes; Lab segment: 80 minutes
- 6) Describe the calendar time frame for gathering the data using human subjects: One year after IRB approval.
- 7) Describe any follow-up procedures planned: None.

(b) Are any of the [subjects under 18 years of age](#)? Yes No

If Yes, you must comply with special regulations for using children as subjects. Please refer to IRB Guide.

3. Provide a detailed description of any [methods, procedures, interventions, or manipulations of human subjects](#) or their environments and/or a detailed description of any existing datasets to be accessed for information. Please indicate the physical location where the research will take place (if applicable). Include copies of any questionnaires, tests, or other written instruments, instructions, scripts, etc., to be used.

Recruitment and Location of Study

Each participant will be sent an email reminder about the study 24 hours prior to participation. This email is designed to ensure that each participant is properly reminded of the activities that must be avoided prior to coming to the lab. The email will be sent to the email address that is listed in the Sona system for the participant. Each participant will report to North Murray Hall room 308 for the study on the assigned day.

Random Assignment

Each subject group will be paired with a randomly drawn number to determine whether that group will receive mortality salience prime version A or mortality salience prime version B (the experimental conditions; see below for description of the difference between the versions), or dental pain prime version A or dental pain prime version B (the control conditions). Groups will be assigned through random assignment by placing 60 pieces of paper in a bucket as follows; numbers 1-15 (Group 1) will be associated with dental pain prime version A; numbers 16-30 will be associated with mortality salience prime version A; numbers 31-45 (Group 3) will be associated with dental pain prime version B; numbers 46-60 (Group 4) will be associated with mortality salience prime version B.

Primes Used

Subjects will experience version A or B of one of the two primes, all of which will take place in North Murray 310. There will be two versions of each prime, as we suspect the current standard mortality salience prime is not the most effective way to elicit mortality salience. Version A of the mortality salience prime asks participants to *write* for 5 minutes to the following prompts: "Please briefly describe the emotions that the thought of your own death arouses in you. Please describe, as specifically as you can, what you think will happen to you as you physically die and once you are physically dead." Version A of the dental pain prime asks participants to write for 5 minutes to the following prompts: "Please describe the emotions that the thought of experiencing dental pain arouses in you. Please describe, as specifically as you can, what you think will happen to you as you experience dental pain and once you are experiencing dental pain." This is the standard, most often used, versions of these primes. There will be a research assistant in the room that will instruct the participants to keep writing if they stop before the five minutes is over. Version B of the mortality salience prime consists of asking participants to *orally* reflect on their own death (with a research assistant) for five minutes. Version B of the dental pain prime consists of asking participants to *orally* reflect on dental pain (with a research assistant) for five minutes.

Informed Consent

After reporting to the location each participant will be properly given an informed consent and asked to sign the consent if they wish to participate. Furthermore, each participant will be given a copy of the informed consent.

Procedure

After participants sign up to participate in the study, the participant will receive a link to complete a series of questionnaires, which ask the participant's views on sex, national identity, humans' place in the animal kingdom, parenting, religiosity, temperament and afterlife.. When the participant visits the link, there will be a short informed consent form to read. By clicking "next," they sign the informed consent. The subject will then complete the seven questionnaires listed previously. This must be finished at least one day before the participant arrives in the lab. It will not be allowed for a student to complete the questionnaire in lab, as this could serve as an accidental religious prime. When the participants arrive in lab, North Murray 308, they will sign the informed consent and will be asked to fill out a series of questionnaires on their demographics, general health, self-esteem and personality. The purpose of the questionnaires is to gather information, but also to allow them to habituate to the lab setting. After all participants have completed the questionnaires (approx. 15 minutes), a baseline saliva sample will be taken. Participants will give a saliva sample via passive drool. They will hold a sterile straw to their mouths with their heads tilted forward, to let gravity pool the saliva in the front of the mouth. The saliva will then travel through the straw into a sterile cryovial. Approximately 1.0 milliliter of saliva will be used for the sample. The cryovial will be labeled only with an identification number, and will then be placed in the freezer to be later analyzed for cortisol and alpha-amylase. Next, the participants, one at a time, will complete either a mortality salience prime or a dental pain prime in North Murray 310. If a participant is in

version B (the oral reflection condition), his or her response will be recorded, for coding purposes. Recording will be discreet as to not add an extra dimension of stress, but the participant will know about the possibility of being recorded upon consent. As soon as each participant completes the prime, he or she will be asked to give another saliva sample, using the same protocol as previously listed. After this, the participant will be asked to sit quietly for 13 minutes. After 13 minutes, the participants will be given a final set of questionnaires which will show their desire to affiliate with those they have a close relationship with and their level of distress (on a 5 point scale) upon completion of the study. In the unlikely event that a subject indicates that she or he is feeling extremely distressed or anxious (rating 4 or above on a 5 point scale), they will be asked at the conclusion of the debriefing if they would like a research assistant to accompany them to the Psychological Services Clinic. At this point, 15 minutes should have elapsed since the collection of the last saliva sample. If 15 minutes have not passed, the participant will sit quietly until 15 minutes has been reached. The purpose of this strict time frame is to allow cortisol levels to reach their peaks. After 15 minutes have passed, the subject will give the final saliva sample, using the protocol outlined above. The participants will then be debriefed, given a copy of both the debriefing form and counseling form and then dismissed. (Please see the attached participant-by-participant timeline.)

Data Storage

All questionnaires will be stored at North Murray Hall Room 308. The questionnaires will be kept for a period of five years after the last publication date associated with the data. All informed consents will be maintained in a locked file cabinet in room 310 of North Murray Hall. The recorded responses from the scripted interviews will be downloaded onto a password-protected computer in North Murray Hall 308; this room remains locked. The recordings will be deleted off the recording device as soon as the download is complete, and the recording device will remain in a locked file cabinet in the same room. Any identifiable information (Sign-In Sheet for Sona Credit) will be kept in a separate locked file cabinet in room 310 of North Murray Hall. At no point will any of the surveys or the informed consents be stored in the same room. Once the required maintenance time has elapsed, all documents associated with this study will be shredded and placed in the appropriate receptor in North Murray Hall. All salivary samples will be kept in the freezer located in North Murray Hall room 308. The samples will be transported from North Murray Hall Room 308 to the Psychoneuroendocrinology Assessment lab in 010 North Murray for analysis. Upon completion of the analysis all physical samples will be destroyed following proper protocol. All electronic records of the data will be maintained on an external hard drive located in North Murray Room 310. All electronic data will be properly removed following the mandatory holding period for the data. We have taken these measures to ensure that all confidentiality procedures are adhered to and that no data can be linked to any participant.

4. Please list by position any additional personnel (undergraduate assistants, graduate research assistants, members of the community) who will be involved in the recruitment or consent process or data collection and/or analysis. Names are not necessary. Include a description of the training in the protection of human subjects in research that these individuals will be required to complete.
- Undergraduate Research Assistants – Will have completed Collaborative Institutional Training Initiative Human Research Curriculum, and project-specific training.
- Graduate Students – Will have completed Collaborative Institutional Training Initiative Human Research Curriculum, and project-specific training.

5. Will the subjects encounter the possibility of stress or psychological, social, physical, or legal risks that are greater than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests? Yes No

If Yes, please justify your position: Some subjects will be asked to write or speak about their own death. This event will likely arouse feelings of mild to moderate distress in participants. However, prior research has been conducted using similar methods in college populations without any long-lasting negative impact on subjects (Arndt et al., 2002). Subjects' responses will be reviewed immediately. In the event that someone talks about suicidal ideation, the person will be escorted to the Psychological Services Center in North Murray (the same building in which

<p>the study will be conducted). The study will only be conducted during times the Psychological Services Center is open. If someone expresses an immediate desire to harm him or herself, 911 will be called.</p>
<p>6. Will medical clearance be necessary for subjects to participate because of tissue or blood sampling, administration of substances such as food or drugs, or physical exercise conditioning? <input type="checkbox"/>Yes <input checked="" type="checkbox"/>No</p> <p>If Yes, please explain how the clearance will be obtained:</p>
<p>7. Will the subjects be deceived or misled in any way? <input type="checkbox"/>Yes <input checked="" type="checkbox"/>No</p> <p>If Yes, please explain:</p>
<p>8. Will information be requested that subjects might consider to be personal or sensitive? <input checked="" type="checkbox"/>Yes <input type="checkbox"/>No</p> <p>If Yes, please explain: Subjects might be asked to write or talk about their own death and to provide certain family history. This information can be considered personal in nature; however, this study has gone to great lengths to ensure confidentiality and anonymity of each participant. The researchers feel that there is absolutely no other way to test the mortality primer than to have each participant either write or speak about his or her own death. Additionally, the demographic information that is collected will be used to show any possible correlation between socio economic status and the presented measures.</p>
<p>9. Will the subjects be presented with materials that might be considered to be offensive, threatening, or degrading? <input type="checkbox"/>Yes <input checked="" type="checkbox"/>No</p> <p>If Yes, please explain, including measures planned for intervention if problems occur.</p>
<p>10. Will any inducements be offered to the subjects for their participation? <input checked="" type="checkbox"/>Yes <input type="checkbox"/>No</p> <p>If Yes, please explain: Participants will earn 2.5 course credits for their participation. Most introductory and lower-level psychology courses offer students a small amount of course credit (usually less than 5% of their grade) for participation in the research process. In psychology 1113 courses, students are required to earn six units of research experience. This requirement may be fulfilled in one of three ways: 1) serving as a human participant in one or two current research project(s), 2) attending two Undergraduate Research Colloquia, or 3) researching and writing two 3-4 page papers on two designated research topics. Each hour of participation in a research project as a participant is generally regarded as satisfying one unit of the requirement, and students participating in this study will earn one hour (or unit) of credit. The course instructor determines the requirement.</p> <p>NOTE: If extra course credit is offered, describe the alternative means for obtaining additional credit available to those students who do not wish to participate in the research project.</p>
<p>11. Describe the process to be used to obtain the consent/assent of all subjects including (as appropriate); who will seek the consent/assent, steps to minimize coercion or undue influence, and the method(s) to be used to document the consent.</p> <p>Please provide copies of all consent documents with your application</p> <p>Subjects will receive an initial informed consent when they click the link to complete the first survey before they are in the lab. The link will be delivered via email. Subjects will be able to click a button to continue with the questionnaire if they agree to the informed consent. This acts as the participant's signature. When participants arrive in the lab, they will be given an additional informed consent to read. The research assistant will then go over the form with them, ask if there are questions, and answer any questions that they may have. If they agree to participate in the study, subjects will be asked to sign the consent form. A copy of the consent form will be given to them.</p>
<p>12. Are you requesting a waiver of documentation of consent (no signature on consent/assent forms)? If you</p>

are conducting an anonymous survey, online or in paper form, check yes here.

Yes No

If yes, provide a justification for waiving documentation based on one of the [two criteria allowing the waiver](#).

13. Do you wish to waive of some of the [elements of consent/assent or parental permission](#) or the entire consent/assent or parent permission process?

Yes No

If yes, provide a justification for the waiver that addresses each of the [criteria](#) that must be met for the waiver to be allowed.

14. Will the data be a part of a [record that can be identified](#) with the subject? Yes No

If Yes, please explain:

15. Describe the steps you are taking to [protect the confidentiality of the subjects](#) and how you are going to advise subjects of these protections in the consent process. Include information on data storage and access. If data will not be reported in the form of group means, please explain how the data will be reported.

Participants will be assigned an arbitrary number for the study. No document linking their name or any other identifying information and their data will be kept. Saliva samples will be kept in a freezer in 310 North Murray until time for assay for cortisol. At such time, the samples (with ID numbers only) will be transported to 010 North Murray for assay. After the assay is complete, the samples will be destroyed. All remaining data (from questionnaires, scripted interviews, records of cortisol levels) will be stored in 310 North Murray Hall for at least five years after publication of the research report. At that time, data will be destroyed; materials will be shredded and deposited in garbage bins located in the Department of Psychology at Oklahoma State University. All electronic data will be cleared from computers using disk cleaning software. Subjects will be informed of confidentiality procedure in the informed consent document.

16. Will the subject's participation in a specific experiment or study be made a part of any record available to his or her supervisor, teacher, or employer? Yes No

If Yes, please describe: For participants recruited via SONA, instructors will receive a report listing credit for their participation, which reflects the amount of time spent doing the research. They will NOT receive information regarding which study was completed or specific responses made during the participation.

17. Describe the benefits that might accrue to either the subjects or society. *Note that 45 CFR 46, Section 46.111(a)(2) requires that the risks to subjects be reasonable in relation to the anticipated benefits. The investigator should specifically state the importance of the knowledge that reasonably may be expected to result from this research.* The results of this study could have major implications for Terror Management Theory. Since this will be the first documented Terror Management Theory study to use biomarkers to measure the physiological stress participants experience in response to mortality salience, the results of this study will provide, for the first time, biological data to what has previously been only a social theory. Also, this study will use a modified method for executing the mortality salience prime; if this prime elicits mortality salience better than the current standard prime, there is a chance this study could create a new standard mortality salience prime, which would allow future studies to run more effectively. Lastly, this study has the potential to provide valuable results in the field of affiliation research.

Application Submission:

Checklist for application submission:

- Completion of required IRB training (<http://compliance.vpr.okstate.edu/IRB/gc-CITI.aspx>)
- Grant Proposal, if research is externally funded
- Outline or script of information to be provided prior to subjects' agreement to participate
- Copies of flyers, announcements or other forms of recruitment
- Informed consent/assent forms
- Instrument(s) [questionnaire, survey, tests]
- Resumes or CV's for all PIs (student or faculty) and advisors (4 page maximum for each)*

*CVs should highlight the education and research expertise of the researcher. Researchers may submit CVs prepared for federal grant proposals (e.g., NIH, NSF, USDA, etc.).

Appendices Included:

- [Appendix A](#) - Request for OSU System Email Addresses for Human Subject Research Recruitment Purposes

Number of copies:

One (1), single sided copy of the application and associated attachments, signed by all PIs and Adviser (if appropriate).

Submission Addresses:

Mail to:
IRB/University Research Compliance
Oklahoma State University
219 Cordell North
Stillwater, OK 74078-1038

Hand deliver to:
IRB/University Research Compliance
208 or 217 Cordell North

Email Submission (Application must be signed):
irb@okstate.edu

For assistance, please contact the IRB staff in the Office of University Research Compliance at 405-744-3377 or email irb@okstate.edu.

Questionnaires

Pre-Study Survey #1

People approach and view sex in a variety of ways. Below are two descriptions of views of sex. Please read the descriptions. Although the descriptions are not likely to apply perfectly to your view, please indicate whether each one mostly characterizes your view on the issue.

For me, sex is associated with romantic love and is symbolic of something greater than the act itself. Sex is deeply meaningful and transcends the physical pleasure of the moment.

Does this description primarily characterize your view on sex?

(Yes / No)

For me, sex is associated mainly with physical pleasure and has little to no transcending meaning. There is no abstract dimension of sex, and sex is typically associated with satisfying physical desires.

Does this description primarily characterize your view on sex?

(Yes / No)

Pre-Study Survey #2

We are all members of different social groups or social categories. One of the social categories one belongs to is the **own nation**. We ask you now to strictly concentrate on your belongingness to that nation. Please give your personal answer to each of the following items on a scale from 1 to 8:

- 1 extremely untrue of you
- 2 quite untrue of you
- 3 moderately untrue of you
- 4 slightly untrue of you
- 5 slightly true of you
- 6 moderately true of you
- 7 quite true of you
- 8 extremely true of you

1.	The nation I belong to is an important reflection of who I am	
2.	In general, others respect the nation that I am a member of.	
3.	I am a cooperative participant in the nation I belong to	
4.	Overall, I often feel that the nation of which I am a member is not worthwhile	
5.	In competition with others my nation comes off worse	
6.	I often feel I'm a useless member of the nation I belong to	
7.	The nation I belong to is superior to other nations in many respects	
8.	All in all, my nation becomes less important in the world	
9.	Overall, my nation is considered good by others	
10.	In general, belonging to this nation is an important part of my self-image	
11.	I am a worthy member of the nation I belong to	
12.	I often regret that I belong to this nation	
13.	Overall, my nation has very little to do with how I feel about myself	
14.	In general, I'm glad to be a member of the nation I belong to	
15.	The nation I belong to is unimportant to my sense of what kind of person I am	
16.	Overall, the nation I belong to plays a more important role than other nations	
17.	I feel good about the nation I belong to	
18.	I feel I don't have much to offer to the nation I belong to	
19.	Most people consider my nation to be more ineffective than other nations	
20.	In general, others think that the nation I am a member of is unworthy	

Pre-Study Survey #3

People view humans' place in the animal kingdom in a variety of ways. Below are two descriptions of views on the issue. Please read the descriptions. Although the descriptions are not likely to apply perfectly to your view, please indicate whether each one mostly characterizes your view on the issue.

Humans share a common ancestor with other animal species, and therefore are just as much an animal as any other member of the animal kingdom. While humans have cognitive abilities greater than those of other animals, these qualities are the result of evolving a larger forebrain and other biological processes.

Does this description primarily characterize your stance on humans' place in the animal kingdom?

(Yes / No)

To be a human means to be separate from the other animals in the animal kingdom; our inclusion in the animal kingdom is just a scientific technicality. We are not simple selfish creatures driven by hunger and lust, but complex individuals with a will of our own, capable of making choices and creating our own destinies.

Does this description primarily characterize your stance on humans' place in the animal kingdom?

(Yes / No)

Pre-Study Survey #4

Please answer each question as accurately as possible. Please use the scale below for answering all items on this questionnaire. Only answer "NA" if you did not have a father / step-father growing up. If you answer "NA" please proceed to Section 2.

1 = Not at all true **2** = Not very true **3** = Sort of true **4** = Very true
5 = NA

Section 1:

1	My father knows a lot about what goes on with me.	
2	My father really knows how I feel about things.	
3	My father and I do special things together.	
4	My father lets me know he loves me.	
5	My father doesn't understand me very well.	
6	Sometimes I feel like my father feels I am hard to like.	
7	At times, when I ask for things from my father he makes me feel like a burden.	
8	I need more than my father has time to give me.	
9	My father makes it clear what will happen if I do not follow his rules.	
10	My father makes it clear to me what he expects from me.	
11	My father expects me to follow our family rules.	
12	When my father tells me he'll do something, he does it.	
13	When I get or got in trouble, my father is not/was not very predictable.	
14	I don't seem to know what my father expects from me.	
15	My father changes/changed the rules a lot at home.	
16	My father can get mad at me with no warning.	
17	My father encourages me to express my feelings even when they're hard to hear.	
18	My father encourages me to express my opinions even when he doesn't agree with them.	
19	My father encourages me to be true to myself.	
20	My father expects me to say what I really think.	
21	My father and I fight a lot.	
22	To get me to do something, my father often yells at me.	
23	My father may sometimes feel that he has to push me to do things.	
24	My father and I often get into power struggles.	

Please answer each question as accurately as possible. Please use the scale below for answering all items on this questionnaire. **Only answer "NA" if you did not have a mother / step-mother growing up. If you answer "NA" you are done with this questionnaire. If you answer "NA" please proceed to Section 3.**

1 = Not at all true **2** = Not very true **3** = Sort of true **4** = Very true

5 = NA

Section 2:

1	My mother knows a lot about what goes on with me.	
2	My mother really knows how I feel about things.	
3	My mother and I do special things together.	
4	My mother lets me know he loves me.	
5	My mother doesn't understand me very well.	
6	Sometimes I feel like my mother feels I am hard to like.	
7	At times, when I ask for things from my mother he makes me feel like a burden.	
8	I need more than my mother has time to give me.	
9	My mother makes it clear what will happen if I do not follow his rules.	
10	My mother makes it clear to me what he expects from me.	
11	My mother expects me to follow our family rules.	
12	When my mother tells me he'll do something, he does it.	
13	When I get or got in trouble, my mother is not/was not very predictable.	
14	I don't seem to know what my mother expects from me.	
15	My mother changes/changed the rules a lot at home.	
16	My mother can get mad at me with no warning.	
17	My mother encourages me to express my feelings even when they're hard to hear.	
18	My mother encourages me to express my opinions even when he doesn't agree with them.	
19	My mother encourages me to be true to myself.	
20	My mother expects me to say what I really think.	
21	My mother and I fight a lot.	
22	To get me to do something, my mother often yells at me.	
23	My mother may sometimes feel that he has to push me to do things.	
24	My mother and I often get into power struggles.	

Please answer each question as accurately as possible based on your relationship with your *closest GRANDPARENT* to you while you were growing up. Please use the scale below for answering all items on this questionnaire. Only answer "NA" if you did not have a grandparent you were close to growing up.

1 = Not at all true **2** = Not very true **3** = Sort of true **4** = Very true
5 = NA

Section 3:

1	My grandparent knows a lot about what goes on with me.	
2	My grandparent really knows how I feel about things.	
3	My grandparent and I do special things together.	
4	My grandparent lets me know s/he loves me.	
5	My grandparent doesn't understand me very well.	
6	Sometimes I feel like my grandparent feels I am hard to like.	
7	At times, when I ask for things from my grandparent s/he makes me feel like a burden.	
8	I need more than my grandparent has time to give me.	
9	My grandparent makes it clear what will happen if I do not follow rules.	
10	My grandparent makes it clear to me what s/he expects from me.	
11	My grandparent expects me to follow our family rules.	
12	When my grandparent tells me s/he'll do something, s/he does it.	
13	When I get or got in trouble, my grandparent is not/was not very predictable.	
14	I don't seem to know what my grandparent expects from me.	
15	My grandparent changes/changed the rules a lot at home.	
16	My grandparent can get mad at me with no warning.	
17	My grandparent encourages me to express my feelings even when they're hard to hear.	
18	My grandparent encourages me to express my opinions even when s/he doesn't agree with them.	
19	My grandparent encourages me to be true to myself.	
20	My grandparent expects me to say what I really think.	
21	My grandparent and I fight a lot.	
22	To get me to do something, my grandparent often yells at me.	
23	My grandparent may sometimes feel that s/he has to push me to do things.	
24	My grandparent and I often get into power struggles.	

Religious Orientation Vignettes

People approach their religious belief system in a variety of ways. These religious experiences and motivations are referred to as an individual's religious orientation. Please read the descriptions of religious orientations below. Although the descriptions are not likely to apply perfectly to your life, please indicate whether each one mostly characterizes your own religious orientation.

Individuals with an **intrinsic** religious orientation approach everything in life from a religious perspective. These individuals attempt to let every aspect of their life – from minor daily activities to larger life-changing events – be guided by their religious beliefs. They rely on their religious beliefs to interpret events and experiences in life. They also look for how these events and experiences coincide with a larger plan and purpose using a religious point-of-view. They enjoy reading about and studying their religion and make it a priority to spend time in private thought and prayer. These individuals continually evaluate their life and strive to make adjustments when they notice inconsistencies with their religious beliefs.

Does this description primarily characterize your own religious orientation?

(Yes / No / Does not apply)

Individuals with an **extrinsic** religious orientation enjoy the comfort and protection that religion brings to their life. They pray primarily for happiness, which may include better health, finances, and other specific social comforts. These individuals also enjoy the social support network of the religious community. One of the things they look forward to the most about attending church is the opportunity to make friends or acquaintances. They particularly enjoy the opportunities that the church provides for fellowship and community, such as church-wide potlucks or small group gatherings, where they can spend time with friends. They find comfort knowing that the people they meet at church will be there for them when they are in times of trouble or sorrow.

Does this description primarily characterize your own religious orientation?

(Yes / No / Does not apply)

Pre-Study Survey #6

Please provide the following information by checking the appropriate response or filling in the blank.

Sex: **Male** **Female**

Is English your first language? **Yes** **No**

Age:

Country of Origin:

ADULT TEMPERAMENT QUESTIONNAIRE (VERSION 1.3)

Directions

On the following pages you will find a series of statements that individuals can use to describe themselves. There are no correct or incorrect responses. All people are unique and different, and it is these differences which we are trying to learn about. Please read each statement carefully and give your best estimate of how well it describes you. Circle the appropriate number below to indicate how well a given statement describes you.

<u>circle #:</u>	<u>if the statement is:</u>
1	extremely untrue of you
2	quite untrue of you
3	slightly untrue of you
4	neither true nor false of you
5	slightly true of you
6	quite true of you
7	extremely true of you

If one of the statements does not apply to you (for example, if it involves driving a car and you don't drive), then circle "X" (not applicable). Check to make sure that you have answered every item.

- | | | | | | | | | | |
|-----|---------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|
| 1. | I become easily frightened. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
| 2. | I am often late for appointments. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
| 3. | Sometimes minor events cause me to feel intense happiness. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
| 4. | I find loud noises to be very irritating. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
| 5. | It's often hard for me to alternate between two different tasks. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
| 6. | I rarely become annoyed when I have to wait in a slow moving line. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
| 7. | I would not enjoy the sensation of listening to loud music with a laser light show. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
| 8. | I often make plans that I do not follow through with. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
| 9. | I rarely feel sad after saying goodbye to friends or relatives. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
| 10. | Barely noticeable visual details rarely catch my attention. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
| 11. | Even when I feel energized, I can usually sit still without much trouble if it's necessary. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
| 12. | Looking down at the ground from an extremely high place would make me feel uneasy. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
| 13. | When I am listening to music, I am usually aware of subtle emotional tones. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |

14. I would not enjoy a job that involves socializing with the public.
1 2 3 4 5 6 7 X
15. I can keep performing a task even when I would rather not do it.
1 2 3 4 5 6 7 X
16. I sometimes seem to be unable to feel pleasure from events and activities that I should enjoy.
1 2 3 4 5 6 7 X
17. I find it very annoying when a store does not stock an item that I wish to buy.
1 2 3 4 5 6 7 X
18. I tend to notice emotional aspects of paintings and pictures.
1 2 3 4 5 6 7 X
19. I usually like to talk a lot.
1 2 3 4 5 6 7 X
20. I seldom become sad when I watch a sad movie.
1 2 3 4 5 6 7 X
21. I'm often aware of the sounds of birds in my vicinity.
1 2 3 4 5 6 7 X
22. When I am enclosed in small places such as an elevator, I feel uneasy.
1 2 3 4 5 6 7 X
23. When listening to music, I usually like turn up the volume more than other people.
1 2 3 4 5 6 7 X
24. I sometimes seem to understand things intuitively.
1 2 3 4 5 6 7 X
25. Sometimes minor events cause me to feel intense sadness.
1 2 3 4 5 6 7 X
26. It is easy for me to hold back my laughter in a situation when laughter wouldn't be appropriate.

27. I can make myself work on a difficult task even when I don't feel like trying.
1 2 3 4 5 6 7 X
28. I rarely ever have days where I don't at least experience brief moments of intense happiness.
1 2 3 4 5 6 7 X
29. When I am trying to focus my attention, I am easily distracted.
1 2 3 4 5 6 7 X
30. I would probably enjoy playing a challenging and fast paced video-game that makes lots of noise and has lots of flashing, bright lights.
1 2 3 4 5 6 7 X
31. Whenever I have to sit and wait for something (e.g., a waiting room), I become agitated.
1 2 3 4 5 6 7 X
32. I'm often bothered by light that is too bright.
1 2 3 4 5 6 7 X
33. I rarely notice the color of people's eyes.
1 2 3 4 5 6 7 X
34. I seldom become sad when I hear of an unhappy event.
1 2 3 4 5 6 7 X
35. When interrupted or distracted, I usually can easily shift my attention back to whatever I was doing before.
1 2 3 4 5 6 7 X
36. I find certain scratchy sounds very irritating.
1 2 3 4 5 6 7 X
37. I like conversations that include several people.
1 2 3 4 5 6 7 X
38. I am usually a patient person.
1 2 3 4 5 6 7 X

39. When I am resting with my eyes closed, I sometimes see visual images.
1 2 3 4 5 6 7 X
40. It is very hard for me to focus my attention when I am distressed.
1 2 3 4 5 6 7 X
41. Sometimes my mind is full of a diverse array of loosely connected thoughts and images.
1 2 3 4 5 6 7 X
42. Very bright colors sometimes bother me.
1 2 3 4 5 6 7 X
43. I can easily resist talking out of turn, even when I'm excited and want to express an idea.
1 2 3 4 5 6 7 X
44. I would probably not enjoy a fast, wild carnival ride.
1 2 3 4 5 6 7 X
45. I sometimes feel sad for longer than an hour.
1 2 3 4 5 6 7 X
46. I rarely enjoy socializing with large groups of people.
1 2 3 4 5 6 7 X
47. If I think of something that needs to be done, I usually get right to work on it.
1 2 3 4 5 6 7 X
48. It doesn't take very much to make feel frustrated or irritated.
1 2 3 4 5 6 7 X
49. It doesn't take much to evoke a happy response in me.
1 2 3 4 5 6 7 X
50. When I am happy and excited about an upcoming event, I have a hard time focusing my attention on tasks that require concentration.
1 2 3 4 5 6 7 X

51. Sometimes, I feel a sense of panic or terror for no apparent reason.
1 2 3 4 5 6 7 X
52. I often notice mild odors and fragrances.
1 2 3 4 5 6 7 X
53. I often have trouble resisting my cravings for food drink, etc.
1 2 3 4 5 6 7 X
54. Colorful flashing lights bother me.
1 2 3 4 5 6 7 X
55. I usually finish doing things before they are actually due (for example, paying bills, finishing homework, etc.).
1 2 3 4 5 6 7 X
56. I often feel sad.
1 2 3 4 5 6 7 X
57. I am often aware how the color and lighting of a room affects my mood.
1 2 3 4 5 6 7 X
58. I usually remain calm without getting frustrated when things are not going smoothly for me.
1 2 3 4 5 6 7 X
59. Loud music is unpleasant to me.
1 2 3 4 5 6 7 X
60. When I'm excited about something, it's usually hard for me to resist jumping right into it before I've considered the possible consequences.
1 2 3 4 5 6 7 X
61. Loud noises sometimes scare me.
1 2 3 4 5 6 7 X

62. I sometimes dream of vivid, detailed settings that are unlike anything that I have experienced when awake.
- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
|---|---|---|---|---|---|---|---|
63. When I see an attractive item in a store, it's usually very hard for me to resist buying it.
- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
|---|---|---|---|---|---|---|---|
64. I would enjoy watching a laser show with lots of bright, colorful flashing lights.
- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
|---|---|---|---|---|---|---|---|
65. When I hear of an unhappy event, I immediately feel sad.
- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
|---|---|---|---|---|---|---|---|
66. When I watch a movie, I usually don't notice how the setting is used to convey the mood of the characters.
- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
|---|---|---|---|---|---|---|---|
67. I usually like to spend my free time with people.
- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
|---|---|---|---|---|---|---|---|
68. It does not frighten me if I think that I am alone and suddenly discover someone close by.
- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
|---|---|---|---|---|---|---|---|
69. I am often consciously aware of how the weather seems to affect my mood.
- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
|---|---|---|---|---|---|---|---|
70. It takes a lot to make me feel truly happy.
- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
|---|---|---|---|---|---|---|---|
71. I am rarely aware of the texture of things that I hold.
- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
|---|---|---|---|---|---|---|---|

72. When I am afraid of how a situation might turn out, I usually avoid dealing with it.
- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
|---|---|---|---|---|---|---|---|
73. I especially enjoy conversations where I am able to say things without thinking first.
- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
|---|---|---|---|---|---|---|---|
74. Without applying effort, creative ideas sometimes present themselves to me.
- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
|---|---|---|---|---|---|---|---|
75. When I try something new, I am rarely concerned about the possibility of failing.
- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
|---|---|---|---|---|---|---|---|
76. It is easy for me to inhibit fun behavior that would be inappropriate.
- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
|---|---|---|---|---|---|---|---|
77. I would not enjoy the feeling that comes from yelling as loud as I can.
- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | X |
|---|---|---|---|---|---|---|---|

Pre-Study Survey #7

Please answer each question as accurately as possible. Please rate each of the following items on a scale from 0 to 10, **0 representing total disagreement** and **10, total agreement**.

1.	Earthly existence is the only existence we have.	
2.	In the premature death of someone close some comfort may be found in knowing that in some way the deceased is still existing.	
3.	Humans die in the sense of “ceasing to exist.”	
4.	The idea of there existing somewhere some sort of afterlife is beyond my comprehension.	
5.	We will never be united with those deceased whom we knew and loved.	
6.	There must be an afterlife of some sort.	
7.	Some existentialists claim that when man dies he ceases to exist: I agree.	
8.	The following statement is true: “There is no such thing as a life after death.”	
9.	Millions of people believe in a life after death: they are correct in so believing.	
10.	Enjoy yourself on earth, for death signals the end of all existence.	

Survey #1

Demographic Information

Please provide the following information by checking the appropriate response or filling in the blank.

1. Sex: Male Female

2. Age: _____

3. Ethnicity: African-American Caucasian Hispanic Native American

Asian-American Other (please explain) _____

4. Which of the following best describes your religious affiliation?

Agnostic Atheist Buddhist

Catholic Muslim Protestant

5. On average, how often do you attend religious services?

Once a week, or more Twice a month Once a month Once every two months

3-5 times a year 1-2 times a year Never

4. Marital Status: Single Married Divorced Separated

Cohabiting

Widowed

5. What was the annual salary of your household while growing up (Parents' Combined Salary)?

\$0 - \$10,000 \$10,000 - \$25,000 \$25,000 - \$45,000

\$45,000 - \$75,000 More than \$75,000

General Inventory

Please circle the appropriate response for each question.

1) What is your mood for the past hour?

1	2	3	4	5
Very Negative	Somewhat Negative	Neutral	Somewhat Positive	Very Positive

2) Describe your level of physical activity for the past hour:

1	2	3	4	5
Very Low (sitting still)	Low-level activity	Moderate (walking across campus)	Somewhat Active	Very Active (full work-out)

3) Have you consumed caffeine in the past hour? 1.) No 2.) Yes

4) Have you had a meal in the past hour? 1.) No 2.) Yes

If yes, what was the size of your meal?

0	1	2	3	4
Not applicable	Snack	Small Meal	Medium Meal	Large Meal

5) Have you slept in the past 2 hours? 1.) No 2.) Yes

If yes, for how long?

0	1	2	3	4	5	6
½-1	1-2	2-3	3-4	4-5	Over 5	N/A

6) Have you had any social problems (problems related to other people) in the past 3 hours?

1.) No 2.) Yes

If yes, did you discuss this problem with a friend? 1.) No 2.) Yes

7) Please rate your current level of anxiety.

1	2	3	4	5
No Anxiety	Low	Moderate	Somewhat	Extreme

Daily Health Screen

1) What is your overall health today? **(circle one)**

1 2 3 4 5 6 7 8 9 10
Poor-----Excellent

2) Have you had a fever in the past 24 hours? 1.) Yes 2.) No

3) Do you feel flushed? 1.) Yes 2.) No

4) Have you had any of the following symptoms in the past 24 hours? (circle all that apply)

- 1.) Runny nose 2.) Cough 3.) Congestion 4.) None of these

Survey #3

ALL INFORMATION REMAINS STRICTLY CONFIDENTIAL

Please read the instructions below.

How to fill out the questionnaire

Below is a list of statements dealing with your general feelings about yourself. If you strongly agree, circle "strongly agree." If you agree with the statement, circle "agree." If you disagree, circle "disagree." If you strongly disagree, circle "strongly disagree."

IN ORDER FOR THE SCALE TO BE VALID, YOU MUST ANSWER EVERY QUESTION.

- | | | | | |
|-------------------------------------------------------------------------------|-------------------|-------|----------|----------------------|
| 1. On the whole, I am satisfied with myself. | strongly
agree | agree | disagree | strongly
disagree |
| 2. At times, I think I am no good at all. | strongly
agree | agree | disagree | strongly
disagree |
| 3. I feel that I have a number of good qualities. | strongly
agree | agree | disagree | strongly
disagree |
| 4. I am able to do things as well as most other people. | strongly
agree | agree | disagree | strongly
disagree |
| 5. I feel I do not have much to be proud of. | strongly
agree | agree | disagree | strongly
disagree |
| 6. I certainly feel useless at times. | strongly
agree | agree | disagree | strongly
disagree |
| 7. I feel that I'm a person of worth, at least on an equal plane with others. | strongly
agree | agree | disagree | strongly
disagree |
| 8. I wish I could have more respect for myself. | strongly
agree | agree | disagree | strongly
disagree |
| 9. All in all, I am inclined to feel that I am a failure. | strongly
agree | agree | disagree | strongly
disagree |
| 10. I take a positive attitude toward myself. | strongly
agree | agree | disagree | strongly
disagree |

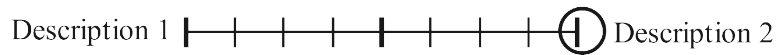
Survey #4

*Below are five pairs of descriptions. Circle **one point** on each scale to indicate how much you think each description sounds like you. For example:*

- If you are slightly more like description 1 than description 2, then mark the scale slightly closer to description 1



- If description 2 is exactly right and description 1 is not like you at all, then mark the scale right next to description 2



How much does each description sound like you?

Generally, I come across as:

someone who is talkative, outgoing, is comfortable around people, but could be noisy and attention seeking



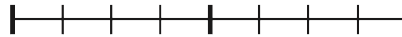
someone who is a reserved, private person, doesn't like to draw attention to themselves and can be shy around strangers

someone who is forthright, tends to be critical and find fault with others and doesn't suffer fools gladly



someone who is generally trusting and forgiving, is interested in people, but can be taken for granted and finds it difficult to say no

someone who is sensitive and excitable, and can be tense



someone who is relaxed, unemotional rarely gets irritated and seldom feels blue

someone who likes to plan things, likes to tidy up, pays attention to details, but can be rigid or inflexible



someone who doesn't necessarily work to a schedule, tends to be flexible, but disorganised and often forgets to put things back in their proper place

someone who is a practical person who is not interested in abstract ideas, prefers work that is routine and has few artistic interests



someone who spends time reflecting on things, has an active imagination and likes to think up new ways of doing things, but may lack pragmatism

Survey #5

Instructions:

Please provide the following information by checking the appropriate response.

1. Please rate how much you would like to be around the other participants for the next hour.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I very much prefer to be alone	I prefer to be alone	I slightly prefer to be alone	I have no preference	I slightly prefer to be with others	I prefer to be with others	I very much prefer to be with others

2. Please rate how much you would like to be around people with whom you have close relationships (e.g. friends, family, romantic partner) for the next hour.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I very much prefer to be alone	I prefer to be alone	I slightly prefer to be alone	I have no preference	I slightly prefer to be with a C.R.	I prefer to be with a C.R.	I very much prefer to be with a C.R.

Survey #6

Current Anxiety Level

1) Please rate your current level of anxiety. **(Please Circle One)**

1
No Anxiety

2
Low

3
Moderate

4
High

5
Extreme



Physiological Effects of Mortality Salience: A Closer Look at Terror Management Theory

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Introduction

Since the time of Plato, philosophers and psychologists have been developing frameworks of thought (often mislabeled as “theories”) to explain the human condition. Most of these “theories” are, even to this day, impossible to test stringently and scientifically; however, through advancements in the field of salivary biomarkers, it is now possible and affordable to hold some of these commonly accepted thought frameworks to higher scientific standards. This study aims to use physiological data to support or not support Terror Management Theory (TMT), a pertinent research area in social psychology.

TMT states that people use culture, more specifically religion, as a buffer against fearing their own deaths (Jonas & Fischer, 2006). Also, people with high self-esteem are reported to show less fear towards death (Pyszczynski, Greenberg, Solomon, Arndt & Schimel, 2004). Conveniently, fear, more specifically stress, is readily measurable by multiple salivary biomarkers, meaning TMT can be physiologically tested (Krieger, 1975; Naler & Rohleder, 2009). In this study, we measure stress biomarkers cortisol and alpha-amylase to answer the following research questions: “Are people with higher levels of self-esteem less physiologically stressed by mortality salience?” and “Are people with higher levels of religiosity less physiologically stressed by mortality salience?” This study integrates responses from self-esteem and religiosity questionnaires with participants’ cortisol and alpha-amylase levels after they have finished reflecting upon their own deaths.

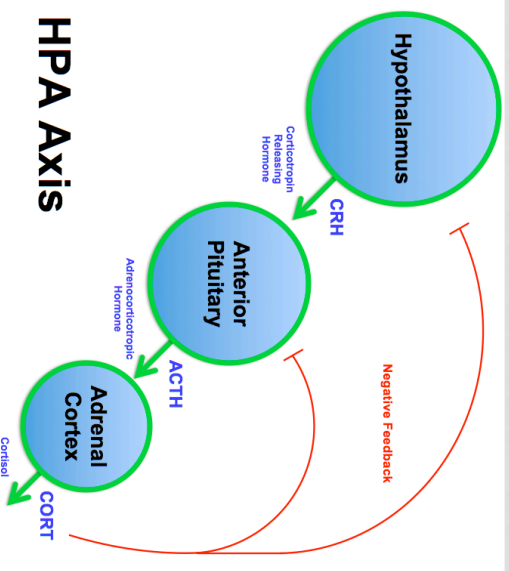
Methods

Participants
Participants are Oklahoma State University undergraduates who sign up through the university’s participant recruitment software (SONA). Both male and female subjects participate in the study.

Procedure
After signing up to participate in the study, participants receives a link to complete seven questionnaires, two of which are used to determine the participants’ level of religiosity. The religiosity questionnaires are mixed with other questionnaires and given before the lab portion of the study to avoid unintended primes. The seven pre-study questionnaires must be finished at least one day before the participant arrives in lab.

When the participants arrive in lab, they will be asked to fill out a series of questionnaires on their demographics, general health, self-esteem and personality; participants will also list three close friends. The purpose of the questionnaires is to gather information, but also to allow them to habituate to the lab setting. After participants have completed the questionnaires (approx. 15 minutes), a baseline saliva sample will be taken. Participants will give a 1.0-milliliter saliva sample via passive drool. The cryovial will then be placed in a freezer to be later analyzed for cortisol and alpha-amylase.

Next, the participants speak or write for five minutes on either their emotions regarding their own death (experimental condition) or their emotions regarding routine dental pain (control condition). Oral responses are recorded, for coding purposes; however, recording is discreet as to not add an extra dimension of stress. As soon as each participant completes the prime, he or she gives another saliva sample. Fourteen minutes later, the participant is given a final set of questionnaires which ask the participant’s desire to affiliate with those listed at the beginning of the study and current level of distress (on a 5 point scale). Fifteen minutes after the second saliva sample, the third saliva sample is taken; the purpose of this strict time frame is to allow cortisol levels to reach their peaks. The participant is debriefed and then dismissed.



The HPA Axis shown above gives a physiological mechanism for how cortisol is produced in response to stress.



Expected Results

This research project has Institutional Review Board approval, and data collection is currently underway, but no saliva samples have been analyzed yet, and there are no preliminary results to offer. We are expecting to have approximately 150 participants complete the study. We have two main trends we are expecting to see in our results:

- > We expect people with higher levels of religiosity will, on average, be less physiologically stressed when their mortality is made salient.
- > We expect there to be little to no difference in physiological stress response to the mortality salience prime between people with high or low self-esteem.

Discussion

Psychobiological research on Terror Management Theory is especially interesting because, to this point in time, no one else has attempted to integrate psychological and physiological data for this topic. Whatever results this study yields, they will be new and interesting to the field; this study will mark the first time the physiological mechanism behind Terror Management Theory has been investigated.

If our study yields the expected results, it has the potential to greatly affect Terror Management Theory. As mentioned in the results, we do not expect the “self-esteem” buffer to show up in the physiological data. The self-esteem component makes sense on paper, but when Terror Management Theory is being physiologically and realistically tested, the self-esteem buffer does not make logical sense.

It turns out that people who are high in religiosity are less physiologically stressed by their own deaths, which is what we expect to see in our data, that would show how powerful religion is. If belief in an afterlife or religion has the ability to physiologically reduce one’s stress response, then it makes evolutionary sense why religion has continued to remain an important part of lives of many modern humans.

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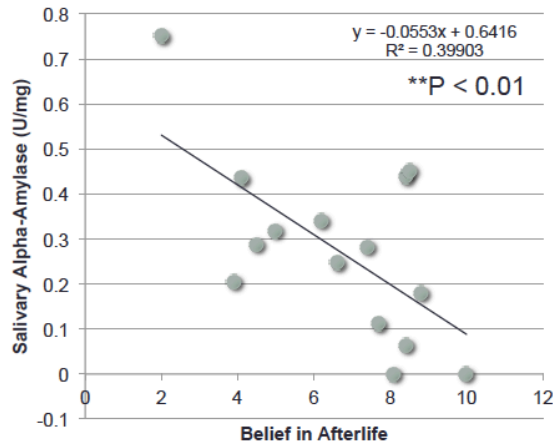
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Belief in afterlife appears to modulate α -amylase reactivity to mortality salience

Brandon Hubbard, Physiology & Psychology

Stress levels 15 minutes after speaking about death



Research question: Do people with different beliefs have systematically different physiological responses to mortality salience?



Link to presentation:

http://www.ostate.tv/play/a_buzMCIZF_nTliCSTMNxIIYq8fizc4t